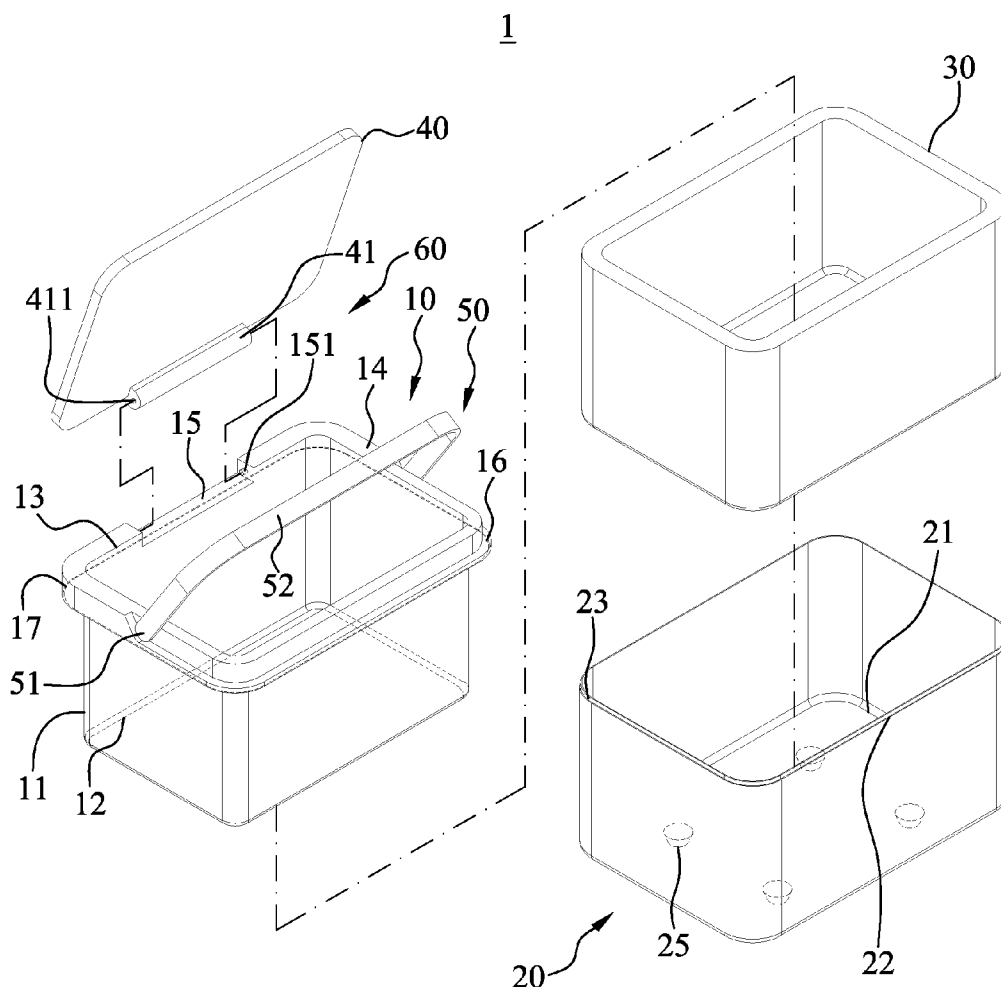




US 20150344211A1

(19) **United States**(12) **Patent Application Publication**
Moon(10) **Pub. No.: US 2015/0344211 A1**(43) **Pub. Date: Dec. 3, 2015**(54) **ADVANTAGEOUSLY RECYCLABLE
ENVIRONMENT-FRIENDLY THERMAL
INSULATION BOX**(52) **U.S. Cl.**
CPC *B65D 81/3825* (2013.01); *B65D 25/2867*
(2013.01); *B65D 43/14* (2013.01)(71) Applicant: **FTI GROUP (HOLDING) COMPANY
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LIMITED**, GRAND CAYMAN (KY)(21) Appl. No.: **14/288,860**(22) Filed: **May 28, 2014****Publication Classification**(51) **Int. Cl.**
B65D 81/38 (2006.01)
B65D 43/14 (2006.01)
B65D 25/28 (2006.01)(57) **ABSTRACT**

An advantageously recyclable environment-friendly thermal insulation box includes an inner box, an outer box and an insulation layer. The inner box has a sealed bottom, a peripheral wall, and a top opening having an engaging edge formed therearound. An engaging groove is provided between the engaging edge and the peripheral wall. The outer box includes a closed bottom and an open top provided with an engaging protrusion. Through engagement of the engaging protrusion with the engaging groove, the outer box is externally connected to the inner box with an enclosing space formed between the two boxes for receiving the insulation layer therein. The inner and outer boxes are made of a PP or an HDPE material, and the insulation layer is made of an EPE material, allowing the no longer usable thermal insulation box to be directly recycled to produce plastic pellets with good mechanical properties and accordingly higher value.



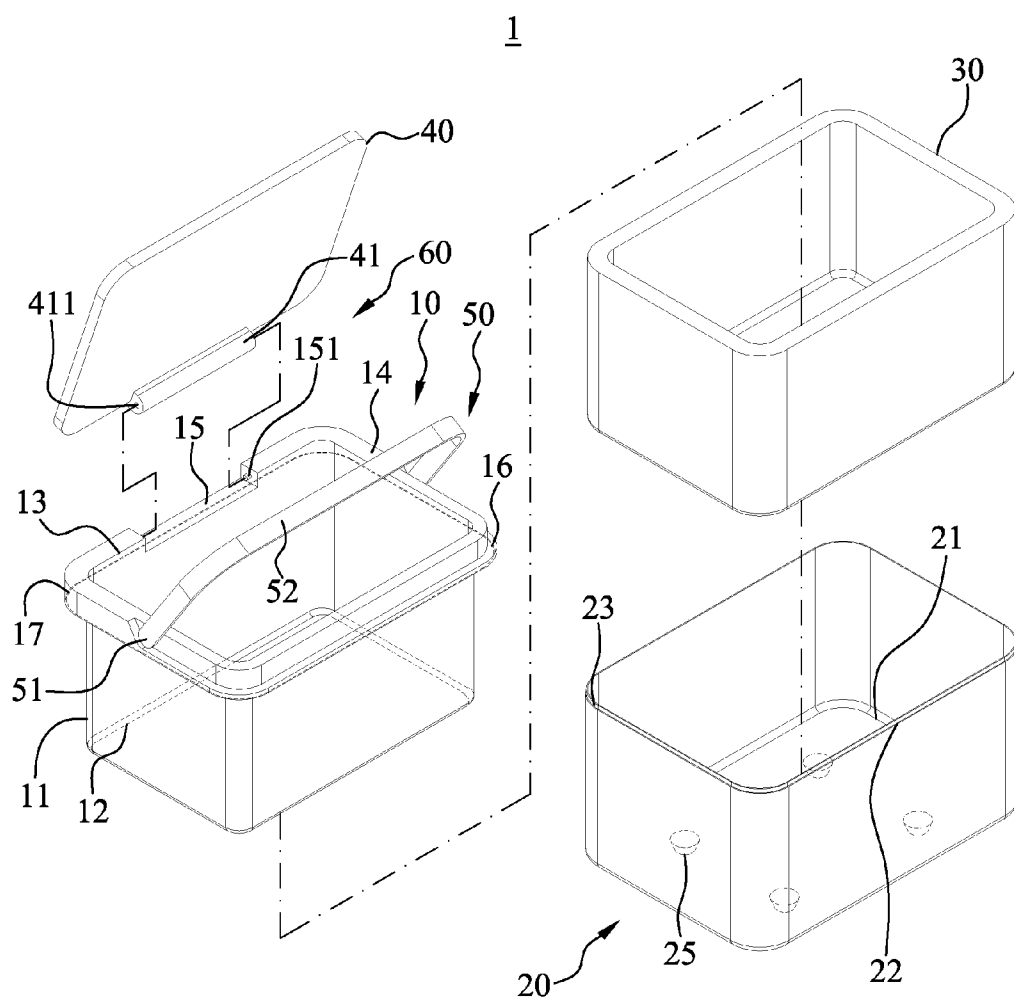


FIG. 1

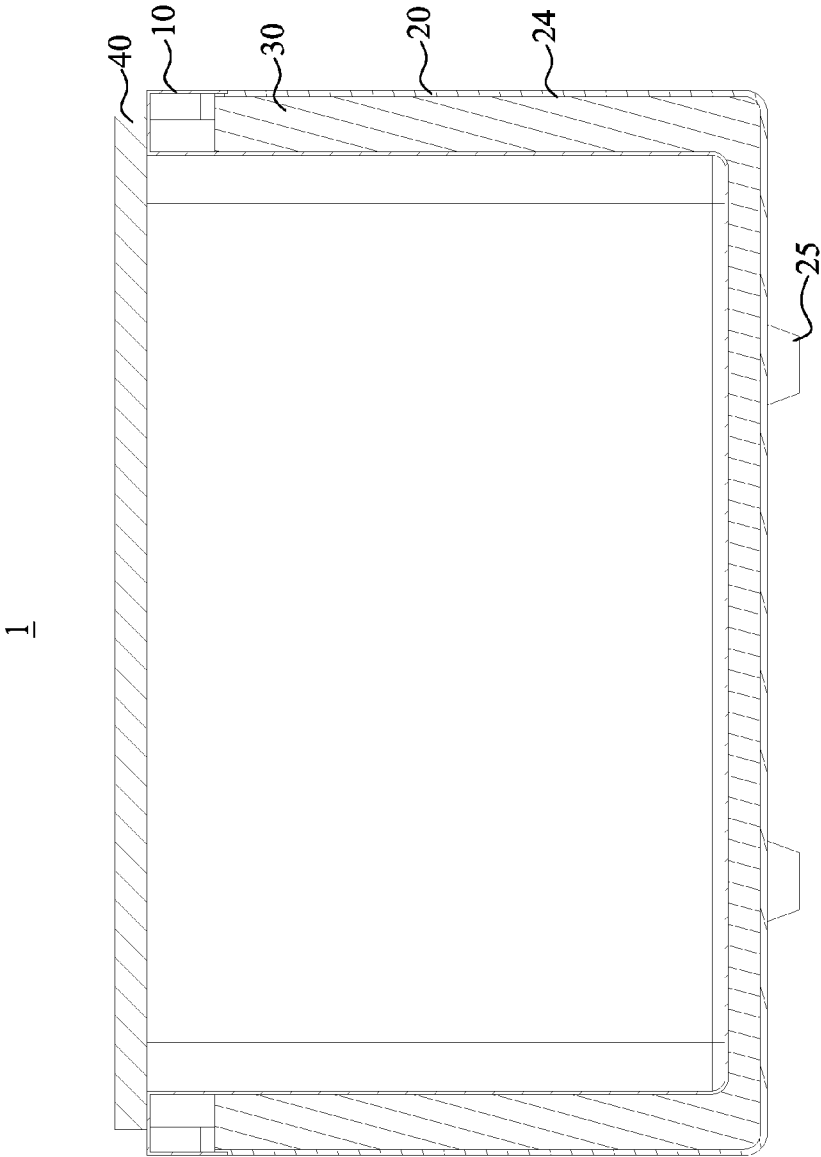


FIG. 2

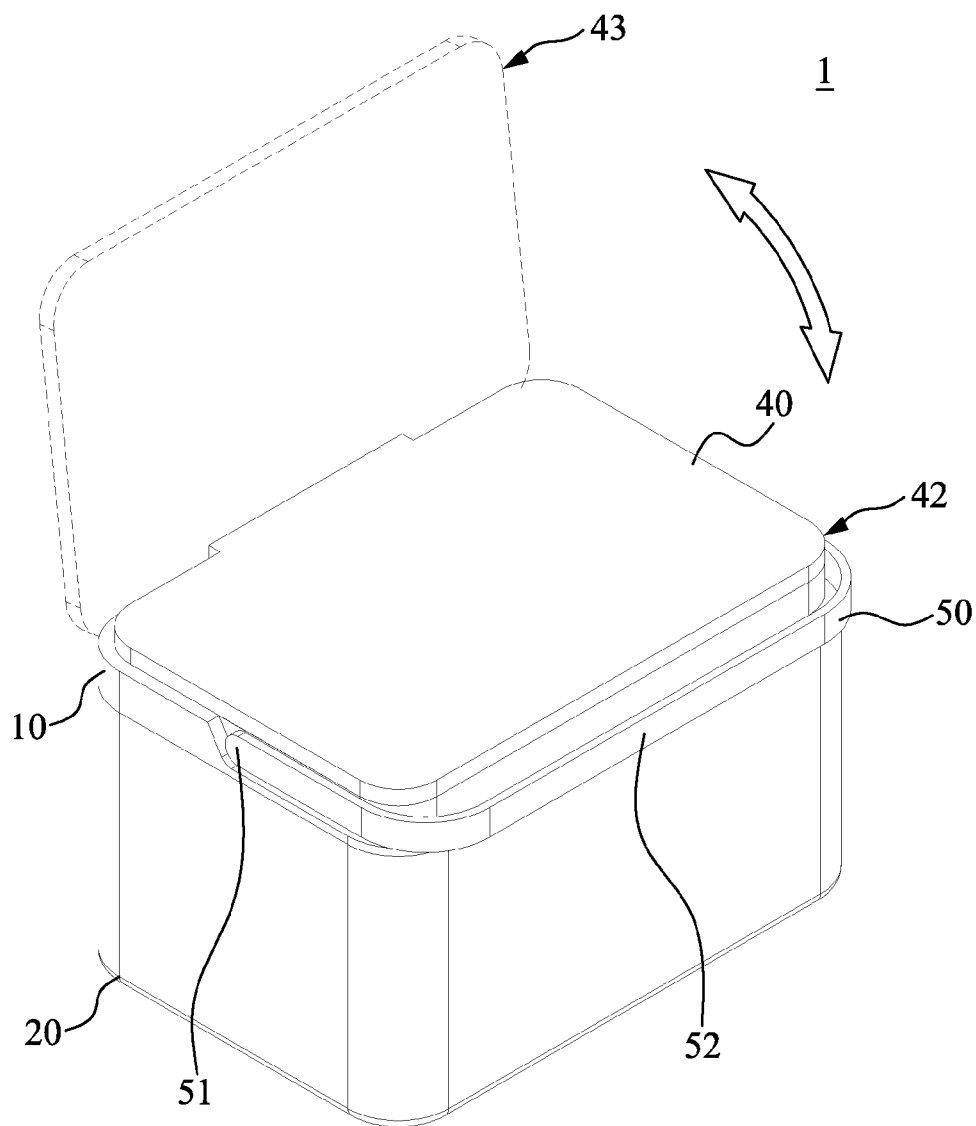


FIG. 3

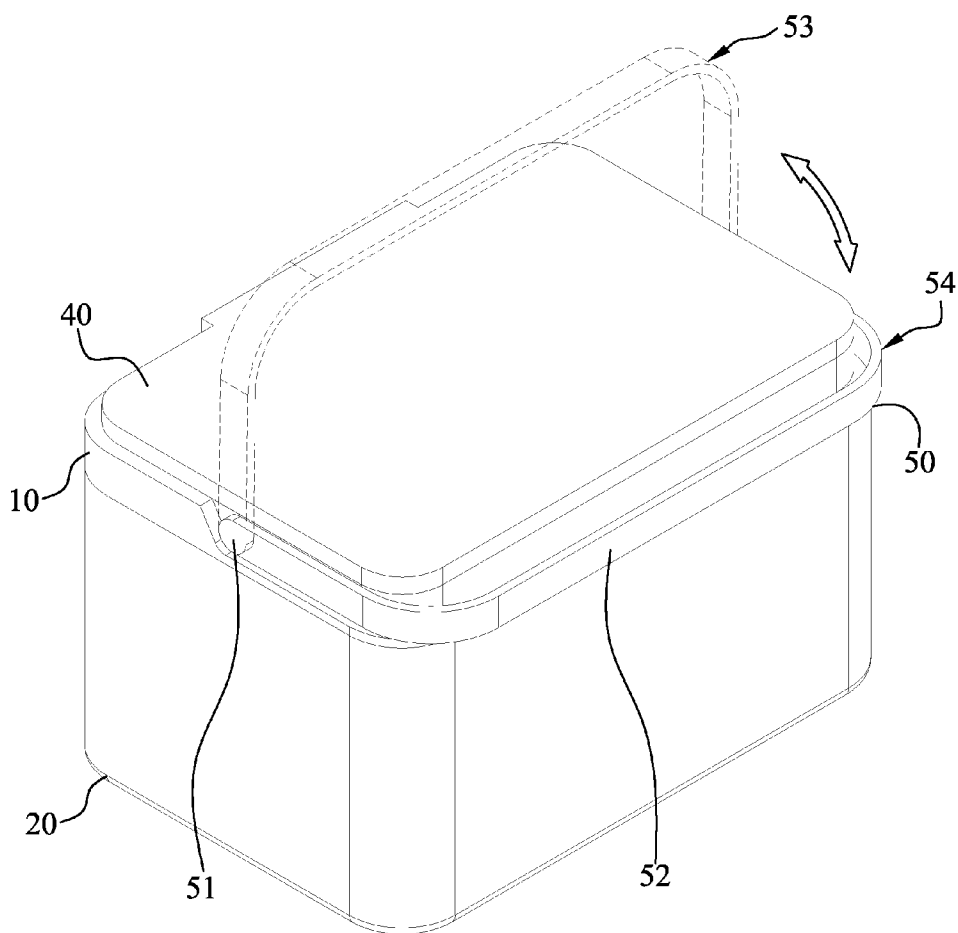


FIG. 4

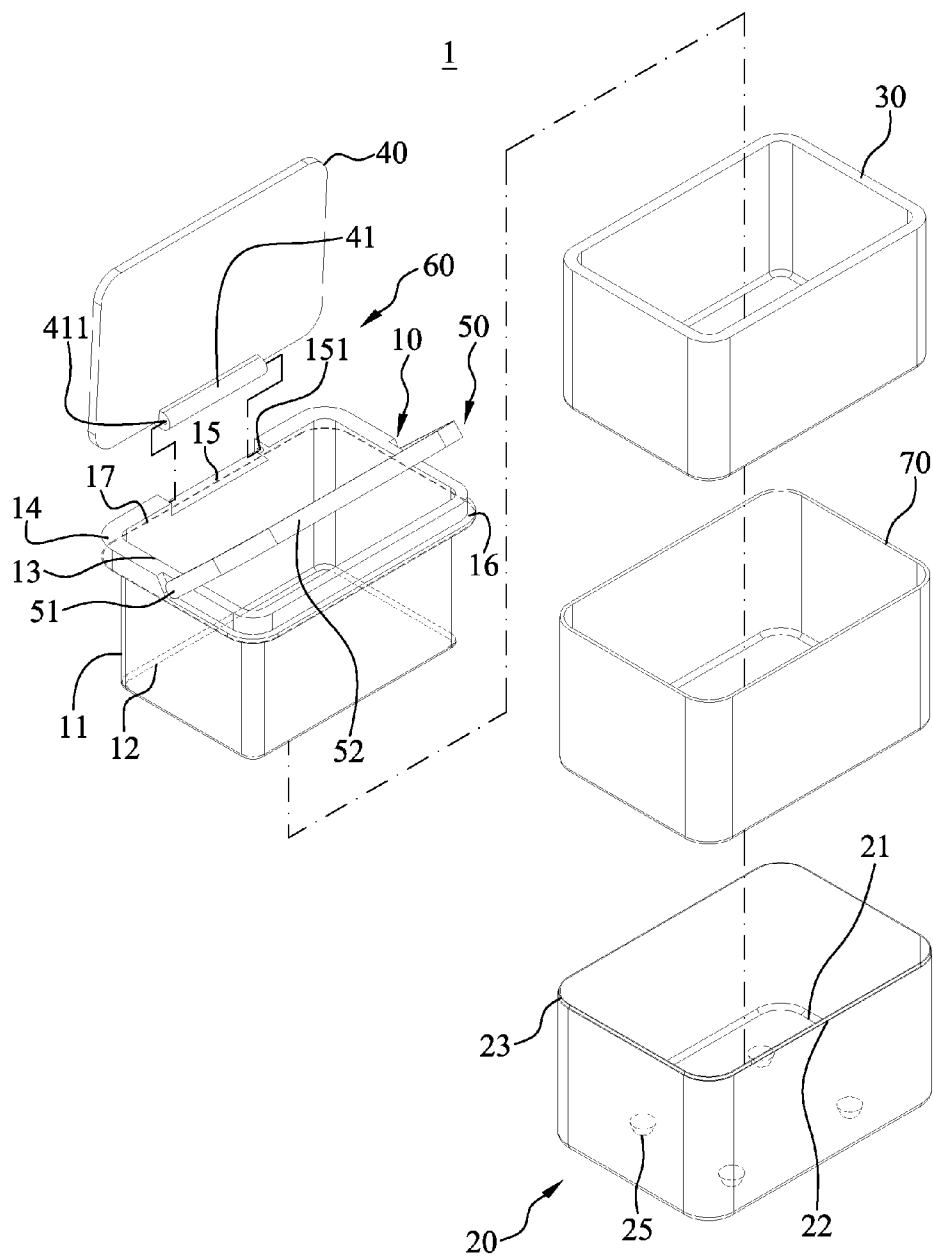


FIG. 5

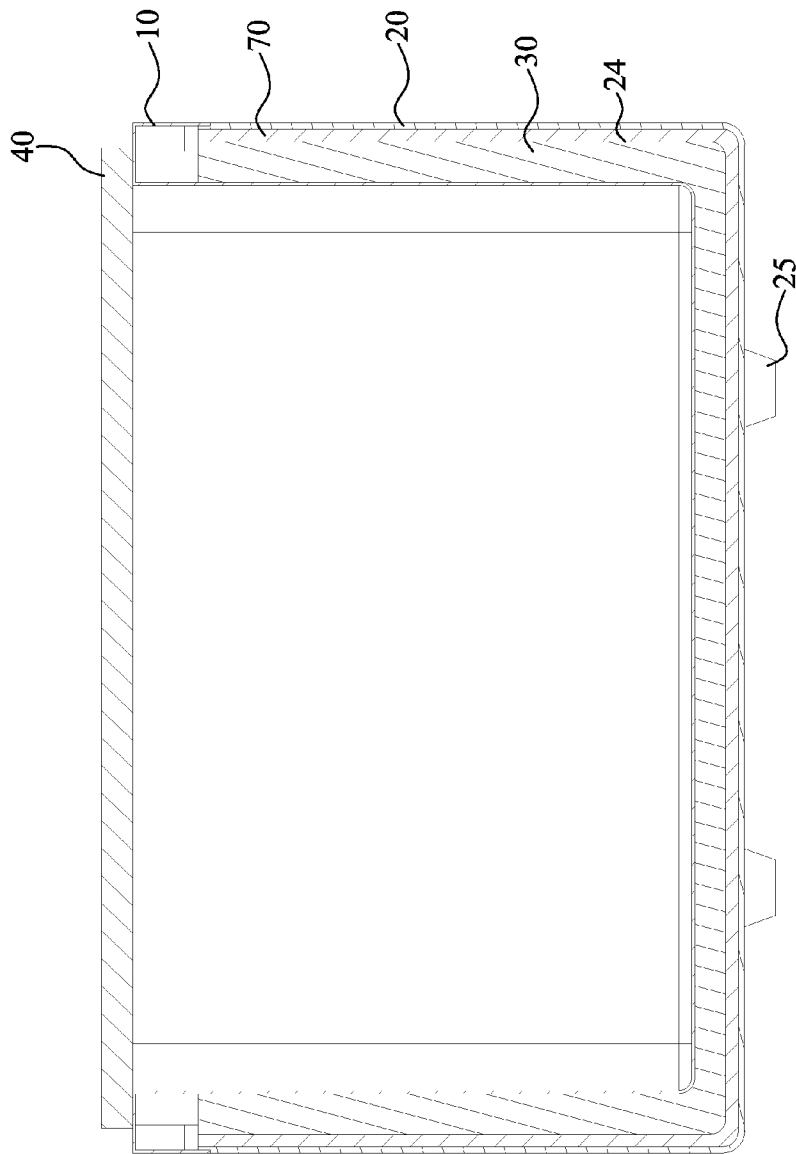


FIG. 6

ADVANTAGEOUSLY RECYCLABLE ENVIRONMENT-FRIENDLY THERMAL INSULATION BOX

FIELD OF THE INVENTION

[0001] The present invention relates to a thermal insulation box, and more particularly to a thermal insulation box that includes an insulation layer made of a specially selected material, so that the thermal insulation box, after becoming no longer usable, can directly undergo a recycling process to produce plastic pellets with good mechanical properties.

BACKGROUND OF THE INVENTION

[0002] Foodstuffs are in contact with air during logistic transportation thereof, which allows microorganisms present in the foodstuffs to multiply abnormally quickly and results in stale or even rotten foodstuffs. For the foodstuffs to maintain fresh longer, the foodstuffs are usually stored in a thermal insulation box during the logistic transportation, so that they are always in a low-temperature environment to lower the probability of becoming rotten.

[0003] Most of the currently commercially available thermal insulation boxes include an insulation layer made of an expandable polystyrene (EPS) material or an extruded polyurethane (EPU) material. Both of the EPS and the EPU material have the advantages of cheap in price and good heat insulation effect. However, in a recycling process, the EPU material undergone a heating procedure is not reusable.

[0004] Moreover, the commercially available thermal insulation boxes usually include a plastic case for enclosing the insulation material. The plastic case is often made of a polypropylene (PP) material or a high-density polyethylene (HDPE) material. The EPS material for the insulation layer has relatively poor compatibility with plastic products from polyolefin polymers. Therefore, when the thermal insulation boxes are recycled, the EPS material will remain in the recycled plastic pellets, making the recycled plastic pellets brittle and not endurable for use to have only low market value.

[0005] In view that the currently commercially available thermal insulation boxes are not advantageously recyclable, it is tried by the inventor to develop an improved thermal insulation box that is made of specially selected materials to enable advantageous recycling of no longer usable thermal insulation box to produce plastic pellets with good mechanical properties.

SUMMARY OF THE INVENTION

[0006] A primary object of the present invention is to provide a thermal insulation box that is made of particularly selected plastic materials, enabling the thermal insulation box, when it is no longer usable, to undergo a recycling process without the need of considering the structural composites thereof, and plastic pellets with good mechanical properties can be produced from the recycled thermal insulation box.

[0007] To achieve the above and other objects, the present invention provides an advantageously recyclable environment-friendly thermal insulation box, a first preferred embodiment of which includes an inner box, an outer box, an insulation layer, a cover and a handle. The inner box is made of a polypropylene (PP) material or a high-density polyethylene (HDPE) material, and includes a peripheral wall, a

sealed bottom connected to a lower end of the peripheral wall, and a top opening locate opposite to the sealed bottom. The top opening has a rim that is outward extended and then downward bent to form an engaging edge around the top opening, and an engaging groove is provided between the peripheral wall and the engaging edge. The outer box is made of a polypropylene (PP) material or a high-density polyethylene (HDPE) material, and includes a closed bottom and an open top. The open top is provided with an engaging protrusion for fixedly engaging with the engaging groove, such that the outer box is externally connected to the inner box with an enclosing space formed between the inner box and the outer box. The insulation layer is made of an extendable polyethylene (EPE) material and disposed in the enclosing space. The cover is connected to the engaging edge of the inner box via a pivoting joint, such that the cover is pivotally turnable between a closed position, in which the cover closes the top opening of the inner box, and a lifted position, in which the cover opens the top opening of the inner box. The handle includes two ends that respectively form a pivotal connection section pivotally connected to the engaging edge of the inner box, and a grip section extended between and connected to the two pivotal connection sections.

[0008] According to the first preferred embodiment of the present invention, the engaging edge of the inner box includes a notched portion and the cover includes a protruded portion located at a position corresponding to the notched portion of the engaging edge. The notched portion is provided at two opposite ends with a pivot protrusion each, and the protruded portion is provided at two opposite ends with a pivot hole each. The pivot protrusions of the notched portion and the pivot holes of the protruded portion are rotatably engaged with one another to form the pivoting joint. And, the outer box is provided on an outer side of the closed bottom with at least one supporting element, with which the thermal insulation box positioned on a surface is always spaced from the surface by a distance.

[0009] According to the first preferred embodiment of the present invention, the engaging edge of the inner box further includes a receiving recess. With the two pivotal connection sections of the handle pivotally turnably connected to the engaging edge of the inner box, the grip section of the handle is pivotally turnable between a first position, in which the grip section is located above the top opening of the inner box, and a second position, in which the grip section is in contact with the receiving recess.

[0010] In a second preferred embodiment thereof, the advantageously recyclable environment-friendly thermal insulation box of the present invention includes an inner box, an outer box, an insulation layer, an auxiliary layer, a cover and a handle. The inner box is made of a polypropylene (PP) material or a high-density polyethylene (HDPE) material, and includes a peripheral wall, a sealed bottom connected to a lower end of the peripheral wall, and a top opening locate opposite to the sealed bottom. The top opening has a rim that is outward extended and then downward bent to form an engaging edge around the top opening, and an engaging groove is provided between the peripheral wall and the engaging edge. The outer box is made of a polypropylene (PP) material or a high-density polyethylene (HDPE) material, and includes a closed bottom and an open top. The open top is provided with an engaging protrusion for fixedly engaging with the engaging groove, such that the outer box is externally connected to the inner box with an enclosing space formed

between the inner box and the outer box. The insulation layer is made of an extendable polyethylene (EPE) material and disposed in the enclosing space. The auxiliary layer is made of an HDPE material and disposed in the enclosing space between the outer box and the insulation layer. The cover is connected to the engaging edge of the inner box via a pivoting joint, such that the cover is pivotally turnable between a closed position, in which the cover closes the top opening of the inner box, and a lifted position, in which the cover opens the top opening of the inner box. The handle includes two ends that respectively form a pivotal connection section pivotally connected to the engaging edge of the inner box, and a grip section extended between and connected to the two pivotal connection sections.

[0011] According to the second preferred embodiment of the present invention, the engaging edge of the inner box includes a notched portion and the cover includes a protruded portion located at a position corresponding to the notched portion of the engaging edge. The notched portion is provided at two opposite ends with a pivot protrusion each, and the protruded portion is provided at two opposite ends with a pivot hole each. The pivot protrusions of the notched portion and the pivot holes of the protruded portion are rotatably engaged with one another to form the pivoting joint. And, the outer box is provided on an outer side of the closed bottom with at least one supporting element, with which the thermal insulation box positioned on a surface is always spaced from the surface by a distance.

[0012] According to the second preferred embodiment of the present invention, the engaging edge of the inner box further includes a receiving recess. With the two pivotal connection sections of the handle pivotally turnably connected to the engaging edge of the inner box, the grip section of the handle is pivotally turnable between a first position, in which the grip section is located above the top opening of the inner box, and a second position, in which the grip section is in contact with the receiving recess.

[0013] The thermal insulation box of the present invention is characterized in that the insulation layer is made of an EPE material and the inner and outer boxes are made of a PP material, allowing the no longer usable thermal insulation box to undergo a recycling process without the need of considering the structural composites thereof, and plastic pellets with good mechanical properties can be produced from the recycled thermal insulation box of the present invention.

[0014] Further, with the auxiliary layer made of the HDPE material being disposed in the enclosing space between the insulation layer and the outer box, it is able to lower the heat transfer efficiency of the insulation layer and therefore upgrade the insulation effect of the thermal insulation box.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

[0016] FIG. 1 is an exploded perspective view of a thermal insulation box according to a first preferred embodiment of the present invention;

[0017] FIG. 2 is an assembled sectional view of the thermal insulation box of FIG. 1;

[0018] FIG. 3 is an assembled perspective view of the thermal insulation box of FIG. 1, showing a cover thereof being turnable between a closed position and a lifted position;

[0019] FIG. 4 is another assembled perspective view of the thermal insulation box of FIG. 1, showing a handle thereof being turnable between a first position and a second position;

[0020] FIG. 5 is an exploded perspective view of a thermal insulation box according to a second preferred embodiment of the present invention; and

[0021] FIG. 6 is an assembled sectional view of the thermal insulation box of FIG. 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] The present invention will now be described with some preferred embodiments thereof and with reference to the accompanying drawings. For the purpose of easy to understand, elements that are the same in the preferred embodiments are denoted by the same reference numerals.

[0023] Please refer to FIGS. 1 and 2, which are exploded perspective and assembled sectional views, respectively, of an advantageously recyclable environment-friendly thermal insulation box according to a first preferred embodiment of the present invention. For the purpose of conciseness and clarity, the present invention is also briefly referred to as the thermal insulation box herein and generally denoted by reference numeral 1. As shown, in the first preferred embodiment, the thermal insulation box 1 includes an inner box 10, an outer box 20, an insulation layer 30, a cover 40, and a handle 50. The inner box 10 is made of a polypropylene (PP) material and includes a peripheral wall 11, a sealed bottom 12 connected to a lower end of the peripheral wall 11, and a top opening 13 locate opposite to the sealed bottom 12. The top opening 13 has a rim that is outward extended and then downward bent to form an engaging edge 14 around the top opening 13. Further, the engaging edge 14 includes a notched portion 15 and a receiving recess 16 respectively located at a predetermined position. An engaging groove 17 is provided between the peripheral wall 11 and the engaging edge 14, and the notched portion 15 is provided at two opposite ends with a pivot protrusion 151 each.

[0024] The outer box 20 is also made of a PP material, and includes a closed bottom 21 and an open top 22. The open top 22 is provided with an engaging protrusion 23, which is adapted to fixedly engage with the engaging groove 17, such that the outer box 20 is externally connected to the inner box 10 with the closed bottom 21 located below the sealed bottom 12 of the inner box 10 and an enclosing space 24 is formed between the inner box 10 and the outer box 20. The closed bottom 21 of the outer box 20 is externally provided with at least one supporting element 25, with which the thermal insulation box 1 positioned on a surface is always spaced from the surface by a distance. The insulation layer 30 is made of an expandable polyethylene (EPE) material and is disposed in the enclosing space 24.

[0025] It is understood the above-mentioned inner and outer boxes 10, 20 made of a PP material are only illustrative and not intended to limit the present invention in any way. That is, the inner and outer boxes 10, 20 can be otherwise made of, for example, a high-density polyethylene (HDPE) material.

[0026] Please refer to FIGS. 1 and 3. The cover 40 includes a protruded portion 41 located at a position corresponding to the notched portion 15 of the engaging edge 14. The pro-

truded portion **41** is provided at two opposite ends with a pivot hole **411** each. The pivot protrusions **151** of the notched portion **15** and the pivot holes **411** of the protruded portion **41** are rotatably engaged with one another to form a pivoting joint **60** between the cover **40** and the inner box **10**, so that the cover **40** is pivotally turnable between a closed position **42**, in which the cover **40** closes the top opening **13** of the inner box **10**, and a lifted position **43**, in which the cover **40** is lifted to open the top opening **13** of the inner box **10**.

[0027] Please refer to FIGS. **1** and **4**. The handle **50** includes two ends that respectively form a pivotal connection section **51**, and a grip section **52** extended between and connected to the two pivotal connection sections **51**. The handle **50** is pivotally turnably connected at the two pivotal connection sections **51** to the engaging edge **14** of the inner box **10**, so that the grip section **52** of the handle **50** is pivotally turnable between a first position **53**, in which the grip section **52** is located above the top opening **13**, and a second position **54**, in which the grip section **52** is in contact with the receiving recess **16** of the engaging edge **14** of the inner box **10**.

[0028] After the thermal insulation box **1** of the present invention has been used over a long period of time, the inner box **10**, the outer box **20**, the cover **40** and the handle **50** are inevitably subject to damage, and the insulation layer **30** tends to gradually lose its insulation performance. In this case, the thermal insulation box **1** can undergo a recycling process, so that the materials thereof can be reused.

[0029] In the recycling process, the no longer usable thermal insulation box **1** is directly crushed and pulverized into plastic scraps of mixed PP and EPE materials. The plastic scraps are washed clean and then directly dried without the need of separating different materials from one another, so that the plastic scraps do not have any water on their surfaces. Finally, the dried plastic scraps of the EPE and PP materials are processed to produce plastic pellets with good mechanical properties. The plastic pellets produced from the recycled PP and EPE materials can be used to manufacture various plastic appliances.

[0030] According to the first preferred embodiment of the present invention, the insulation layer **30** is made of an EPE material, which has open-cell foam structure and therefore has good heat transfer efficiency to adversely lower the insulation performance of the thermal insulation box **1**. FIGS. **5** and **6** show a thermal insulation box **1** according to a second preferred embodiment of the present invention. As shown, the thermal insulation box **1** in the second preferred embodiment is generally structurally similar to that in the first preferred embodiment, but further includes an auxiliary layer **70**, which is made of an HDPE material and disposed in the enclosing space **24** between the outer box **20** and the insulation layer **30**. It is noted the HDPE material has closed-cell foam structure.

[0031] By fitting the auxiliary layer **70** made of the HDPE material with closed-cell foam structure on an outer side of the insulation layer **30**, the heat transfer efficiency of the insulation layer **30** can be effectively lowered, and the thermal insulation box **1** can have upgraded insulation performance. Since the inner box **10**, the outer box **20**, the insulation layer **30**, the cover **40** and the handle **50** for the thermal insulation box **1** of the second preferred embodiment are the same as those in the first preferred embodiment, they are not repeatedly described herein.

[0032] In brief, the present invention is characterized in that the thermal insulation box has inner and outer boxes made of a PP material and an insulation layer made of an EPE mate-

rial, so that the thermal insulation box, when it is no longer usable, can directly undergo the recycling process without the need of considering the structural composites of the thermal insulation box, and the plastic pellets produced from the recycled thermal insulation box have good mechanical properties.

[0033] The present invention has been described with some preferred embodiments thereof and it is understood that many changes and modifications in the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

What is claimed is:

1. An advantageously recyclable environment-friendly thermal insulation box, comprising:

an inner box being made of a material selected from the group consisting of a polypropylene (PP) material and a high-density polyethylene (HDPE) material, and including a peripheral wall, a sealed bottom connected to a lower end of the peripheral wall, and a top opening locate opposite to the sealed bottom; the top opening having a rim that is outward extended and then downward bent to form an engaging edge around the top opening; and an engaging groove being provided between the peripheral wall and the engaging edge;

an outer box being made of a material selected from the group consisting of a polypropylene (PP) material and a high-density polyethylene (HDPE) material, and including a closed bottom and an open top; the open top being provided with an engaging protrusion for fixedly engaging with the engaging groove, such that the outer box is externally connected to the inner box with an enclosing space formed between the inner box and the outer box; and

an insulation layer being made of an extendable polyethylene (EPE) material and disposed in the enclosing space.

2. The thermal insulation box as claimed in claim 1, further comprising a cover connected to the inner box via a pivoting joint provided on between the cover and the engaging edge of the inner box, whereby the cover is pivotally turnable between a closed position, in which the cover closes the top opening of the inner box, and a lifted position, in which the cover opens the top opening of the inner box.

3. The thermal insulation box as claimed in claim 2, wherein the engaging edge of the inner box includes a notched portion and the cover includes a protruded portion located at a position corresponding to the notched portion of the engaging edge; the notched portion being provided at two opposite ends with a pivot protrusion each, and the protruded portion being provided at two opposite ends with a pivot hole each; and the pivot protrusions of the notched portion and the pivot holes of the protruded portion being rotatably engaged with one another to form the pivoting joint.

4. The thermal insulation box as claimed in claim 1, wherein the outer box is provided on an outer side of the closed bottom with at least one supporting element, with which the thermal insulation box positioned on a surface is always spaced from the surface by a distance.

5. The thermal insulation box as claimed in claim 1, further comprising a handle; and the handle including two ends that respectively form a pivotal connection section pivotally con-

nected to the engaging edge of the inner box, and a grip section extended between and connected to the two pivotal connection sections.

6. The thermal insulation box as claimed in claim 5, wherein the engaging edge of the inner box further includes a receiving recess; and, with the two pivotal connection sections of the handle pivotally turnably connected to the engaging edge of the inner box, the grip section of the handle being pivotally turnable between a first position, in which the grip section is located above the top opening of the inner box, and a second position, in which the grip section is in contact with the receiving recess.

7. An advantageously recyclable environment-friendly thermal insulation box, comprising:

an inner box being made of a material selected from the group consisting of a polypropylene (PP) material and a high-density polyethylene (HDPE) material, and including a peripheral wall, a sealed bottom connected to a lower end of the peripheral wall, and a top opening locate opposite to the sealed bottom; the top opening having a rim that is outward extended and then downward bent to form an engaging edge around the top opening; and an engaging groove being provided between the peripheral wall and the engaging edge;

an outer box being made of a material selected from the group consisting of a polypropylene (PP) material and a high-density polyethylene (HDPE) material, and including a closed bottom and an open top; the open top being provided with an engaging protrusion for fixedly engaging with the engaging groove, such that the outer box is externally connected to the inner box with an enclosing space formed between the inner box and the outer box;

an insulation layer being made of an extendable polyethylene (EPE) material and disposed in the enclosing space; and

an auxiliary layer being made of a high-density polyethylene (HDPE) material and disposed in the enclosing space between the outer box and the insulation layer.

8. The thermal insulation box as claimed in claim 7, further comprising a cover connected to the inner box via a pivoting joint provided on between the cover and the engaging edge of the inner box, whereby the cover is pivotally turnable between a closed position, in which the cover closes the top opening of the inner box, and a lifted position, in which the cover opens the top opening of the inner box.

9. The thermal insulation box as claimed in claim 8, wherein the engaging edge of the inner box includes a notched portion and the cover includes a protruded portion located at a position corresponding to the notched portion of the engaging edge; the notched portion being provided at two opposite ends with a pivot protrusion each, and the protruded portion being provided at two opposite ends with a pivot hole each; and the pivot protrusions of the notched portion and the pivot holes of the protruded portion being rotatably engaged with one another to form the pivoting joint.

10. The thermal insulation box as claimed in claim 7, wherein the outer box is provided on an outer side of the closed bottom with at least one supporting element, with which the thermal insulation box positioned on a surface is always spaced from the surface by a distance.

11. The thermal insulation box as claimed in claim 7, further comprising a handle; and the handle including two ends that respectively form a pivotal connection section pivotally connected to the engaging edge of the inner box, and a grip section extended between and connected to the two pivotal connection sections.

12. The thermal insulation box as claimed in claim 11, wherein the engaging edge of the inner box further includes a receiving recess; and, with the two pivotal connection sections of the handle pivotally turnably connected to the engaging edge of the inner box, the grip section of the handle being pivotally turnable between a first position, in which the grip section is located above the top opening of the inner box, and a second position, in which the grip section is in contact with the receiving recess.

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