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(54) **METHOD AND SYSTEM FOR RECYCLING POLYSTYRENE WASTE**

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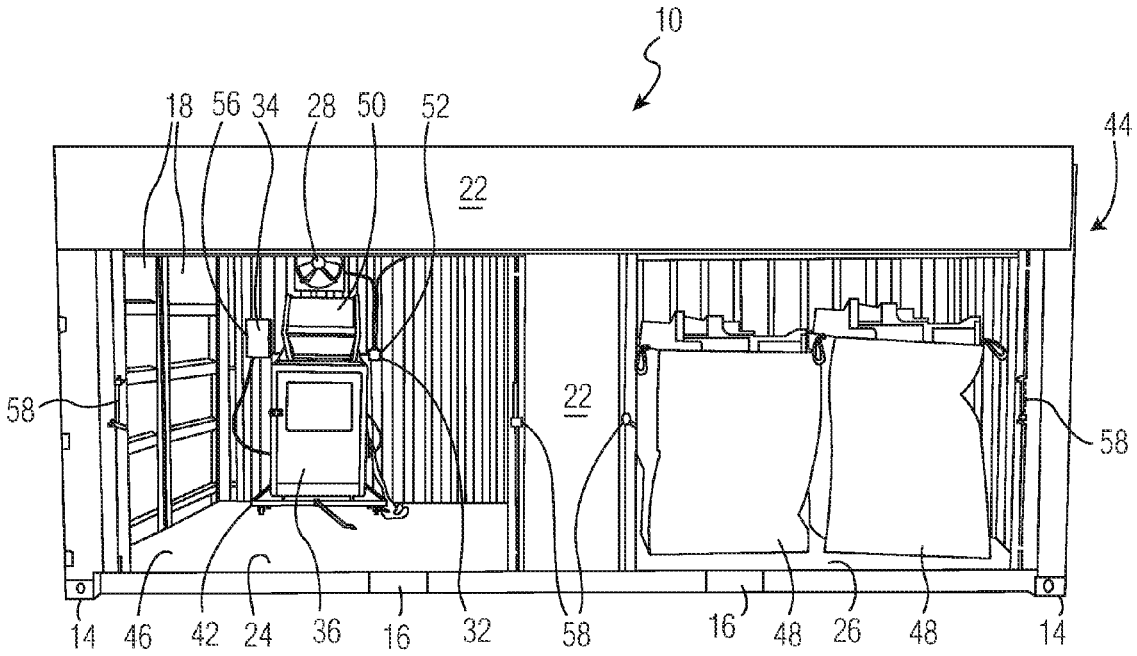
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(57) **ABSTRACT**

A mobile polystyrene foam waste recycling method and system are disclosed. The system includes a mobile housing or mobile container that houses a polystyrene foam densifying machine. The foam densifying machine reduces the size of Expanded Polystyrene (EPS) and PS polystyrene material into a marketable product. The mobile container includes secure access doors, electrical connections, lighting, exhaust fans, and storage bins for EPS waste. The waste recycling system provides a mobile outdoor or indoor recycling facility and collection center where EPS/PS may be recycled instead of being sent to a landfill.



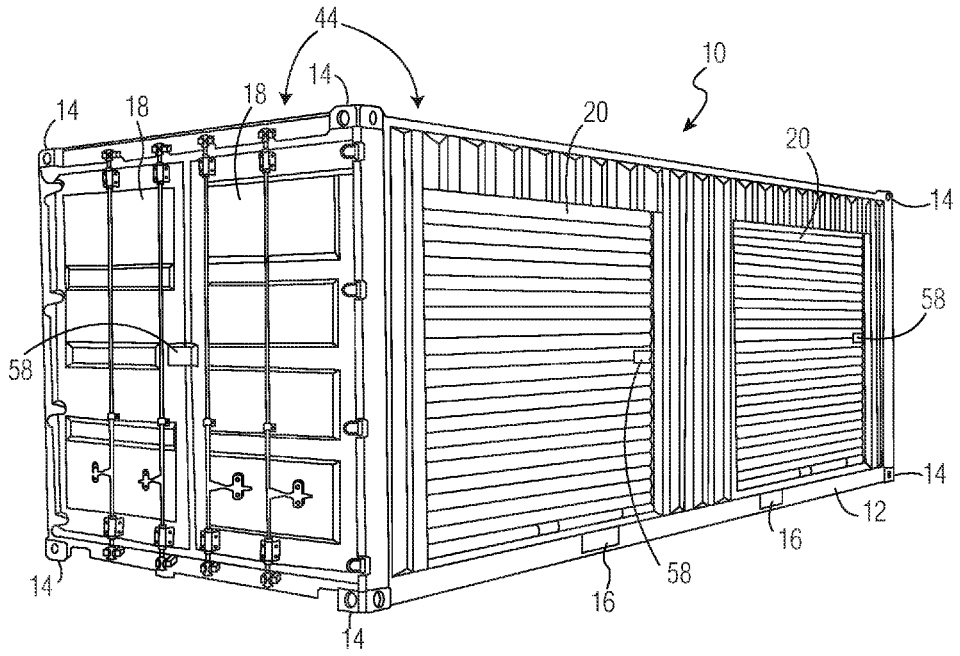


FIG. 1

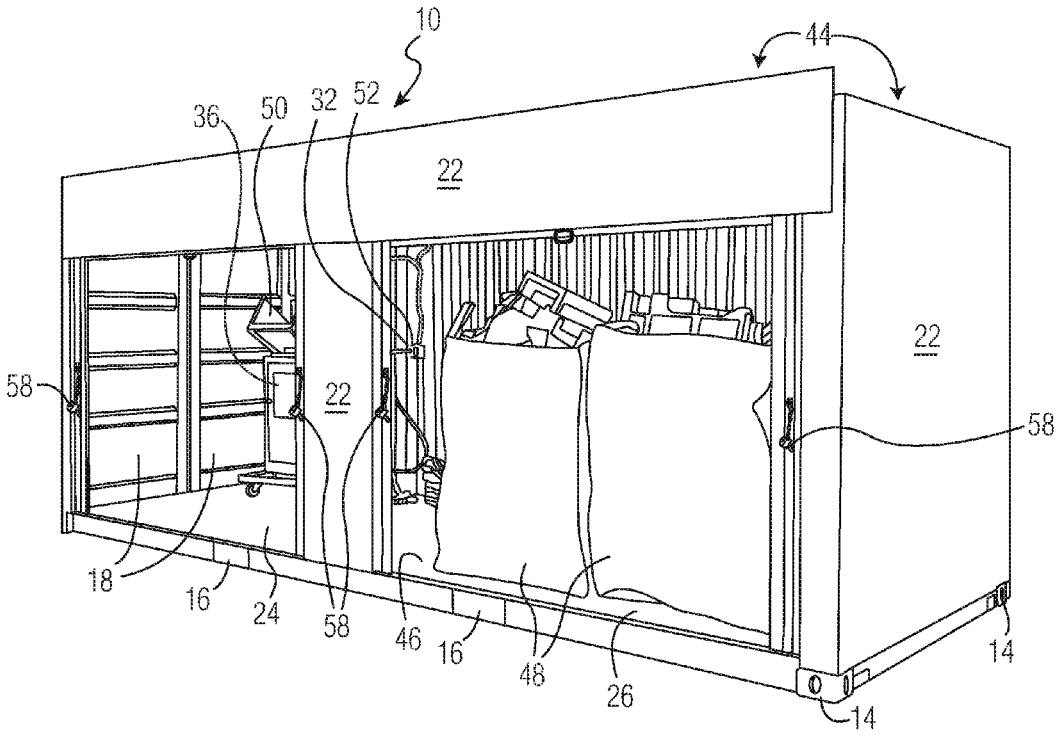


FIG. 2

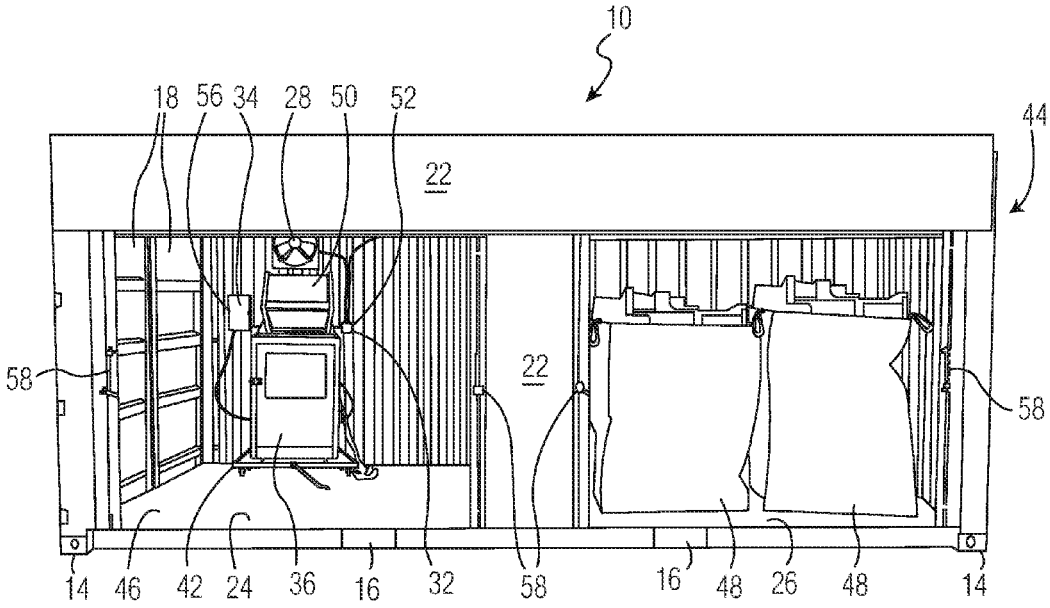

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FIG. 3

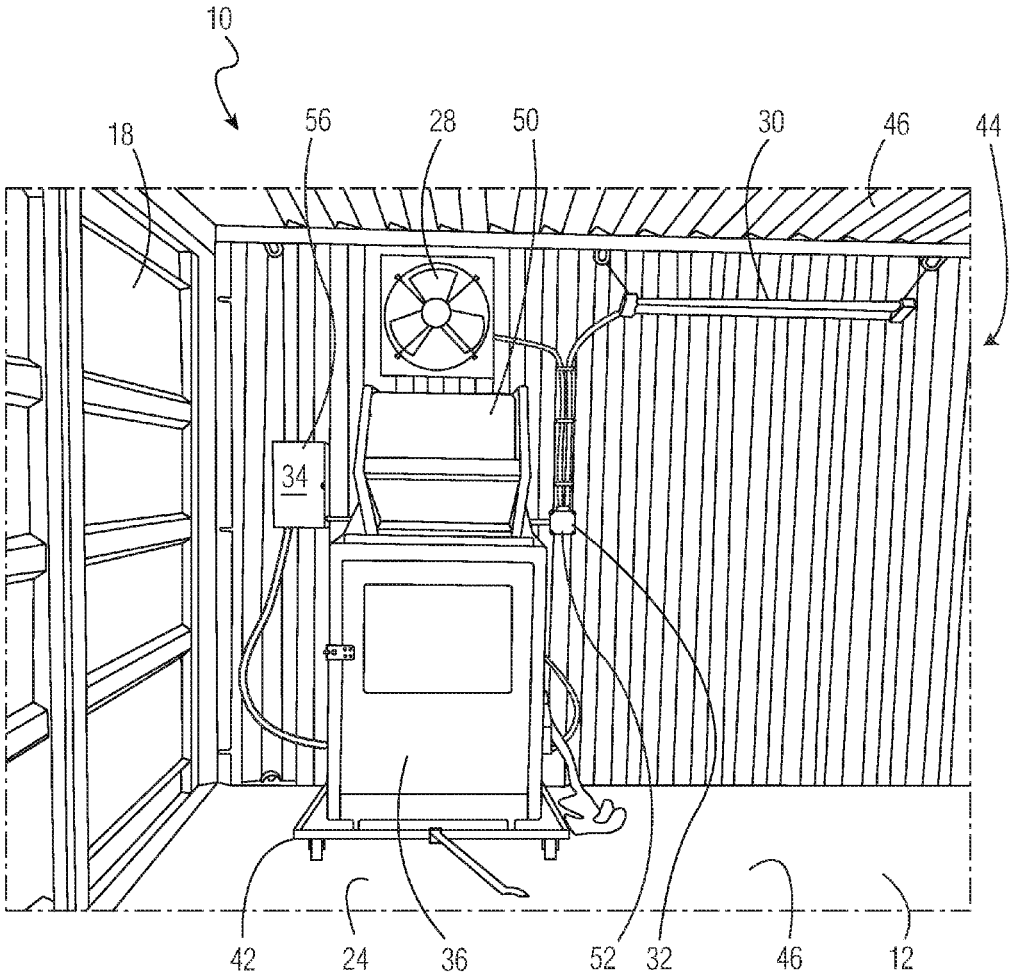


FIG. 4

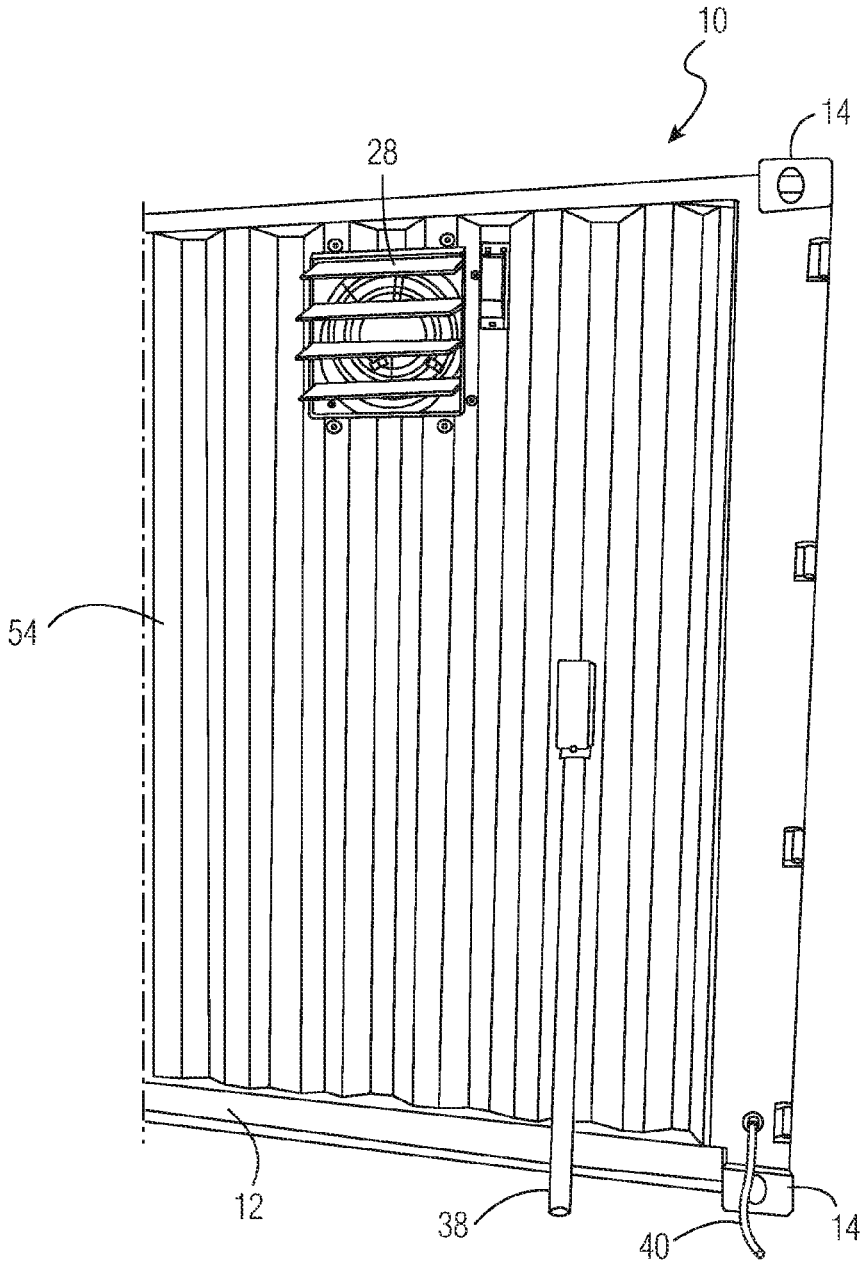


FIG. 5

METHOD AND SYSTEM FOR RECYCLING POLYSTYRENE WASTE

CROSS REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims the benefit of U.S. provisional application No. 62/406,335, filed Oct. 10, 2016, which is incorporated by reference as if fully set forth.

FIELD OF INVENTION

[0002] The present invention relates to a method and system for recycling polystyrene foam waste, and more particularly to a recycling environment for polystyrene foam waste.

BACKGROUND

[0003] The two basic types of polystyrene suitable for recycling are EPS polystyrene, IE expanded polystyrene, and PS, IE polystyrene. EPS is the expanded type foam used for packaging. PS is the condensed foam commonly used in the food service industry for cups and food clamshells. EPS material is also known as Styrofoam (Dow Chemical Trademarked name) and its recycling symbol is the number **6**. EPS foam and PS densifying machines are utilized to reduce the size of EPS/PS Polystyrene material into marketable products.

[0004] EPS foam and PS polystyrene densifying machines, regardless of the manufacturers, are normally not constructed for outdoor use and are normally utilized at indoor locations. A typical EPS polystyrene/PS polystyrene densifier machine is not weather resistant by design so an outdoor recycling center operated by a municipality, county, school or college currently has no option to recycle and reduce the size of EPS material.

[0005] By encapsulating an EPS/PS densifying machine in a mobile container configured as an EPS polystyrene/PS polystyrene recycling environment, the foam densifying machine may be operated in the vicinity of an indoor or outdoor recycling and collection center, thus enabling the site to collect and recycle EPS polystyrene/PS polystyrene material that would otherwise be sent to a landfill.

[0006] Therefore, there is a need for a method and system for efficient indoor or outdoor recycling of EPS polystyrene/PS polystyrene waste. The claimed invention is an improvement over current methods and systems for recycling EPS polystyrene/PS polystyrene waste.

SUMMARY

[0007] A method and system for recycling polystyrene waste in either an indoor or outdoor location is disclosed. A polystyrene foam densifying machine is installed and operated within a mobile container that includes multiple walls, a top surface, a bottom surface, and an interior space.

[0008] At least one access door is configured in an exterior wall of the mobile container to enable access to the interior space of the mobile container from outside the mobile container. At least one power connection is configured within the mobile container to provide electrical power to the polystyrene foam densifying machine and to other electrical devices as required. At least one exhaust fan and at least one storage container are configured within the mobile container.

[0009] In some embodiments of the invention, the mobile container is comprised of a substantially metal container, and other embodiments, the mobile container is comprised of a substantially plastic container or else a substantially wooden container.

[0010] In some embodiments of the invention, the mobile container is comprised of an ISO certified intermodal shipping container.

[0011] In some embodiments of the invention, the access door is comprised of a roll-up type door, and in other embodiments the access door is comprised of a swinging type door.

[0012] In some embodiments of the invention, a locking mechanism is configured on an access door on the exterior of the mobile container. In other embodiments of the invention, at least one electric lighting fixture is configured on exterior or interior surfaces of the mobile container.

[0013] Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWING(S)

[0014] The foregoing Summary as well as the following detailed description will be readily understood in conjunction with the appended drawings which illustrate embodiments of the invention. In the drawings:

[0015] FIG. **1** is a perspective view of a mobile container for a polystyrene recycling system.

[0016] FIG. **2** is a perspective view of a mobile container for a polystyrene recycling system;

[0017] FIG. **3** is a front view of the interior of a mobile container for a polystyrene recycling system;

[0018] FIG. **4** is a front detail view of a foam densifier machine in the interior of a polystyrene recycling system;

[0019] FIG. **5** is a back view of a mobile container for a polystyrene recycling system.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENT(S)

[0020] The present invention **10** presents a solution to the problem of recycling expanded polystyrene, both EPS and PS polystyrene foam at locations that have no building or structures to house polystyrene foam densifying machines. EPS and PS densifying machines are utilized to reduce the size of EPS/PS polystyrene material into marketable products.

[0021] FIG. **1** presents a perspective view of the mobile container **12**. A polystyrene foam densifying machine **36** (FIG. **4**) is installed and operated within a self-contained mobile container **12** that includes multiple side walls **44**, top and bottom surfaces **46** (FIG. **2**), an interior processing area **24** and an interior storage space **26**. The self-contained mobile container **12** can then be operated as a self-contained polystyrene foam recycling system **10**. Polystyrene foam can then be processed in either indoor or outdoor locations using the self-contained polystyrene foam recycling system **10**.

[0022] The mobile container **12** employed in some embodiments of the invention **10** may be a specially designed ISO intermodal certified shipping container built new to the specifications of the invention **10**. ISO or

intermodal containers **12** comprise containers that meet size, strength, and durability requirements of the invention **10**, along with structural integrity suitable for multiple transportation methods such as truck, rail, or ship. The ISO or intermodal shipping container **12** may be prismatic or rectangular in shape, and may be of standardized dimensions or non-standardized dimensions.

[0023] At least one access door **18**, **20** is configured in an exterior wall **44** of the mobile container **12** to enable access to the interior space **24**, **26** of the mobile container **12** from outside the mobile container **12**. In some embodiments of the invention **10**, modifications to the mobile container **12** may include metal roll-up doors **20** mounted on the sides of the mobile container **12** for user, equipment and material storage access. In other embodiments the access doors **18** are comprised of swinging type hinged doors **18**. The roll-up doors **20** or swinging doors **18** are utilized to move into the mobile container **12** unprocessed EPS/PS polystyrene material, and after recycling, remove the condensed EPS/PS pieces known as ingots or blocks.

[0024] A display area **22** suitable for signage may be mounted at various clear spanning points on the outside of the mobile container **12**.

[0025] In some embodiments of the invention **10**, the mobile container **12** is comprised of a substantially metal container, and in other embodiments, the mobile container **12** is comprised of a substantially plastic container or else a substantially wooden container.

[0026] In some embodiments of the invention **10**, the mobile container **12** may have twist lock connectors **14** configured at its ends. The twist lock connectors **14** may be used to lock multiple containers together when shipping as well as to engage the mobile containers **12** for lifting and transport. In some embodiments of the invention **10**, the mobile container **12** may be equipped with fork lift tubes **16** configured for lifting and moving the mobile container **12**.

[0027] In some embodiments of the invention **10**, a locking mechanism **58** is configured on an access door **18**, **20** on the exterior of the mobile container **12**. The locking mechanism **58** prevents unauthorized access to the mobile container **12**.

[0028] FIG. **2** presents a perspective view of a mobile container **12**. A polystyrene foam densifying machine **36** is installed and operated within a self-contained mobile container **12** that includes multiple side walls **44**, top and bottom surfaces **46**, an interior processing area **24** and an interior storage space **26**. The self-contained mobile container **12** can then be operated as self-contained polystyrene foam recycling system **10**. Polystyrene foam can then be processed in either indoor or outdoor locations using the self-contained polystyrene foam recycling system **10**.

[0029] A processing area **24** is allocated within the mobile container **12** near the foam densifier **36**. A storage area **26** is allocated within the interior of the mobile container **12** that houses plastic carts, plastic containers, or other suitable storage containers **48** used to hold both processed and unprocessed EPS/PS foam.

[0030] A display area **22** suitable for signage may be mounted at various clear spanning points on the outside of the mobile container **12**.

[0031] In some embodiments of the invention **10**, the mobile shipping container may have twist lock connectors **14** configured at its ends. The twist lock connectors **14** may be used to lock multiple containers together when shipping as well as to engage the mobile containers **12** for lifting and transport. In some embodiments of the invention **10**, the mobile container **12** may be equipped with fork lift tubes **16** configured for lifting and moving the mobile container **12**.

[0032] The EPS/PS foam densifier machine **36** receives the EPS/PS polystyrene material that is usually placed in a hopper **50**. The polystyrene material is ground up, shredded and either heated or cold compressed by the densifier machine **36**.

[0033] In some embodiments of the invention **10**, a locking mechanism **58** is configured on an access door **18**, **20** on the exterior of the mobile container **12**. The locking mechanism **58** prevents unauthorized access to the mobile container **12**.

[0034] FIG. **3** presents a front view of the interior of the mobile container **12**. FIG. **2** presents a perspective view of a mobile container **12**. A polystyrene foam densifying machine **36** is installed and operated within a self-contained mobile container **12** that includes multiple side walls **44**, top and bottom surfaces **46** (FIG. **2**), an interior processing area **24** and an interior storage space **26**. The mobile container **12** can then be operated as self-contained polystyrene foam recycling system **10**. Polystyrene foam can then be processed in either indoor or outdoor locations using the self-contained polystyrene foam recycling system **10**.

[0035] A processing area **24** is allocated within the mobile container **12** near the foam densifier **35**. This processing area **24** is in close proximity to the electrical panel **34**, power switch **32**, exhaust fan **28** and interior lighting **30**.

[0036] A storage area **26** is allocated within the interior of the mobile container **12** that houses plastic carts, plastic containers, or other suitable storage containers **48** used to hold both processed and unprocessed EPS/PS foam.

[0037] In some embodiments of the invention **10**, densifier machines **36** are placed on custom-made metal dollies **42** so they can be moved within the processing area **24** for cleaning and maintenance to all points of the densifier machine **36**.

[0038] A display area **22** suitable for signage may be mounted at various clear spanning points on the outside of the mobile container **12**.

[0039] An electrical panel **34** will be installed in the mobile container **12** to provide electrical connections to the polystyrene densifier **36**, the interior lighting **30**, and the exhaust fan **28**. The mobile container **12** is equipped with an interior electrical outlet **32** to allow the operation of cleaning equipment such as vacuums and blowers used to keep the mobile container **12** clean when needed.

[0040] In some embodiments of the invention **10**, the mobile shipping container may have twist lock connectors **14** configured at its ends. The twist lock connectors **14** may be used to lock multiple containers together when shipping as well as to engage the mobile containers **12** for lifting and transport. In some embodiments of the invention **10**, the mobile container **12** may be equipped with fork lift tubes **16** configured for lifting and moving the mobile container **12**.

[0041] The EPS/PS foam densifier machine **36** receives the EPS/PS polystyrene material that is usually placed in a hopper **50**. The polystyrene material is ground up by the densifier machine **36**.

[0042] In some embodiments of the invention **10**, a locking mechanism **58** is configured on an access door **18**, **20** on

the exterior of the mobile container **12**. The locking mechanism **58** prevents unauthorized access to the mobile container **12**.

[0043] FIG. **4** presents a front detail view of a foam densifier machine **36** installed in the mobile container **12**. In some embodiments of the invention **10**, the mobile container **12** is equipped with wiring for the operation of optional interior lighting **30** exhaust fans **28**. One or more exhaust fans **28** are installed in the side of the mobile container **12** and are used to exhaust interior heat and odor generated by the densifier machine **36**.

[0044] The EPS/PS foam densifier machine **36** receives the EPS/PS polystyrene material that is usually placed in a hopper **50**. The polystyrene material is ground up by the densifier machine **36**.

[0045] A polystyrene foam densifying machine **36** is installed and operated within a self-contained mobile container **12** that includes multiple side walls **44**, top and bottom surfaces **46** (FIG. **2**), an interior area **24** and an interior storage space **26**.

[0046] An electrical panel **34** will be installed in the mobile container **12** to provide electrical connections to the polystyrene densifier **36**, the interior lighting **30**, and the exhaust fan **28**. The mobile container **12** is equipped with a switch **52** controlled interior electrical outlet **32** to allow the operation of cleaning equipment such as vacuums and blowers used to keep the mobile container **12** clean when needed. The mobile container **12** is equipped with a 3 phase power disconnect switch **56** that is permanently mounted to a wall of the mobile container **12** interior wall **44**. Thus electrical power that feeds all interior electrical devices such as the densifier unit **36**, exhaust fan **28** and interior lights **30** can all be immediately turned on or off.

[0047] Interior lighting **30** is mounted on the wall or ceiling of the mobile container **12** so the densifier machine **36** can be operated and polystyrene recycling may be done without the necessity to open the doors **18**, **20** of the mobile container **12** to provide outside light.

[0048] A commercially available EPS/PS densifying machine **36** is installed in the mobile container **12**. The EPS/PS foam densifier machine **36** receives the EPS/PS polystyrene material that is usually placed in a hopper **50**. The polystyrene material is ground up by the densifier machine **36**. The ground up polystyrene material is heated inside the densifier machine **36** and this more condensed material is extruded at the bottom of the densifier machine **36** into something called an ingot. This ingot is a marketable and saleable commodity which can be sold to the reuse market such as picture frame manufacturers who use this material as a feedstock in making new picture frames.

[0049] In some embodiments of the invention **10**, densifier machines **36** are placed on custom-made metal dollies **42** so they can be moved within the processing area **24** for cleaning and maintenance to all points of the densifier machine **36**.

[0050] FIG. **5** presents a view of the back **54** of the mobile container **12**. The exterior of the exhaust fan **28** is visible. An external electric feed **38** is located outside the mobile container **12** where electric feed wire from an outside source such as a generator or nearby building power enters the mobile container **12** and is connected to the interior electrical panel **34** (FIG. **4**). An outside ground wire **40** is used to ensure that the electrical supply to the mobile container **12** meets electrical codes.

[0051] In some embodiments of the invention **10**, the mobile container **12** may have twist lock connectors **14** configured at its ends.

[0052] The entire mobile container **12** including the densifier machine **36** and interior storage containers **48** can be shipped in their entirety by truck, rail and sea. EPS/PS foam densifier machines are not normally manufactured or configured for outdoor use as these machines have many sensitive electrical components. The benefit of this invention **10** is to provide a self-contained EPS/PS polystyrene recycling system at outdoor locations such as county and municipal recycling centers or at buildings that have limited or no interior EPS/PS densifier machine placement capabilities. The invention **10** enables EPS/PS polystyrene recycling at locations that otherwise would not be able to collect and recycle these materials.

[0053] While embodiments of the invention **10** have been described in detail above, the invention **10** is not limited to the specific embodiments described above, which should be considered as merely exemplary illustrations set forth for a clear understanding of the principles of the invention **10**. Further variations, modifications, extensions, or equivalents of the invention **10** may be developed without departing from the scope of the invention **10**. It is therefore intended that the invention **10** not be limited to the particular embodiments disclosed as the best mode contemplated for carrying out this invention **10**, but that the invention **10** will include all the embodiments falling within the scope of the appended claims.

What is claimed is:

1. A system for recycling polystyrene waste, comprising:

a housing having a plurality of walls, a top surface, a bottom surface, and an interior space;

a polystyrene foam densifier apparatus mounted within said interior space;

at least one access door configured in a wall of said housing to enable access to said interior space from outside said housing;

at least one electric power connection configured within said housing to provide electrical power to said system;

at least one exhaust fan;

at least one storage container configured within said housing; and

wherein said system comprises a mobile, self-contained polystyrene waste recycling facility.

2. The system of claim **1**, wherein said housing comprises a substantially metal mobile container.

3. The system of claim **1**, wherein said housing comprises a substantially plastic mobile container.

4. The system of claim **1**, wherein said housing comprises a substantially wooden mobile container.

5. The system of claim **1**, wherein said housing comprises an ISO certified intermodal shipping container.

6. The system of claim **1**, wherein said interior space contains a distinct processing area and a distinct storage area.

7. The system of claim **1**, wherein said access door comprises a roll-up type door.

8. The system of claim **1**, wherein said access door comprises a swinging type door.

9. The system of claim **1**, further comprising a locking mechanism configured on said access door.

10. The system of claim **1**, further comprising at least one electric lighting fixture configured on a surface of said housing.

11. A method for recycling polystyrene waste, the method comprising the steps of:

providing a housing comprising a plurality of walls, a top surface, a bottom surface, and an interior space,

installing at least one access door in a wall of said housing to enable access to said interior space;

installing at least one electric power connection within said housing;

circulating air within said housing using at least one exhaust fan;

densifying polystyrene foam with a polystyrene densifier apparatus mounted within said interior space of said housing;

collecting polystyrene material within at least one storage container within said housing.

12. The method of claim **11**, wherein said step of providing a housing comprises providing a substantially metal mobile container.

13. The method of claim **11**, wherein said step of providing a housing comprises providing a substantially plastic mobile container.

14. The method of claim **11**, wherein said step of providing a housing comprises providing a substantially wooden mobile container.

15. The method of claim **11**, wherein said step of providing a housing comprises providing an ISO certified intermodal shipping container.

16. The method of claim **11**, wherein said step of providing a housing further comprises providing an interior space within said housing configured with a distinct processing area and a distinct storage area.

17. The method of claim **11**, wherein said step of installing at least one access door comprises installing a roll-up type door.

18. The method of claim **11**, wherein said step of installing at least one access door comprises installing a swinging type door.

19. The method of claim **11**, further comprising the step of installing a locking mechanism configured on said access door.

20. The method of claim **11**, further comprising configuring at least one electric lighting fixture on a surface of said housing.

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