

ARTICLE AND METHOD OF MANUFACTURE

Field of the invention

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This invention relates to an article, and more particularly (though not exclusively), to an article used for lamps; as well as a method of manufacturing such an article.

Background of the invention

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Most lighting structures are made with glass or plastics or a combination of both. Glass lampshades usually require hot working i.e. slumping, glass blowing, moulding, etc. Glass structures can be cold worked by soldering with metal frames or wires such as, for example, Tiffany lamps.

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The problem with most of the current techniques is that they require moulds and hot working for commercial manufacture. This is an expensive process and usually requires a large quantity before they can be cost effectively manufactured. Variations in size and colour create difficulties in production because usually new moulds have to be made for different sizes.

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New/different colours for glass and plastics are also expensive and often require highly skilled artisans or factories if such colours are not readily available.

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Glass or plastics may be cold worked into structures as well. The disadvantage is they usually require pre-moulded pieces or are joined as flat sheets. An example is a Tiffany lamp. These are small flat pieces of glass soldered or joined together with metal frames/wires. Although beautiful, the technique cannot be used to join large sheets of glass which are too heavy for the structures to hold. Joining small pieces of glass for complex structures is very time consuming.

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Glass and plastics can also be joined by screws and metal frames without cold working. The disadvantage is that the wires and screws often add shadows and lines to interfere with the look of the lamps.

In addition to the above lamps, there are also lamps that are made of paper/cloth with vellum and wires. In order to bind cloth to a lamp frame, most lamp makers traditionally create a wire frame. They would then sew the cloth directly onto the frame or reinforce
5 the fabric with vellum or plastics before attaching to the wire frame.

Since the material is sewn or attached to a wire frame, skilled artisans are required and this adds to the high cost of manufacturing such lamps. Also, the wire frames interfere with the light by casting shadows and lines. Further, the materials used may potentially
10 be a fire hazard because they may not be able to withstand the high heat generated by the lamps.

Summary of the invention

15 In accordance with a first preferred aspect of the invention, there is provided an article comprising a thermoplastic sheet, wherein a first edge of the thermoplastic sheet is bonded with a second edge of the thermoplastic sheet to form the article.

Preferably, the first edge is directly bonded with the second edge to form a non-opaque
20 article. By "opaque", it is meant to refer to the state of being impenetrable to light. Advantageously, when the article is used as a lamp, there are no intervening portions between the first and the second edge to affect the light cast from the light source of the lamp. There are no intervening frames or other opaque structures to interfere with the lighting emanating from the light source.

25 Preferably, the thermoplastic sheet has four edges and the first and second edges are opposite sides to each other.

Preferably, the articles further comprises a top portion and a bottom portion, wherein the
30 top and bottom portions are each bonded to the exposed two edges of the thermoplastic sheet respectively. More preferably, the edges of the top and bottom portions contain at least one projection for bonding with the edge of the thermoplastic sheet.

Preferably, wherein the top and bottom portions are also formed from a thermoplastic sheet.

5 Preferably, a supporting structure is bonded to the top portion. More preferably, the supporting structure is a sheet of polycarbonate twinwall. Polycarbonate is used to reinforce the thin polycarbonate sheets in areas where strength, high melting point and rigidity is needed. Polycarbonate twinwall is also light and easy to cut and shape. Supporting structures made of wood or any other light but sturdy material such as pa
10 wooded sheet or thick acrylic or a thicker polycarbonate sheet or aluminium may be used.

Preferably, bonding is achieved by adhesives. This provides the advantage of, when used as a lamp, the article will not interfere with the lighting by casting unsightly shadows and lines.

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It is an advantage to bond the sheets together by adhesives instead of other forms of bonding such as, for example melting the hot working, because the structural hold is adhesive is better and stronger. The sheets do come apart when heat and mechanical stress is applied to the sheets. In addition, unlike hot working, use of adhesives is safer
20 to handle and there are no "scars" on the surface of the article which are not aesthetically pleasing.

Preferably, the thermoplastic sheets are polycarbonate sheets. Polycarbonate has advantageous properties such as a high melting point and is malleable and strong
25 without hot working. The high melting point ensures safety. When used as a lamp, the article will not melt when the light source is switched on. Its malleability without hot working allows for different shapes to be made without large machinery and equipment. The clear or colourless version of polycarbonate is used when maximum light is needed to shine through the lamp shade. Other colours such as translucent/white are used when
30 light has to be obscured. Still more preferably, polycarbonate sheets between 0.5mm and 1mm thickness are used for the lamps.

It may also be possible to use other material to form the article so long as the material has a high melting point and is malleable and strong without hot working.

Preferably, a translucent cloth is bonded to the surface of the thermoplastic sheets. This enhances the aesthetic appearance of the article. Additionally, depending on the translucency of the cloth, the cloth will control the amount of light emitting from the article
5 when the article is used as a lamp.

In accordance with a second preferred aspect of the invention, there is provided a lamp comprising a light source exchangeably fixed in sockets mounted in the framework of the article according to any one of claims 1 to 10.
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In accordance with a third preferred aspect of the invention, there is provided a method for manufacturing an article, the method comprising:

- (a) preparing a thermoplastic sheet having four edges;
- (b) bending the thermoplastic sheet; and
15 (c) bonding a first edge of the thermoplastic sheet with a second edge of the thermoplastic sheet.

Preferably, the adhesives are applied to either the first or the second edge before bending the thermoplastic sheet.
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Preferably, the sheet is scored prior to bending. Scoring is carried out only when it is desired to have the article shaped into a box-like shape with 90 degree angles or more or when large pieces of the polycarbonate sheets need to be bent.

25 Preferably, wherein the thermoplastic sheet is a polycarbonate sheet.

More preferably, the method of the third aspect of the invention further comprises

- (a) preparing a top portion and a bottom portion;
- (b) indenting the edge of each of the top portion and the bottom portion to
30 form at least one projection;
- (c) bonding the top and bottom portions to the exposed two edges of the thermoplastic sheet respectively.

Preferably, the adhesives are applied to the at least one projection on each of the top portion and the bottom portion before bonding the portions to the exposed edges of the thermoplastic sheet.

- 5 Preferably, the top and bottom portions are prepared from a thermoplastic sheet.

Preferably, the method further comprises bonding a supporting structure to the top portion. More preferably, the supporting structure is a sheet of polycarbonate twinwall.

- 10 Preferably, the method further comprises the step of bonding a translucent cloth to the article.

By "article", it is meant to include any structure such as a lamp, box e.g. ornamental boxes and tissue boxes, sculptures, architectural pieces, furniture and the like.

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By "thermoplastic material", it is meant to refer to any material that is plastic or deformable, melts to a liquid when heated and freezes to a brittle, glassy state when cooled sufficiently. Most thermoplastics are high molecular weight polymers whose chains associate through weak van der Waals forces (polyethylene); stronger dipole-dipole interactions and hydrogen bonding (nylon); or even stacking of aromatic rings (polystyrene). Thermoplastic polymers differ from thermosetting polymers (Bakelite; vulcanized rubber) which once formed and cured, can never be remelted and remolded. Many thermoplastic materials are addition polymers; e.g., vinyl chain-growth polymers such as polyethylene and polypropylene. Thermoplastics can go through melting/freezing cycles repeatedly and the fact that they can be reshaped upon reheating gives them their name.

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Thermoplastics include acrylonitrile butadiene styrene (ABS), acrylic, celluloid, cellulose acetate, ethylene-vinyl acetate (EVA), ethylene vinyl alcohol (EVAL), fluoroplastics (PTFEs, including FEP, PFA, CTFE, ECTFE, ETFE), ionomers, liquid crystal polymer (LCP), polyacetal (POM or acetal), polyacrylates (acrylic), polyacrylonitrile (PAN or acrylonitrile), polyamide (PA or nylon), polyamide-imide (PAI), polyaryletherketone (PAEK or ketone), polybutadiene (PBD), polybutylene (PB), polybutylene terephthalate (PBT), polyethylene terephthalate (PET), polycyclohexylene dimethylene terephthalate

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(PCT), polycarbonate (PC), polyketone (PK), polyester, polyethylene/polythene/polyethene, polyetheretherketone (PEEK), polyetherimide (PEI), polyethersulfone (PES), polyethylenechlorinates (PEC), polyimide (PI), polylactic acid (PLA), polymethylpentene (PMP), polyphenylene oxide (PPO), polyphenylene sulfide (PPS), polyphthalamide (PPA), polypropylene (PP), polystyrene (PS), polysulfone (PSU), polyvinyl chloride (PVC) and spectralon.

It is also included any material that can withstand temperatures of 115°C and beyond, for example, nylon. Polycarbonates have high melting points. Advantageously, when the article is used as a lamp, the material used according an embodiment of the present invention can be very close to or almost touch the light source, for example, a light bulb. On the other hand, PVC and acrylics, for example, have melting points of around 100°C, so lamps using them should preferably not be too close to the lamp source and have good ventilation. In standards set out by the governments of most development countries, heat emanating from lamp structures cannot be higher than about 95°C when the light source is switched on. Therefore, any material used in the lamps of the present invention must be able to withstand such high temperatures.

By "adhesives", it is meant to refer to any compound that adheres or bonds two items together. These include adhesives derived from natural and/or synthetic sources. Natural adhesives may be obtained from vegetable (natural resin), food (animal hide and skin), and mineral sources (inorganic materials) sources. Synthetic adhesives are usually based on elastomers, thermoplastic, and thermosetting adhesives.

One group of adhesives is known as "hot glue" that is commonly in solid sticks designed to be melted in a special gun. The glue needs only to cool to harden, so it is commonly used when quick bonding is desired. Also known as "hot melt" adhesives, these adhesives are generally thermoplastics; they are applied hot and simply allowed to harden as they cool. These adhesives have become popular for crafts because of their ease of use and the wide range of common materials to which they can adhere. A glue gun, pictured right, is one method of applying a hot adhesive. The glue gun melts the

solid adhesive and then allows the liquid to pass through the "barrel" of the gun onto the material where it solidifies.

5 Another group of adhesives are known as the reactive adhesives and are generally thermosetting plastics. Epoxy resins are the most common example of this kind of adhesive. Reactive adhesives generally come in two separate containers. The two ingredients of the adhesive must be mixed in certain proportions immediately before application. Generally one ingredient is a monomer, or resin, and the second is a reaction initializer. When the two are mixed together, a polymerization reaction occurs
10 which solidifies the adhesive. Reaction adhesives may also react with the surface of the materials to be stuck together. This process is called bonding, in which the adhesive forms chemical bonds with the material, and is distinct from sticking, the action of common glues. A special case of this kind of adhesive is cyanoacrylate which reacts with trace moisture on the surfaces being bonded and therefore does not need any
15 mixing before application. Reactive adhesives are very strong and are used for high-stress and high-temperature applications.

Further, by "adhesives" it is also included adhesive tapes, i.e. an adhesive-coated fastening tape used for temporary and/or permanent joining. Single-sided tapes allow
20 joining of two overlapping or adjoining materials, while double-sided tape (adhesive on both sides) allows joining of two items back-to-back. These tapes are made by applying an adhesive emulsion to a tape or film that is then wound onto a roll. Manufacture often involves winding large films of material onto a roll and then cutting the roll into convenient widths.

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In the case where the article is used as a lamp, the adhesive used must be able to withstand the heat emanating from the light source of the lamp. Also, the adhesive used should be easy to apply and does not stain the thermoplastic sheets and/or the material (for example, cloth or fabric) bonded to the surface of the thermoplastic sheets.

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It may also be necessary to apply adhesive primers to the adherend before the application of the actual adhesive. Any structural adhesive bonding primers used should

serve three basic purposes: (1) they should protect the adhered surface from being affected by the workshop environment; (2) they should inhibit corrosion of the bonded surface during its service life; and (3) they should provide a compatible surface to which the adhesive can bond for long-term strength. They should also have excellent mar resistance, protect the adhered from re-oxidizing, and be readily cleaned prior to bonding using standard workshop procedures. Additionally, they should protect the adherend during high humidity conditions; from salt corrosive environments; and withstand the effects of numerous fuels, hydraulic fluids, and lubricating oils.

By "cloth", it is meant to refer to any a flexible artificial material made up of a network of natural or artificial fibres (thread or yarn) formed by weaving or knitting (textiles), or pressed into felt. However, other materials such as paper, coconut fibres, grass mache, wood laminates, silk, fabric, string, rattan, etc. may be used.

Brief description of the drawings

In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limitative examples only preferred embodiments of the present invention, the description being with reference to the accompanying illustrative figures.

In the figures:

Figure 1 is a perspective view of an article according to an embodiment of the invention;

Figure 2 is a perspective view of a lid of the article of Figure 1;

Figure 3 is a perspective view of a round cover of the article of Figure 1;

Figure 3A is a cross section view of the round cover of Figure 3;

Figure 4 is a perspective view of a cloth cover base of the article of Figure 1;

Figure 5 is a perspective view of an article according to another embodiment of the invention;

Figure 5A is a perspective view of the article according to Figure 5 cut at line X-Y; and

Figure 6 is a perspective view of the article according to another embodiment of the invention.

Detailed Description of Preferred Embodiments

An article 5 according to an embodiment of the invention comprises a top lid 10, a round cover 15 and a base 20.

The base 20 comprises a first clear polycarbonate sheet 25 with a plurality of projections 30 along the edge of the polycarbonate sheet 25; and a second polycarbonate sheet covered with cloth 35.

The round cover 15 is formed by bending a polycarbonate sheet over itself and its ends are adhered together at 40. A cloth 45 is adhered to polycarbonate sheet.

The top lid 10 comprises of a polycarbonate sheet 50 with a plurality of projections 55 along the edge of the polycarbonate sheet 50; and a polycarbonate twinwall 60 as reinforcement. A cut-out 60 is formed at the top lid to allow sockets (not shown in figures) to be mounted in the article 5 so that, when used as a lamp, a light source may be exchangeably fixed to the sockets.

The process for making the article is broken down into five steps, as detailed below:

Step 1: Making the cloth cover base;

Step 2: Making the round cover;

Step 3: Making the top lid;

Step 4: Bonding the round cover, clear polycarbonate sheet and cloth base; and

Step 5: Bonding the round cover and top lid.

Step 1

A polycarbonate sheet is prepared. In this present invention, a 'clear' polycarbonate sheet i.e. transparent, colourless sheet is used. It comes pre-laminated on both sides
5 with plastic, one side clear and one side green. This therefore gives it a 'green' appearance.

The desired shape and design of the polycarbonate sheet is marked out on the laminate
backing of polycarbonate sheet. The marked out design on the polycarbonate sheet is
10 then cut. This maybe by any suitable process such as, for example, being scored with a
penknife. Alternatively, the marked out design may be cut out using an automatic cutting
machine, a guillotine, a pair of scissors or the like. Once the polycarbonate sheet has
been cut to size, the laminate backing may be removed.

15 A double-sided adhesive tape such as, for example, 3M 9075 Tissue Tape ("9075") is
then applied onto the polycarbonate sheet, making sure that the 9075 tape is laid evenly
across the polycarbonate sheet. This is to ensure that there are little or no "bubbles"
when the double-sided backing of the 9075 tape is removed.

20 Once the double-sided 9075 tape is laid out, the excess tape is cut away. The double
sided backing of 9075 tape is then peeled away.

A piece of cloth is laid onto a flat surface. The polycarbonate sheet is placed onto the
cloth, making sure the sticky side of the double sided tape is in contact evenly with the
25 surface of the cloth. In cases where the cloth has to be folded onto the polycarbonate
sheet, a thin strip of 3M 9448 Tissue Tape ("9448") may need to be placed onto the cloth
just outside the polycarbonate. The excess cloth just outside the double-sided 9448 tape
is cut away. The double-sided backing of the 9448 tape is then peeled away and excess
cloth is folded inwards onto the polycarbonate sheet.

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Step 2

The same process as above in Step 1 is applied to another polycarbonate sheet. The
polycarbonate sheet, with a layer of 9075 tape, is then laid onto a piece of cloth. In

cases where the edge of the cloth is not folded inwards but attached to another cloth/polycarbonate, a gap of about 5mm is made between polycarbonate sheet and the double sided tape 9075 tape. Excess cloth is then cut away.

- 5 For areas of the cloth not meant to adhere to other pieces of polycarbonate sheet and the cloth, the cloth is folded back onto itself instead of the polycarbonate sheet. Once the polycarbonate sheet is prepared, 3M 94 Primer ("94") is applied to the two ends of the polycarbonate sheet surface that are to be bonded together..
- 10 A layer of double-sided tape, 3M 468MP ("468MP"), is laid on one side of the contacting polycarbonate sheet surface. If there is a folded layer of cloth on the polycarbonate sheet, the 3M 468MP ("468MP") tape will be applied on both the polycarbonate and the cloth surface.
- 15 This is to ensure the cloth does not open up when the heat emanating from the light source of the lamp gets too hot. The two ends of the polycarbonate sheet are adhered together.

Step 3

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A twinwall polycarbonate sheet is cut to size. Double-sided tape (2075 Tissue Tape) is applied to the twinwall and excess tape is cut away. The twinwall is then applied to the polycarbonate B. The projections of the polycarbonate sheet are bent upwards. Primer 94 is then applied before 3M 468MP Tape ("468MP") is pasted on the projections.

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Step 4

- Step 4 consists of first attaching the clear polycarbonate sheet to the prepared round cover. After this is done, the cloth base is attached to the clear polycarbonate sheet. The
- 30 clear polycarbonate sheet needs to be prepared for attachment to the round base.

The projections of the polycarbonate sheet are first coated with Primer 94. 468MP tape is then applied onto the projections of the polycarbonate sheet. Primer 94 is also applied

onto the other contacting surface of round cover. The polycarbonate sheet with the projections is laid into contact with the round cover.

5 The excess cloth on the round cover is then folded onto the clear polycarbonate sheet. A layer of double-sided tape is laid on the polycarbonate side of polycarbonate sheet. The excess is cut away. The backing for double sided tape is peeled away and the polycarbonate sheet is laid onto the clear polycarbonate sheet.

Step 5

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The backing of double-sided tape is removed. Primer 94 is then applied before 3M 468MP Tape ("468MP") is pasted on the projections. The backing of the double-side tape is removed and the cloth is folded evenly inwards onto the polycarbonate sheet.

15 Besides round structures, many other shapes such as squares can also be made. The methodology for making both are essentially the same, but with a few small differences. Unlike the round article described above, the article as shown in Figure 5 is box-shaped. Since the square cover has to be bent at an acute angle, the polycarbonate sheet has to be scored first at positions such as 70. The polycarbonate sheet is scored in a jagged
20 line fashion. This allows the polycarbonate to be bent without snapping.

In another embodiment of the present invention, a lamp is provided wherein a light source that is exchangeably fixed in sockets is mounted in the article. Figure 6 shows such an embodiment. Light bulbs 75 are fixed in sockets on a support structure 80 are
25 mounted in the article 5.

It is understood that other materials known in the art such as paper, coconut fibres, grass mache, wood laminates, silk, fabric, string, rattan, etc. may be used instead of cloth. These materials may be selected to enhance the aesthetic appearance of the
30 article.

The adhesives, such as the double-sided adhesive tape, used in the present invention are obtained from 3M. The adhesives were selected based on their property to withstand the heat emanating from the light source of the lamp. Advantageously, the adhesives do

not stain the cloth material bonded on the surface of the article and allow strong bonding of the cloth material to the surface of the article. Also, the adhesives prevent the article from coming apart when the lamp reaches a high enough temperature. Further, the adhesives provide the advantage of having an article having heat resistance, shear strength, the right transparency/translucency when the article is used as a lamp, and at the same time being aesthetically pleasing to the eye.

Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications in details of design or construction may be made without departing from the present invention.

CLAIMS

1. An article comprising a thermoplastic sheet, wherein a first edge of the thermoplastic sheet is bonded with a second edge of the thermoplastic sheet to form the article.
2. An article according to claim 1, wherein the first edge is directly bonded with the second edge to form a non-opaque article.
3. An article according to claim 2, wherein the thermoplastic sheet has four edges and the first and second edges are opposite sides to each other.
4. An article according to claim 3, further comprising a top portion and a bottom portion, wherein the top and bottom portions are each bonded to the exposed two edges of the thermoplastic sheet respectively.
5. An article according to claim 4, wherein the edges of the top and bottom portions contain at least one projection for bonding with the edge of the thermoplastic sheet.
6. An article according to any one of claims 4 or 5, wherein the top and bottom portions are formed from a thermoplastic sheet.
7. An article according to any one of claims 4 to 6, wherein a supporting structure is bonded to the top portion.
8. An article according to claim 7, wherein the supporting structure is a sheet of polycarbonate twinwall.
9. An article according to any one of the preceding claims, wherein bonding is achieved by adhesives.
10. An article according to any one of the preceding claims, wherein the thermoplastic sheets are polycarbonate sheets.

11. An article according to any one of the preceding claims, wherein a cloth is bonded to the surface of the thermoplastic sheets.
12. A lamp comprising a light source exchangeably fixed in sockets mounted in the framework of the article according to any one of claims 1 to 11.
13. A method for manufacturing an article, the method comprising:
 - (a) preparing a thermoplastic sheet having four edges;
 - (b) bending the thermoplastic sheet; and
 - (c) bonding a first edge of the thermoplastic sheet with a second edge of the thermoplastic sheet.
14. The method according to claim 13, wherein adhesives are applied to either the first or the second edge before bending the thermoplastic sheet.
15. The method according to any one of claims 13 or 14, wherein the sheet is scored prior to bending.
16. The method according to any one of claims 13 to 15, wherein the thermoplastic sheet is a polycarbonate sheet.
17. The method according to claim 13, further comprising:
 - (a) preparing a top portion and a bottom portion;
 - (b) indenting the edge of each of the top portion and the bottom portion to form at least one projection;
 - (c) bonding the top and bottom portions to the exposed two edges of the thermoplastic sheet respectively.
18. The method according to claim 17, wherein adhesives are applied to the at least one projection on each of the top portion and the bottom portion before bonding the portions to the exposed edges of the thermoplastic sheet.
19. The method according to any one of claims 17 or 18, wherein the top and bottom portions are prepared from a thermoplastic sheet.

20. The method according to any one of claims 17 to 19, further comprising bonding a supporting structure to the top portion.

21. The method according to claim 20, wherein the supporting structure is a sheet of polycarbonate twinwall.

22. The method according to any one of claims 13 to 21, comprising the further step of bonding a cloth to the article.