# United States Patent [19]

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[54] **PORTABLE HEATING UNIT**


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[52] **U.S. Cl.** ..... **237/12.3 C,** 123/142.5, 165/64

[51] **Int. Cl.** ..... **B60h 1/22**

[58] **Field of Search** ..... 123/41.7, 142.5; 237/12.1, 12.3 A, 12.3 C; 165/64, 52, 51



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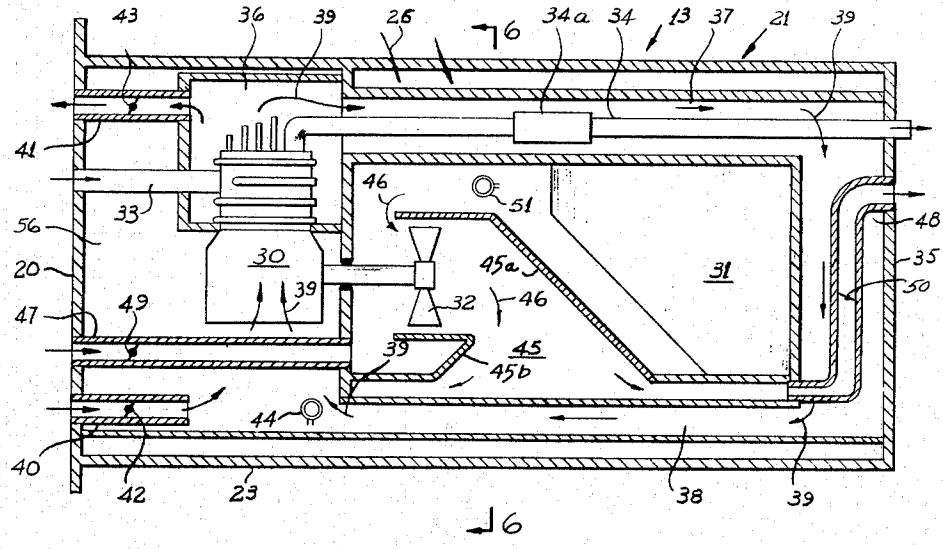
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[57] **ABSTRACT**

A portable self-contained temperature controlling unit is removably inserted in a shipping container so that the contents may be heated or cooled during shipment. In the instance of heating, the portable unit derives its heat output from the operation of an internal combustion engine which is embodied in the unit along with its fuel supply. The heating unit includes primary and secondary air circuits in heat exchange relation with each other, and connections of these circuits to outside air have thermostatically controlled valves arranged so that the heat output of the unit is regulated while the operating speed of the engine remains constant.


**5 Claims, 6 Drawing Figures**




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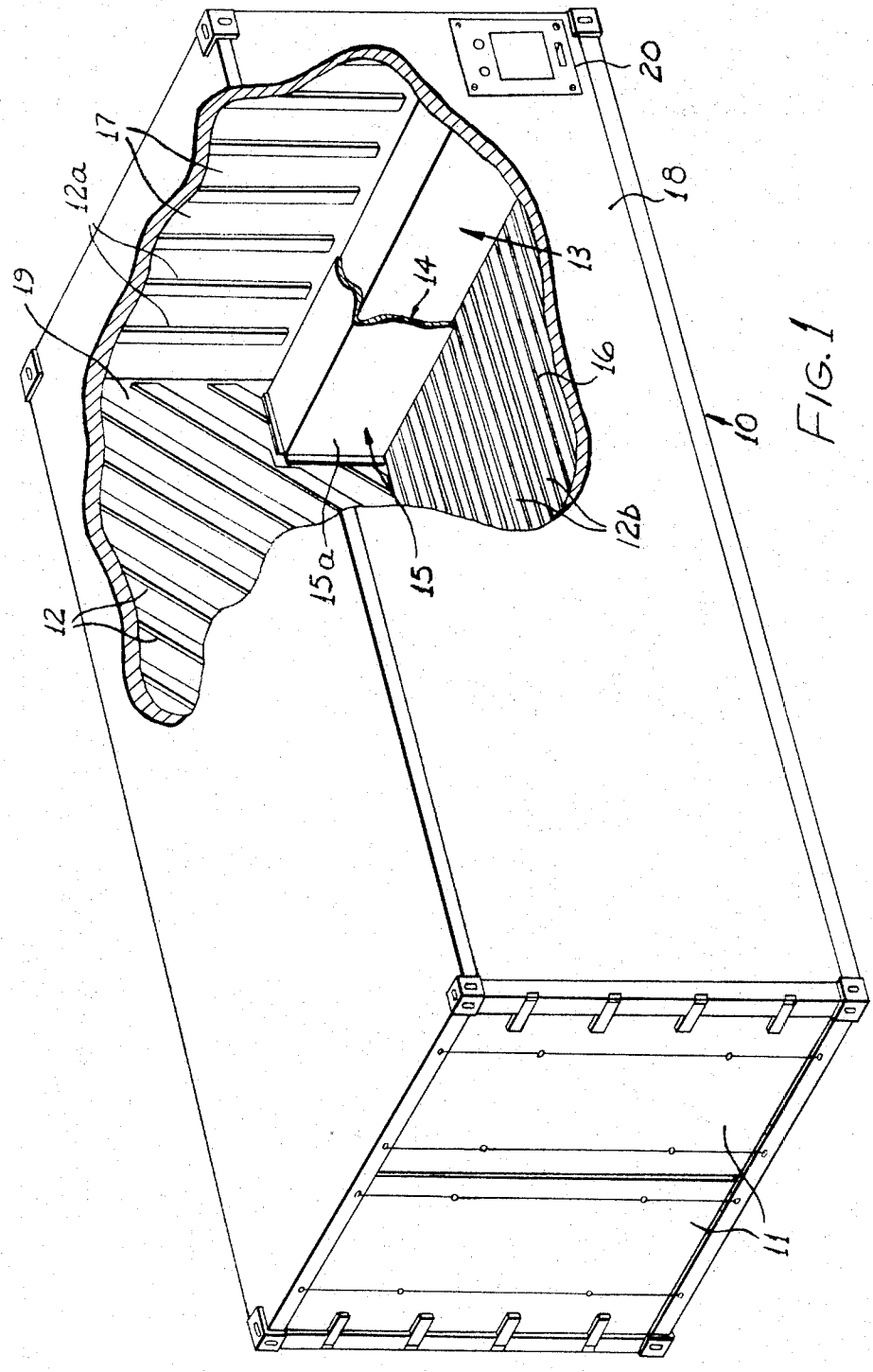



FIG. 1

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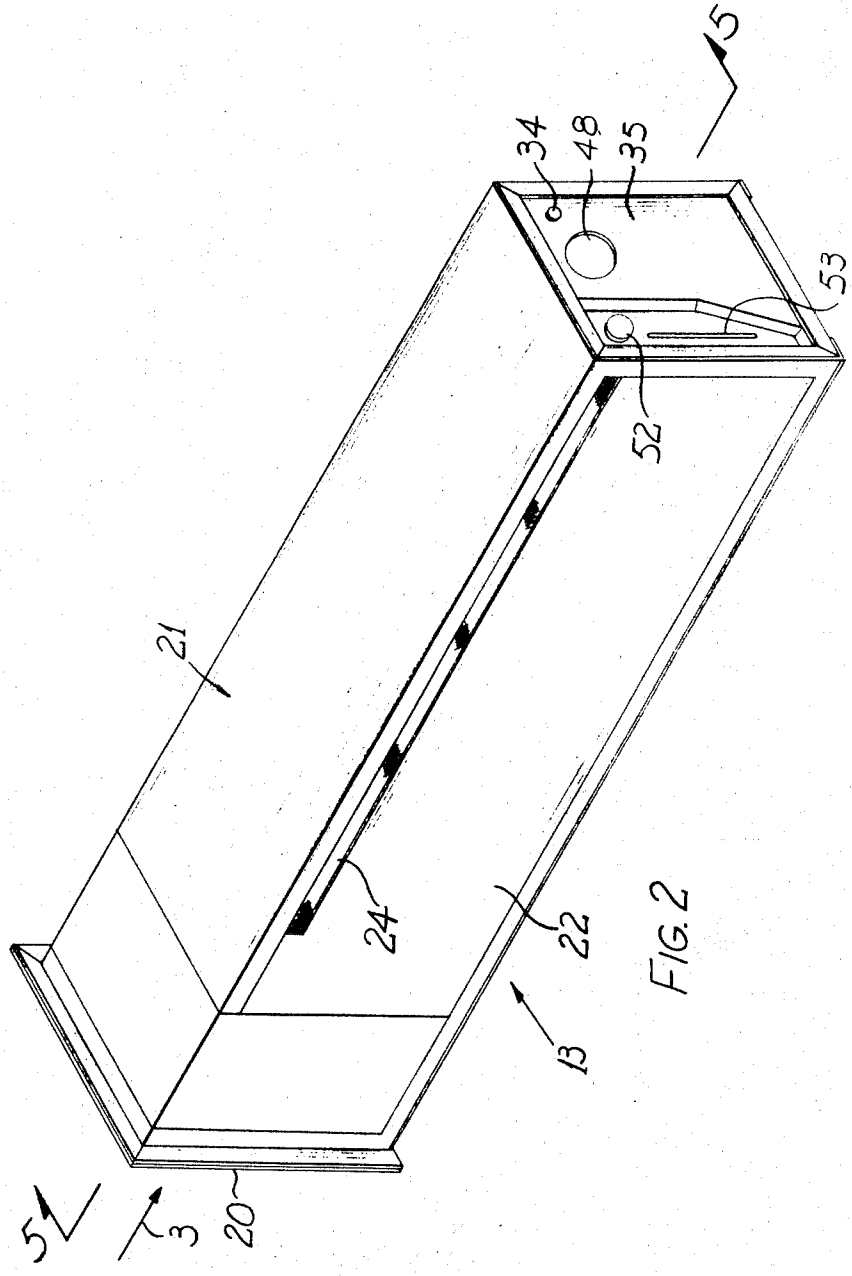



FIG. 2

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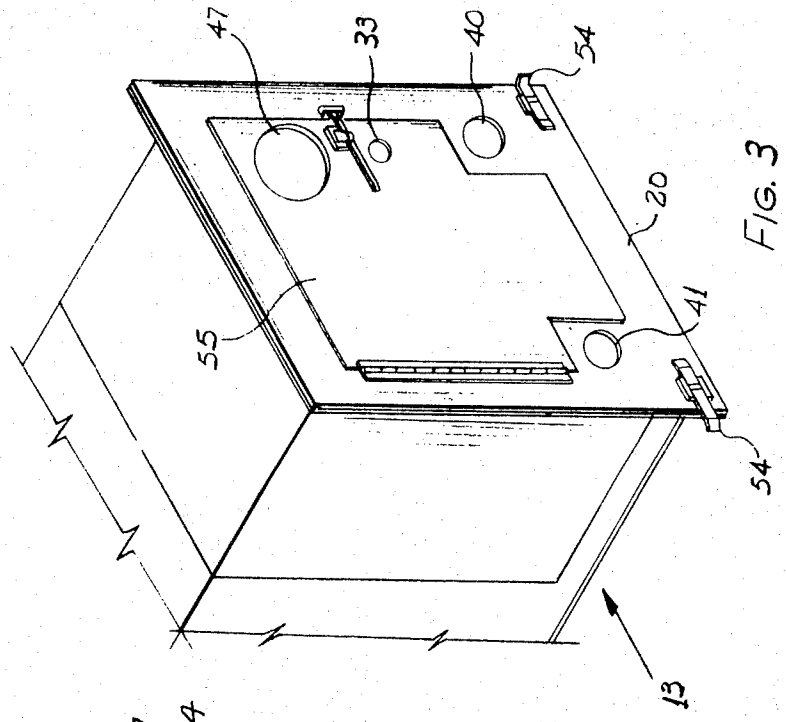



FIG. 3

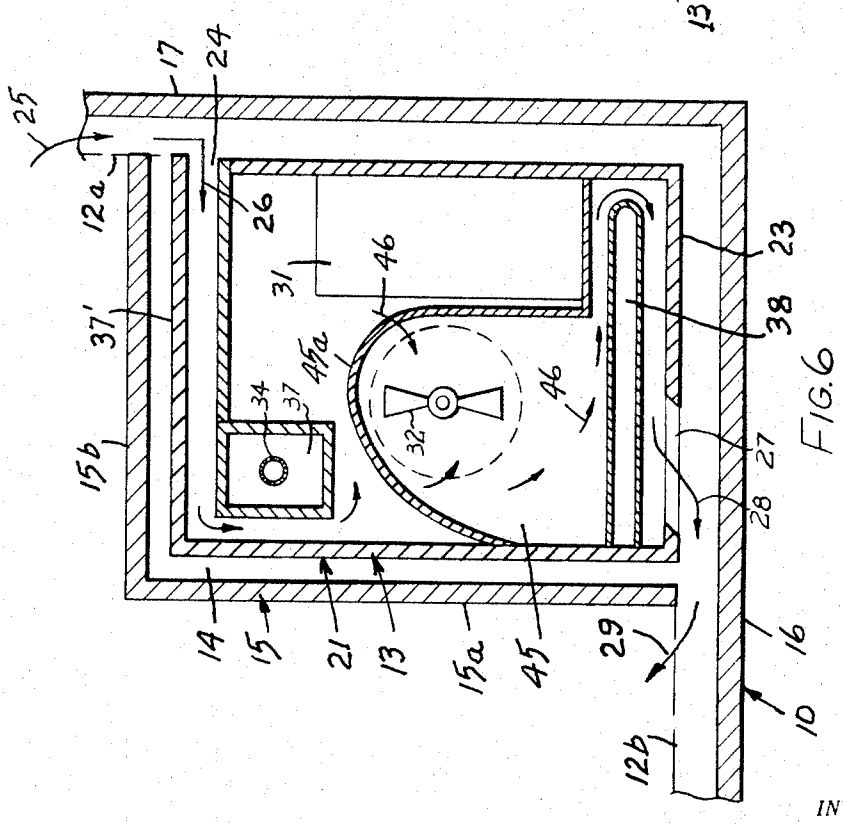



FIG. 6

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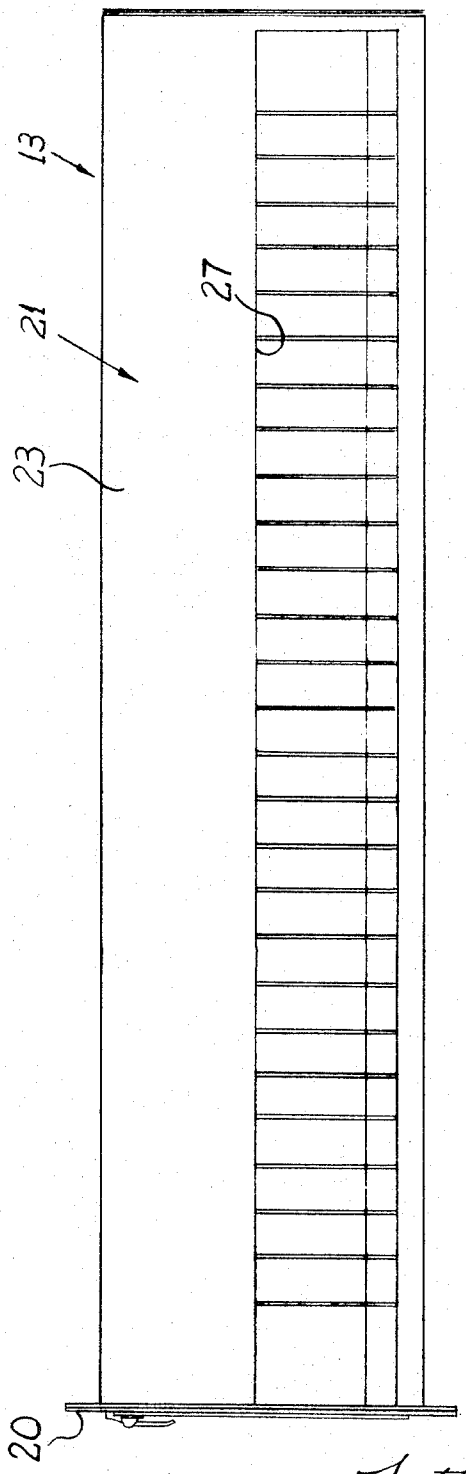



FIG. 4

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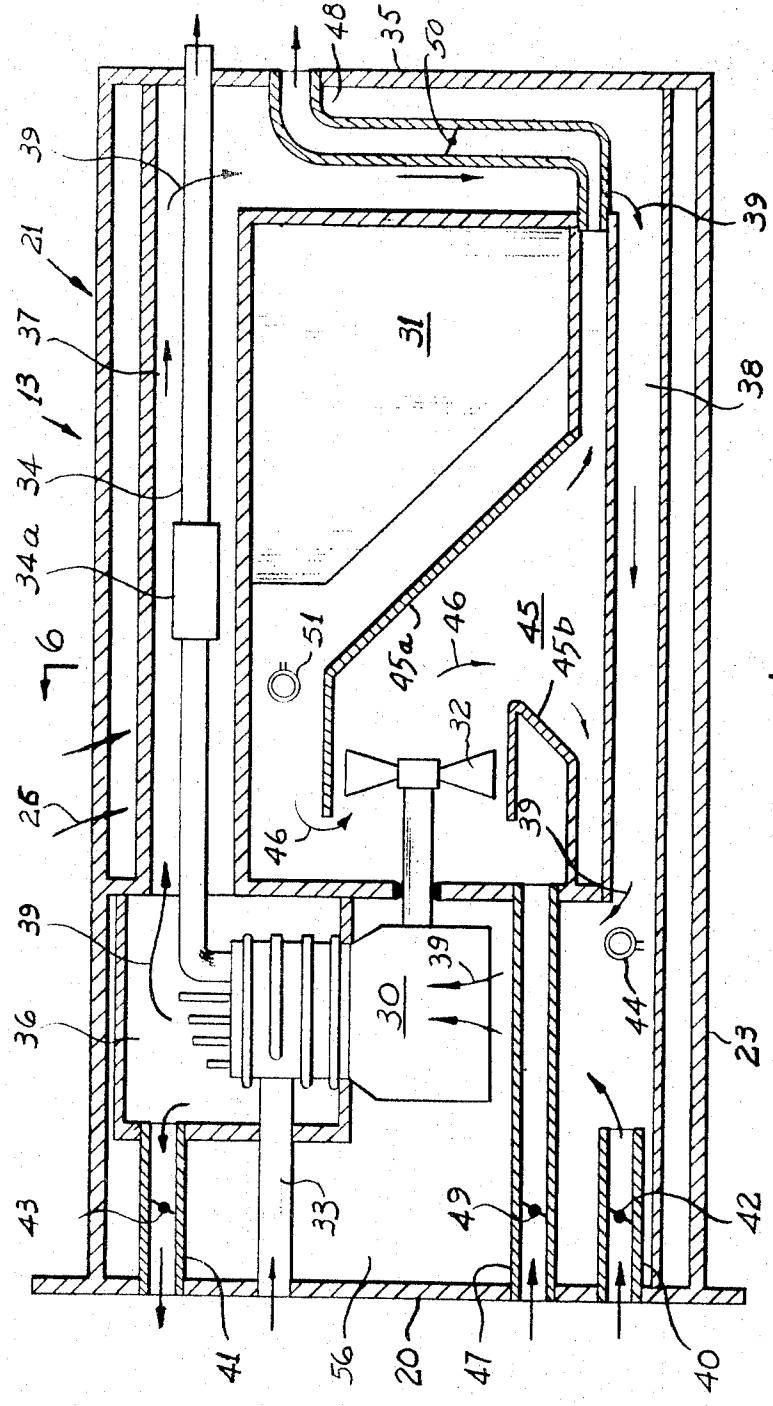



FIG. 5

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# PORTABLE HEATING UNIT

This invention relates to new and useful improvements in shipping containers commonly used for transport of cargo by truck, rail, plane or ship. Such containers are commonly of a standardized type designed for repeated use in the shipment of various different commodities. Under some circumstances it is desirable for the contents to be heated or to be cooled during shipment, while under other circumstances heating or cooling is not at all needed. To the extent that a controlled temperature is desirable, it is not always expeditious or practical to depend upon facilities of the transporting vehicle to maintain the shipping containers and contents thereof at a desired temperature. Thus, a need has arisen for providing a temperature controlling unit which may be directly associated with a particular container to heat or cool the contents thereof without relying on temperature conditioning facilities which the transporting vehicle may or may not have.

It is the principal object of the invention to fulfill this need by providing a portable, self-contained temperature controlling unit which may be quickly and easily installed in a shipping container when the contents are to be heated or cooled, and which may be readily removed from the container when heating or cooling is not necessary.

Another important object of the invention is to provide a portable temperature conditioning unit which, specifically, is a heating unit readily insertable in and removable from a shipping container, the unit deriving its heat output from the operation of an internal combustion engine which is embodied in the unit along with its fuel supply, so that the unit is completely self-contained.

In conjunction with the foregoing, another object of the invention is to provide a portable, self-contained heating unit in which the air flow is controlled by thermostatically actuated valves having connections to outside air, so that the heat output of the unit is automatically regulated while the operating speed of the engine remains constant.

With the foregoing more important objects and features in view and such other objects and features which may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawings, wherein like characters of reference designate like parts, and wherein:

FIG. **1** is a perspective view, partly broken away, showing a shipping container with the temperature controlling unit of the invention;

FIG. **2** is an enlarged perspective view of the unit per se, the unit specifically being a heating unit;

FIG. **3** is a fragmentary perspective view of the heating unit, taken in the direction of the arrow **3** in FIG. **2**;

FIG. **4** is a bottom plan view of the unit;

FIG. **5** is a largely diagramatic longitudinal sectional view of the unit, taken substantially in the plane of the line **5—5** in FIG. **2**; and

FIG. **6** is a cross-sectional view, taken substantially in the plane of the line **6—6** in FIG. **5** and also showing by dotted lines adjacent portions of the shipping container.

Referring now to the accompanying drawings in detail, in FIG. **1** the general reference numeral **10** designates a conventional standard shipping container which



is provided at one end thereof with loading doors **11**, the container walls being provided at the inside thereof with sets of mutually spaced battens **12**, **12***a*, **12***b* in the conventional manner.

In accordance with the invention, a portable self-contained temperature controlling unit **13** is removably inserted in the container **10** so that the contents thereof may be heated or cooled during shipment. The unit **13** is removably inserted in a compartment **14**, the latter being formed by providing a right-angularly shaped partition plate **15** in the lower end portion of the container remote from the doors **11**. The partition plate **15** includes a vertical wall **15***a* which extends across the battens **12***b* on the bottom **16** of the container, and a horizontal wall **15***b* which extends across the battens **12***a* on the end wall **17** of the container, as will be clear from FIG. **1** and also from FIG. **6**. The partition plate spans the full width of the container between the side walls **18, 19**, and due to the spaces between the battens **12***a* and **12***b*, the compartment **14** is in air communication with the rest of the container interior. The compartment **14** has an access opening in the container side wall **18**, through which opening the temperature conditioning unit **13** may be slidably inserted in or removed from the compartment. The unit is provided at one end thereof with a plate **20** which closes the access opening in the container side wall **18** when the unit is inserted in the compartment.

As will be apparent from FIGS. **2** and **4**, the temperature conditioning unit **13** includes a housing **21** which is of such size and shape as to occupy the entire compartment **14** when it is slidably inserted thereinto. The housing **21** includes a back wall **22** and a bottom wall **23**, the back wall being provided with an air inlet slot or opening **24** so that when the unit is inserted in the compartment and the housing back wall **22** is disposed against the battens **12***a* on the container end wall **17**, air from the interior of the container may flow through the spaces between the battens **12**a as indicated at **25** in FIG. **6**, and through the inlet opening **24** into the housing **21**, as indicated at **26**. Similarly, the bottom wall **23** of the housing is provided with an air outlet opening **27**, so that air which has been temperature-conditioned within the housing may be discharged through the opening and through spaces between the battens **12**b as at **28** into the interior of the container as at **29**. In this manner the air inside the container is circulated through the unit **13** and is heated or cooled thereby so that the contents of the container may be kept at a desired temperature.

The temperature conditioning unit **13** as hereinafter described in detail is a heating unit which is intended to heat the contents of the container during shipment. However, it may be replaced by a cooling unit intended to cool the contents of the container. In actual practice, a heating unit may be installed in the container at the start of its journey and may be withdrawn at some point along the journey and replaced by a cooling unit. Generally speaking, a heating or cooling unit is installed in the container for transportation by road or rail. Where a part of the journey involves transfer of the container to a ship, neither a heating unit nor a cooling unit is necessary inasmuch as the temperature in the hold of the ship is usually maintained at a uniform level by the outside water. However, if the journey should originate, for example, in a hot climate, a cooling unit could be installed and withdrawn when the container is about

to be lowered into the hold of the ship. If the journey is to a cold climate, a heating unit could be installed as soon as the container is lifted out of the hold and would remain until the container reaches its destination. This sequence, of course, would be reversed if the journey were from a cold to a hot climate.

Also generally speaking, heating units would be required only in cold parts of the world and cooling units in the tropics. Thus, in between the two, either heating or cooling units installed at the start of a journey would not be required at the destination. Accordingly, several units removed from several containers may be packed in one empty container and shipped back to a port where they would be required to be used again. This can be done at very little expense and avoids the storage of a large number of units at one or the other end of a ship's voyage, and overhead is thus greatly reduced.

Reference is now drawn to FIG. 5 which shows, somewhat diagramatically, a typical arrangement of the unit **13** as a heating unit. The same is characterized in that the heat output of the unit is derived from the operation of a small internal combustion engine **30** which is air-cooled and is suitably installed in the unit housing **21** along with its fuel tank **31.** The engine drives a fan or blower **32,** the purpose of which will be hereinafter explained.

A combustion air intake pipe **33** extends from the end **20** of the housing **21** to the engine **30** and an exhaust pipe **34** extends from the engine through the opposite end **35** of the housing. The interior of the housing is suitably partitioned to provide an engine compartment **36** communicating with a heat transfer duct **37** which encloses the exhaust pipe **34** and may also accommodate a muffler **34a** on the exhaust pipe. The duct **37** has an extension **38** for returning air to the engine compartment **36.** The compartment **36** and the ducts **37, 38** constitute the primary air circuit within the housing **21,** in which circuit the air is heated by operation of the engine **30** and is circulated as indicated by the arrows **39.** The primary air circuit is continuous, but is provided with a primary air inlet **40** and a primary air outlet **41,** both of which communicate with the atmosphere at the outside of the housing end **20.** Butterfly valves **42, 43** in the inlet **40** and outlet **41,** respectively, are simultaneously opened or closed by automatic controls (not shown) actuated by a thermostat **44** in the primary air circuit. In addition to the aforementioned blower **32,** the engine **30** has the usual cooling fan (not shown) which serves to circulate the air past the engine and past the exhaust pipe **34** in the primary air circuit, as shown by the arrows **39.**

The partitioning of the interior of the housing **21** is also such as to provide a secondary air circuit obtained by the entry of air from the shipping container into the housing opening **24** as indicated by the arrows **25, 26.** The air entering the opening **24** flows across a partition **37'** supporting the duct **37** as shown in FIG. **6,** the air thus being heated by the duct **37** and entering the secondary heat transfer chamber **45** where it also comes in heat exchange contact with the duct extension **38,** before being discharged through the outlet opening **27** as at **28** and **29** into the shipping container to heat the contents of the latter. The chamber **45** contains baffles **45***a*, **45***b* around which the secondary air passes as indicated at **46** on its way to the outlet opening **27.** The engine driven blower **32** is disposed in the heat transfer chamber **45** to circulate the secondary air through the housing.

The circulation of secondary air through the housing and through the container interior is continuous, but a secondary air inlet **47** and a secondary air outlet **48** communicate the chamber **45** with the outside of the housing at the housing ends **20** and **35,** respectively. Butterfly valves **49, 50** in the inlet **47** and outlet **48,** respectively, are simultaneously opened or closed by automatic controls (not shown) actuated by a thermostat **51** in the chamber **45.**

It should be mentioned at this point that the side wall **19** of the shipping container **10** is provided with an opening at the end of the compartment **14** so that when the unit **13** is installed in the compartment, the end **35** of the unit housing **21** is exposed through the opening in the container wall **19** and the secondary air outlet **48** as well as the exhaust pipe **34** discharge into the atmosphere outside of the shipping container. Conveniently, the exposed end **35** of the unit housing may also be equipped with a filler cap **52** and with a fuel level sight gauge **53** for the fuel tank **31,** as shown in FIG. **2.**

Similarly, the other end **20** of the unit housing **21,** which closes the access opening in the container side wall **18,** has the combustion air intake pipe **33,** the primary air inlet **40** and outlet **41,** and the secondary air inlet **47** in communication with the atmosphere at the outside of the shipping container, as will be apparent from FIG. **3.** The housing end plate **20** is equipped with latches **54** to engage suitable catches on the container side wall **18** for retaining the entire unit **13** in position in the compartment **14.** Also, the plate **20** may be provided with a door **55** for access to a chamber **56** in the housing **21,** which chamber may accommodate controls for the engine **30,** and the like.

When the unit **13** is removed from the shipping container, the access openings in the container walls **18** and **19** are closed off by suitable blank plates or covers.

In a typical operation of the heating unit, the secondary air circuit thermostat **51** may be set at 75° F., and the primary air circuit thermostat **44** may be set at 95° F. The thermal capacity of the heating unit is controlled by the speed of the engine **30** which is set at a given speed and that setting normally is not changed while the unit is in operation. The substantially constant engine speed therefore makes the heating unit completely autonomous as the heat output adjusts itself to the temperature outside the shipping container while retaining the temperature within the container at the demand of variations of temperature from outside to inside of the container. This, of course, is effected by opening or closing of the valves **42, 43** and of the valves **49, 50** which communicate the respective primary air and secondary air circuits with the outside atmosphere under varying temperatures as sensed by the thermostats **44** and **51.**

When contents of the shipping container are such that heating of the container is required, the heating unit **13** is simply slid into the compartment **14** and fastened in position by the latches **54.** The engine **30** is started by means of controls in chamber **56** and the air circulated through the unit plus the volume of primary and/or secondary air to be admitted or bled off is automatically controlled by the thermostats to maintain the desired temperature within the container.

While in the foregoing there has been described and shown the preferred embodiment of the invention, vari-

ous modifications and equivalents may be resorted to within the spirit and scope of the invention as claimed.

What is claimed as new is:

**1.** A portable self-contained heating unit comprising a housing, an internal combustion engine provided in said housing, a supply of fuel in the housing for said engine, said engine having a combustion air intake and an exhaust pipe communicating with the exterior of the housing, a continuous primary air circuit provided in the housing past said engine and said exhaust pipe, a secondary air circuit through the housing in heat exchange relation with said primary air circuit, and a blower driven by said engine for circulation of air through the secondary air circuit.

**2.** The device as defined in claim **1** together with thermostatically controlled air inlet and outlet valve means communicating each of said primary and secondary air circuits with the exterior of said housing.

**3.** The device as defined in claim **1** together with a valved primary air inlet and a valved primary air outlet communicating said primary air circuit with the exterior of said housing, and a thermostat within the primary air circuit for controlling the valved air inlet and outlet.

**4.** The device as defined in claim **1** together with a valved secondary air inlet and a valved secondary air outlet communicating said secondary air circuit with the exterior of said housing, and a thermostat within the secondary air circuit for controlling the valved air inlet and outlet.

**5.** The device as defined in claim **1** together with a valved primary air inlet and outlet and a valved secondary air inlet and outlet communicating the respective primary and secondary air circuits with the exterior of said housing, and thermostats within the respective primary and secondary air circuits for controlling the primary air inlet and outlet and secondary air inlet and outlet respectively, the device being further characterized in that the heat output of the heating unit is controlled by the valued air inlets and outlets while the operating speed of said engine remains substantially constant.

* * * * *