

## MODULAR PACKAGING FOR ELONGATED DRILL TOOLS

The present invention relates to packaging for transporting and handling elongated articles.

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The transportation of large long objects requires careful logistics planing and assurance that the object will be safely delivered. Reference herein to elongated articles includes, in particular, large drilling apparatus such as drilling tools used in down the hole drilling for production or exploration of oil or gas.

Drilling tools are large and expensive to hire. They are often required to be air freighted to the drilling site with little time to spare so to reduce millions of dollars in downtime costs and lost production. Frequently a drilling tool needs to be transported from a location on one side of the world to another location on the other side of the world. Sometimes drilling tools are too long to fit inside a standard aircraft and are freighted in specific freighter aircraft. However, tool transportation is restricted to the timetables and space availability of these freight aircraft.

An alternative is to instead transport the tool by securing cables to the tool packaging and suspending the tool from an aircraft, such as a helicopter. This is also useful where the tool needs to be delivered to a remote location far from any airfield. Transportation of tools also typically includes a surface component where the tool is transferred to or from a road vehicle, train or water vessel such as an offshore supply vessel.

Drilling tools of this kind, usually weighing around 2½ tons, are usually packaged in long timber containers constructed to the size of the tool. These containers are deemed single use containers because after one use damage

- 2 -

to the container makes it unsuitable for re-use. The problem with these containers is that they do not effectively protect a heavy tool and can be easily damaged. Timber containers may also create problems and  
5 delays with local quarantine laws at border controls of most countries.

The present invention aims to alleviate problems with known packaging for elongated articles such as, but not  
10 restricted to, drilling tools.

In accordance with the present invention there is provided packaging for elongated articles comprising a plurality of modular plastics units capable of assembling together to  
15 form an elongated packaging; each unit having a lower portion engageable with an upper portion to close the unit and form therebetween a bore through which an elongated article is supported wherein the article spans across at least two modular units.

20 The lower and upper portions are preferably casings that are hinged together and securely closed to encapsulate an article. In one embodiment pneumatic or hydraulic struts are provided between the upper and lower casings to assist  
25 in biasing the unit open.

In one embodiment the modular units are directly joined one adjacent the other end to end to form an elongated packaging comprising generally three to eight modular  
30 units in line.

In another embodiment a tubular sheath extends between and is engageable with modular units on either side of the sheath whereby the article extends inside the sheath and  
35 through the modular units. In this embodiment the packaging includes at least two modular units with a sheath extending between the two units but typically the

- 3 -

packaging includes three modular units with two sheaths extending between the three units.

5 The bore defined between the upper and lower portions is preferably circular in cross section although it may be rectangular, or another shape in cross section. The upper and lower portions may be moulded to correspond with and accommodate physical features on the article.

10 In a preferred embodiment the modular units engage with each other and/or with the sheaths by interlocking profiles provided at ends of the units and/or sheaths.

15 Dampening ribs may be provided inside the bore to absorb impacts of force and to protect the article. The ribs are typically strips of a resilient and absorbent material, such as rubber, fastened around the circumference of the bore in recesses which are spaced at intervals along each modular unit.

20 Internal sleeves may be inserted inside the bore to reduce the bore diameter in order to support articles having a smaller diameter than the diameter of the bore.

25 The lower portion and/or the upper portion may have a flat base to enable the packaging to be supported on a surface. In general, the exterior of the modular units are rectangular thereby allowing the units to be stacked next to and one on top of the other. Interconnecting  
30 protrusions and recesses assist in stabilising the stackability of the packaging.

Lifting lugs and cable anchor points may be provided on the exterior of each modular unit to define lifting points  
35 from which the packaging can be lifted. Similarly, forklift recesses provided on the underside of the lower portion allow for forklifts to be used to move the

- 4 -

packaging.

A sump hole and plug together with a drainage channel can provide for drainage of fluids inside the packaging, such as oil.

Each packaging is preferably provided with a Global Positioning System (GPS) tracking device to determine the precise location of the packaging and can include information on the packaging that is transmitted by communicating means to a remote processor. This information includes the tool's asset number, tool type and any information relevant to its transportation. The GPS may indicate where the package is at all times and could flag specific events, for instance the event of the package arriving at a specific location.

In accordance with the present invention there is further provided plastics packaging for a drilling tool comprising a plurality of modular plastics units capable of being assembled to form an elongated packaging whereby each unit has a lower portion that is engageable with an upper portion to form therebetween a bore through which a drilling tool is supported and extends across at least two assembled modular units.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments, incorporating all aspects of the invention, will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is an isometric view of packaging for elongated articles in accordance with a first embodiment of the present invention;

Figure 2 is an isometric view of the packaging of Figure 1

- 5 -

with a cover open;

Figure 3 is an exploded isometric view of the packaging of Figure 1;

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Figure 4 is an isometric view of a modular unit of the packaging;

Figure 5 illustrates the modular unit of Figure 4 with an upper cover open;

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Figure 6 is an exploded isometric view of the modular unit of Figure 4;

Figure 7(a) is a side elevation of the modular unit;

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Figure 7(b) is an end view of the modular unit;

Figure 8(a) is a sectional view taken at section A-A of Figure 7(a);

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Figure 8(b) is a sectional view taken at section B-B of Figure 7(a);

Figure 8(c) is a sectional view taken at section C-C of Figure 7(a);

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Figure 9 is a plan view of the packaging of the first embodiment of the invention;

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Figure 10 is a side elevation of the packaging of the first embodiment;

Figure 11(a) is a side sectional view of the packaging taken at section E-E of Figure 9;

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Figure 11(b) is an enlarged view of area F of Figure

- 6 -

11(a);

Figure 11(c) is an end sectional view taken at section I-I of Figure 10;

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Figure 11(d) is a part sectional plan view taken at section L-L of Figure 10;

Figure 11(e) is an isometric view showing the assembly of two modular units;

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Figure 12(a) is an end view of the packaging of the first embodiment with upper cover open;

Figure 12(b) is a similar view to Figure 12(a) but with cover closed;

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Figure 13 is a perspective view of packaging for elongated articles according to a second embodiment of the present invention;

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Figure 14 is a perspective view showing the packaging of the second embodiment with upper covers open;

Figure 15 is an exploded perspective view of the packaging of the second embodiment;

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Figure 16 is a plan view of the packaging of the second embodiment;

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Figure 17 is a side elevation view of the packaging of the second embodiment;

Figure 18(a) is a side sectional view of the packaging of Figure 16 taken at section A-A;

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Figure 18(b) is an enlarged view of area B of Figure

- 7 -

18(a); and

Figure 19 is an end sectional view of a sheath of the packaging of the second embodiment.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Illustrated in the drawings are two embodiments for packaging for elongated articles. The packaging of the present invention is for supporting and protecting an elongated article and facilitating its transportation.

Figures 1 to 12(b) illustrate a first embodiment for the packaging 10 and Figures 13 to 19 illustrate a second embodiment 20 for packaging for elongated articles.

It is understood that while the elongated articles described in relation to the preferred embodiments of the packaging are drilling tools, any large elongated article can be supported and packaged by the described packaging 10, 20. One example of another elongated article that may be packaged is rolled up flooring such as rolled carpet or a rolled rug, or rolls of textile fabrics.

The packaging 10, 20 of both preferred embodiments incorporate the use of a number of modular plastics units 30 that can be directly or indirectly assembled in order to house the elongated article. In the first embodiment the packaging 10 incorporates a plurality of the modular units 30 that are directly assembled end to end to form an extended packaging 10 substantially having a length of the elongated article. In the second embodiment the packaging 20 includes at least two modular units indirectly assembled by way of a connecting tubular sheath 22 through which the elongated article is encased between the modular units 30 located at each end of sheath 22. In the embodiment shown packaging 20 includes three modular units

- 8 -

30 interconnected by two sheaths 22.

Turning to the first embodiment, Figures 1, 2 and 3 illustrate packaging 10 comprising four modular units 30 inter-engaged end to end to form a long packaging for supporting a drilling tool 12 in a recess in the packaging and closing the packaging around drilling tool 12.

Figures 4, 5 and 6 illustrate a modular unit 30 moulded in plastics. In the preferred embodiment the modular units are made by rotational moulding low density polyethylene. Other plastics that could be used include polypropylene or other densities of polyethylene. While rotational moulding is the preferred moulding technique other moulding processes such as blow moulding could be used.

With modular units made of plastics means a substantial portion of the packaging 10, 20 is made of a plastics material and typically a strong yet lightweight plastics material. Packaging made of plastics is less prone to serious damage and avoids any customs problems at borders experienced with timber packaging. Plastics can furthermore be moulded to more accurately accommodate and support the article being transported whereby the features of the article can be negatively moulded in the packaging.

The present packaging 10, 20 is overall significantly lighter than known packaging, which translates into savings in transportation costs. The packaging 10, 20 is also weather resistant and has a longer useful life than known packaging for elongated articles.

Modular units 30 are capable of assembling end to end to each other to form the packaging 10 of the first embodiment, or assembling with another component to form the elongated packaging 20 of the second embodiment.

- 9 -

Each unit 30 has a lower portion, namely a base or a bottom casing 32, and an upper portion, namely a cover or upper casing 34. The two casings each have a bore recess, namely an upper bore recess 36 in upper casing 34 and bottom bore recess 37 in the bottom casing 32 such that when the upper casing engages the lower casing a bore 38 is created therebetween. Drilling tool 12 locates in bore 38. Each unit has at least one bore opening 39 at an end of the unit through which the drilling tool spans into the adjacent unit. In many cases both ends of a unit will have a bore opening 39, although where the unit is an end unit in the unit assembly forming the packaging, one of the unit ends may be a blind end.

In the embodiment shown especially in figures 8(a) to 8(c), bottom casing 32 contains a bore recess 37 that is designed to extend around more than half of the bore's circumference whereas bore recess 36 of the upper casing 34 surrounds less than half of the bore's circumference. The proportion of circumference which the bottom and upper casings 32, 34 surround may vary depending on the shape and circumference of the article to be packaged.

In the embodiments shown bore 38 is substantially circular in cross section to accommodate the cylindrical shape of the drilling tool 12. It is understood that the bore may be shaped otherwise, such as rectangular, depending on the shape and structure of the article to be packaged.

The bottom and upper casings 32, 34 are engaged together by hinges 40 located along one side of the modular unit (see Figures 6, and 8(a) to 8(c)). Each hinge 40 is attached to both the upper and lower casings. In the second embodiment best illustrated in Figure 15 hinge 41 is a pin that locates alternately through corresponding pin bores in the upper and lower casings.

- 10 -

Figure 5 illustrates a modular unit 30 in an open position and Figure 4 illustrates the modular unit closed. The upper and bottom casings are securely closed by way of latches 44 best seen in Figure 7(a) and 8(a). Latches 44 in this embodiment are over centre latches on the bottom casing having shifting "T" hooks which locate in corresponding latch channels 45 in the upper casing to securely shut the upper and bottom casings together. It is understood however that any suitable locking means or clamping means can be used to secure the upper and bottom casings together.

To assist in biasing the upper casing towards an open position hydraulic or pneumatic struts 27 are located between the bottom and upper casings. This prevents the upper casing unintentionally dropping closed when the packaging is open.

The drawings illustrate dampening ribs 46 which can be positioned on the inside of the upper and lower casings either directly on the wall of the bore 38 or inside moulded rib recesses 47 located at intervals along bore 38. The ribs are fastened, by screws or the like, onto the bore wall or into the recesses 47 which lie on the inside perimeter of the bore in the bottom and upper casings 32, 34. Dampening ribs 46 have the effect of providing a cushioned support for the drilling tool 12 along its length and for absorbing any impacts and vibrations experienced during handling and transportation which can damage the tool. Accordingly, ribs 46 are made of a rubber material, or a similar resilient material, capable of withstanding sudden forces and providing general support to the tool.

Dampening ribs 46 may be moved along the length of the bore and inserted in the most appropriate recesses 47 corresponding to where the most support is required

- 11 -

according to the shape of the tool. The ribs 46 may also be provided in a variety of sizes and in particular different depths to allow selection of the extent at which the dampening ribs extend into the bore. This is useful  
5 where the tool varies in external diameter along its length, as is often the case. The dampening ribs can thereby be adjusted to protrude more or less into the bore to securely bear against the tool at spaced intervals along the tool's length. This feature also allows for the  
10 orientation of the tool to be changed inside the packaging and allows for the same packaging to be used for a different tool.

Illustrated in particular in the isometric views of  
15 Figures 6 and 11(e), and cross sectional views of Figures 11(a), 11(b) and 11(c) are engaging means which allow engagement of one modular unit 30 to another modular unit 30 to form packaging 10. The engaging means is defined, in a simple sense, by interlocking grooves and ridges  
20 provided at each end of the modular unit 30. However in a more specific sense the grooves and ridges have more complex interlocking profiles. A first interlocking profile 48 comprises at least one set of groove and protrusion that is complemented by a second interlocking  
25 profile 49.

One end of each unit 30 is provided with the first interlocking profile 48 while the opposite end of the unit 30 is provided with the complementary second interlocking  
30 profile 49. The interlocking profiles 48, 49 are such to allow side by side assembly of modular units 30. Assembly takes place when the units are open or closed, that is when upper casing 34 is hinged open as illustrated in Figures 2 and 5 or closed as illustrated in Figure 11(e).

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The first interlocking profile 48 may change in profile between the upper and bottom casing of the same modular

- 12 -

unit. The second interlocking profile 49 matches any change in profile. This change is primarily to facilitate easy assembly of the casings when the modular units are in the open or closed positions.

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As illustrated in Figure 11(e) assembly is carried out by sliding the end of one bottom casing into the end of an adjacent bottom casing. In side view the first interlocking profile 48 at the end of the modular unit is stepped facing downwards while the second interlocking profile 49 is stepped facing upward such that the first profile 48 can be lowered and engaged with the second profile 49. The interlocking profiles are correspondingly tapered so that the profiles are self-guided into engagement. Screws 53 or other fastening means may also be used to locate through screw holes 54 (Figures 3 and 11(d)) to more readily secure adjacent units.

Accordingly modular units 30 can be securely assembled together to create the elongated packaging 10. Figures 12(a) and 12(b) illustrate in end profile packaging 10 in the open and closed position.

Where identical modular units 30 are used for all sections of the packaging 10, end plugs 14 are insertable at the ends of packaging 10 to cap off the bore 38 and fully enclose drilling tool 12 in packaging 10 or 12. This arrangement is illustrated in the second embodiment of Figures 13 to 19.

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In the first embodiment the modular units assembled at the opposite ends of the packaging are specifically formed as right or left end units 31 such that end capping is not required because while one end of end unit 31 includes a bore 38, the other end is a blind end.

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Anchor brackets 16, or lifting lugs 29, provide a point of

- 13 -

lift to which cables and other lifting means may be attached in order to raise packaging 10. Anchor brackets 16 are fastened and extend under and partly up the sides of the bottom casing to obtain a good hold on the casing when lifting means is attached to opposite sides of the anchor bracket.

Forklift recesses 18 on the underside of the bottom casing 32 are spaced to receive the prongs of a forklift which can be inserted to raise the packaging 10.

A drainage channel 17, sump hole 19 and sump plug 21 located in each modular unit 30 allows for fluid such as oil collected in bore 38 to be drained from packaging 10 thereby maintaining a clean packaging interior that can be easily drained of fluid (see Figure 8(b)).

Figures 13, 14 and 15 illustrate in perspective view the second embodiment of the packaging 20. As discussed earlier this embodiment comprises modular units interconnected by tubular sheaths 22. This version is suitable for use where potential damage to a tool is low and the tool during transit is expected to be handled with care. This version is less robust as it has fewer modular units 30 to protect the tool, every second modular unit 30 being replaced by a sheath 22.

Sheath 22 is also made of a plastics material and is formed in two parts as illustrated in Figure 19, namely an upper sheath half 23 and a lower sheath half 24. The ends of sheath 22 are provided with similar interlocking profiles 48, 49 as the modular units 30 to enable the sheaths to be engageable with the modular units. The upper and lower sheath halves 23, 24 are themselves provided along their length with interlocking edges 25 to ensure locked alignment which is fully secured when the modular units are closed. Tool 12 is adapted to extend

- 14 -

across all three modular units and the two sheaths 22 illustrated in Figures 13 to 19.

For both the first and second embodiment, internal  
5 sleeves, not shown in the drawings, may be provided as inserts in bore 38 and extending circumferentially around the bore 38 to reduce the effective diameter of the bore and thereby allow the existing packaging 10, 20 to support  
10 articles having a smaller diameter than that afforded by the sleeveless bore 38. This is suitable, for example, where the packaging is adapted to support a narrower drilling tool. Accordingly, the same packaging 10, 20 may be used for supporting different diameters of tools and other articles.

15 The length of the packaging 10, 20 is obviously also adjustable depending on the number of modular units and/or sheaths 22 assembled to create the packaging. As an example, the modular units 30 may be 1.8 metres in length.  
20 For a 7 metre tool four modular units would be assembled to comfortably accommodate the tool. The sheaths 22 may be made to the same length as the modular units or in a variety of lengths in order to accommodate tools of varying lengths. The modular units may also be  
25 constructed in a selection of compatible lengths in order to accommodate a tool of any size by selecting an appropriate combination of modular unit lengths.

While the bore 38 is substantially circular in cross  
30 section, lengthwise the packaging 10, 20 is ideally rectangular to ensure stability of the packaging and to promote stackability where the packaging may be stacked one against the other and one on top of the other. This minimises space wastage during transit and storage, which  
35 can be costly.

When stacked the packaging 10, 20 interlocks in a vertical

- 15 -

sense whereby protruding feet 50 on the underside of the bottom casing 32 locate in corresponding footprints 52 recessed on top of the upper casing 34. This minimises relative shifting and movement of the packaging during transit.

It is also envisaged that a Global Positioning System (GPS) tracking system would be applied to each packaging. A GPS tracking device mounted in or on the packaging will provide accurate information on the precise location of the packaging at any given moment. Aside from accurately tracking the location of the packaging the GPS device would also provide information on the article or tool packaged within the packaging such as an asset number, tool type, delivery location, and the like.

Owing to the modular nature of the packaging 10, 20, when not supporting an article the package can be easily unassembled into the modular unit sections and stored or transported as appropriate. The modular nature of the units furthermore allows the units to be stored in a stacked manner so as to reduce storage space wastage.

It is also envisaged that to assist in lowering the article into the packaging and lifting it out of the packaging and an internal pack sling (not shown) is provided and lies in the bottom bore recess 37 underneath the article. The ends of the sling are accessible and may be lifted from the open packaging.

In another embodiment of the invention, which is not illustrated in the drawings, the packaging may hold more than one tool. The tools would be held in a parallel arrangement in the same packaging. In this case the plastics modular units would be moulded to incorporate at least two parallel bores, one for each tool.

- 16 -

The moulding of the units provides great flexibility in creating moulded features to cater for any other desired application or storage requirement. For example, recessed outlines may be moulded for specific tools, such as hand tools or short drilling components, so that the smaller components can be transported together with the longer drilling tools in the same package. This in turn facilitates accountability of the tools and assists in any audits carried out in respect of the transported components.

It will be understood to persons skilled in the art of the invention that many modifications may be made without departing from the spirit and scope of the invention.

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THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. Packaging for elongated articles comprising a plurality of modular units each having a lower portion engageable with an upper portion to close the unit and form therebetween a bore, at least one end of each modular unit having a bore opening and engaging means at the bore opening end for securing the modular unit end to end to another modular unit, or a connecting unit, to form an elongated packaging comprising two or more modular units through which an elongated article is supported.
2. The packaging claimed in claim 1 wherein each modular unit is directly joined to an adjacent modular unit to form an elongated packaging.
3. The packaging claimed in claim 2 wherein the packaging comprises three to eight modular units joined in line.
4. The packaging claimed in any one of claims 1 to 3 wherein the engaging means are interlocking end profiles .
5. The packaging claimed in claim 4 wherein the interlocking end profiles are such to allow the modular units to be assembled while open or closed.
6. The packaging claimed in claim 1 wherein the modular units are indirectly joined to one another by way of a tubular sheath extending between modular units, the modular units and sheath forming the elongated packaging.
7. The packaging claimed in claim 6 wherein the packaging includes at least three units spaced apart by sheaths located therebetween.
8. The packaging claimed in any one of the preceding

claims including internal sleeves inserted inside the bore to reduce the bore diameter to support smaller articles.

9. The packaging claimed in any one of the preceding  
5 claims including dampening ribs provided on the bore inside the units to protect the elongated article.

10. The packaging claimed in claim 8 wherein the dampening ribs are made of a resilient and absorbent  
10 material and are fastened around the circumference of the bore in recesses spaced at intervals along each modular unit.

11. The packaging claimed in any one of the preceding  
15 claims wherein the modular units are made of plastics.

12. The packaging claimed in any one of claims 1 to 11 wherein the lower and upper portions are lower and upper casings respectively that are hinged together to  
20 securely close and encapsulate an elongated article.

13. The packaging claimed in claim 12 wherein pneumatic or hydraulic struts are provided between the upper and lower casing.  
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14. The packaging claimed in any one of the preceding claims wherein the bore is substantially circular in cross section.

30 15. The packaging claimed in any one of the preceding claims wherein the upper and lower portions have formations that correspond with physical features of the article to be packaged to thereby securely accommodate the article.

35 16. The packaging claimed in any one of the preceding claims wherein the exterior of the modular units are

substantially rectangular such that the units have a flat base and are capable of being stacked one next to the other and one on top of the other.

5 17. The packaging claimed in any one of the preceding claims wherein lugs, or other anchor points, spaced along the exterior of each unit allow the packaging to be lifted.

10 18. The packaging claimed in any one of the preceding claims wherein the underside of the lower portion is provided with forklift recesses.

15 19. The packaging claimed in any one of the preceding claims including a global positioning system tracking device capable of tracking the location of the packaging and communicating with a remote processor.

20 20. A modular plastics unit capable of assembling together with a similar unit, or a connecting unit, the modular unit having a lower portion engagable with an upper portion to close the unit and form a bore therebetween, at least one end of the modular unit having  
25 a bore opening and engaging means at the bore opening end for securing the modular unit end to end to another modular unit, or a connecting unit, to form an elongated packaging comprising two or more modular units through which an elongated article is supported.

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