

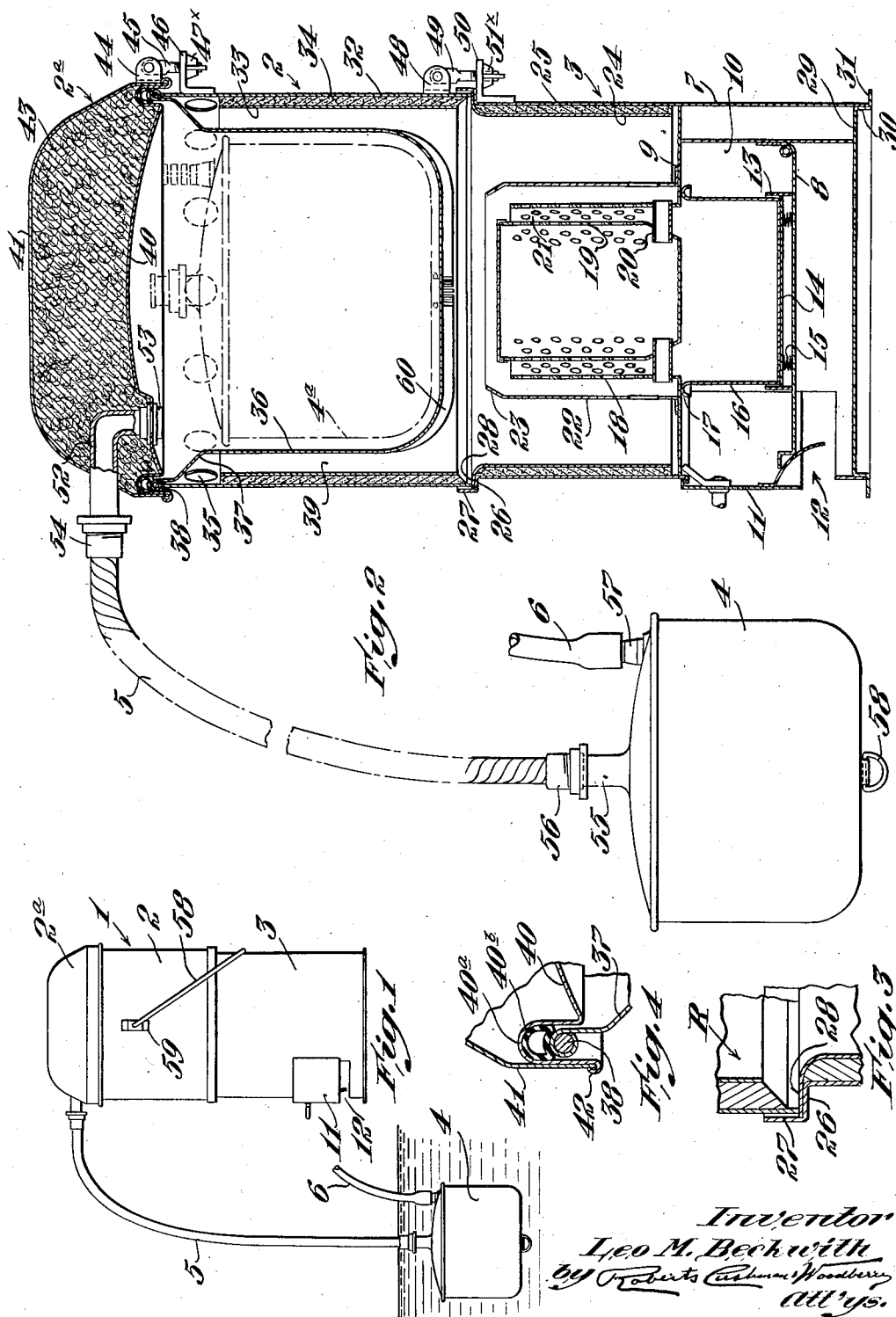
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PORTABLE WATER STILL

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PORTABLE WATER STILL

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This invention pertains to stills for use in converting sea water into drinking water, and relates more particularly to a portable still for emergency use, for instance for use in the life-boats of aircraft.

For such purposes a still must be very compact; of small external dimensions and light in weight, but at the same time capable of producing a substantial quantity of drinking water by the combustion of a minimum amount of fuel; it should be so devised as to operate satisfactorily with a solid non-explosive fuel; capable of operation in the tropics as well as in cooler climates; and it must be rugged and durable and not readily subject to corrosion or deterioration when exposed to the weather, and to sea water.

The principal object of the present invention is to provide a portable still having all of the above desirable characteristics embodied in apparatus of practical construction and which may be produced on a commercial scale at a reasonable cost. Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawing wherein

Fig. 1 is a diagrammatic elevation showing the still with its several parts arranged for operation;

Fig. 2 is a view, to larger scale, showing the boiler and burner units of the device in vertical section, but showing the condenser and flexible tubing in elevation (certain parts being broken away);

Fig. 3 is a fragmentary section on the same plane as Fig. 2, but to larger scale, illustrating certain details; and

Fig. 4 is a similar view illustrating other details.

Referring to the drawing (Fig. 1), the numeral 1 designates the portable still of the present invention with its parts arranged in the position which they occupy when the still is in operation. This still comprises the boiler unit 2 having the removable cover 2^a, the burner unit 3, the condenser 4, the flexible tube 5 connecting the boiler unit with the condenser, and the flexible vent tube 6.

It is to be understood that the several parts of the still will be made of material which is not readily corroded when exposed to the weather or to sea water and which is not injuriously affected by the products of combustion of the solid fuel employed, and that the parts will be made as light as possible commensurate with the requisite durability and strength. Preferably sheet

aluminum anodized to make it resistant to corrosion will be used for most of the metallic parts of the apparatus.

The burner unit 3, in the specific embodiment herein disclosed, comprises the cylindrical open-ended shell 7 (Fig. 2) having within its lower part, but spaced from its lower end, a supporting shelf 8 which may be held in place in any desired manner but with provision for the passage of air upwardly from the space below the shelf to that above it. Above the shelf 8 there is arranged an annular septum 9 which completely divides the lower and upper parts of the space within the shell except for the central opening in the septum. The space 10 between the shelf 8 and the septum 9 constitutes a combustion compartment and the shell is furnished with a fuel admission opening leading into this compartment and which is normally closed by a door 11. An air admission opening 12 permits the free entrance of air into the space below the shelf 8.

The shelf 8 supports a cylindrical positioning ring 13 within which is arranged the vertically movable platform 14 resiliently supported by springs 15 and which constitutes a rest for a container 16 for the fuel. This container and the fuel in it (not shown) may be of a commercial type, the fuel being solid and capable of producing, by combustion, approximately 20,000 B. t. u.'s per pound. Such fuel should not melt while burning but should be capable of ignition by a spark-type ignitor. The receptacles 16, as commercially produced, are of metal and the upper edge 17 of the receptacle is usually beaded or rounded. The height of the compartment 10 is such that when the receptacle 16 is seated on the platform 14, where it is held in place by the ring 13, its upper edge is held in close engagement with the under surface of the septum by the upward urge of the springs 15.

An open-topped sleeve 18 of perforated metal or other suitable non-combustible material is arranged above the septum 9, coaxially with the opening in the septum, and is secured to the septum in any desired manner. As here indicated it is integral with the septum but it may be a separate element if preferred. This sleeve 18 extends up nearly to the top of the burner unit and within it is arranged the hollow cylindrical perforated flame spreader 19, closed at top and bottom and supported by the sleeve 18 by means of suitable brackets 20. As here illustrated these brackets are tubular so as to provide communication between the interior of the hollow flame spreader and the space outside the sleeve 18.

The flame spreader 19 is of such external diameter as to provide an annular flue 21 between it and the sleeve 18—this flue providing for the upward travel of the products of combustion. Surrounding the sleeve 18 is a guard cylinder 22 which, as here illustrated, is supported at its lower end on the septum 9 and which is of substantially greater diameter than the sleeve 18 so as to provide an annular air flue 22^a (having air entry openings at its lower end) between it and the sleeve. The upper portion of the guard cylinder 22 preferably tapers in diameter, as shown at 23, thereby directing the air flowing up the flue 22^a into intimate contact with the upwardly moving stream of hot gases and to contract said stream as it emerges from the top of the flue 21, thereby to concentrate the heat of said gases against the bottom of the boiler.

That portion of the shell 7 which surrounds the guard cylinder 22 is preferably provided with a lining sleeve 24 spaced from the inner wall of the shell to provide an annular chamber for the reception of insulating material 25, such for example as compressed glass wool. Preferably this space should be $\frac{1}{4}$ inch or more in radial thickness.

The upper portion of the shell 7 is turned outwardly as shown at 26 (Fig. 3) and then upwardly at 27, and the upper portion of the lining 24 is turned outwardly at 28 so as to overlap the part 26, thereby providing the recess R (Fig. 3) for the reception of the lower edge of the boiler unit 2.

The lower end of the shell 7 is preferably normally closed by a grid 29. This grid is provided with a cylindrical portion 30 which is designed to slide into the lower end of the shell 7 with a tight fit so as to be retained therein frictionally, although removable therefrom at will. The grid also has the outturned flange 31 on which the lower edge of the shell 7 normally rests, said flange 31 forming a foot or base for the support of the burner unit.

The boiler unit 2 comprises the shell 32 open at top and bottom and of such diameter that its lower end may fit snugly within the recess R of the burner unit. This shell 32 is preferably provided with a lining cylinder 33 extending from its lower end to a point near but spaced from its upper end, the lining cylinder 33 being of such diameter as to provide a space between it and the shell 32 for the reception of insulation such as compressed glass wool, the thickness of the insulation preferably being $\frac{1}{4}$ inch or more. Above the insulation the shell 32 is preferably provided with a plurality of vent openings 35 through which the products of combustion may escape to the atmosphere.

Within the boiler unit is arranged the boiler 36. As here illustrated this boiler is a unitary piece of sheet metal, suitably shaped by pressure or the like and preferably of a size such that it will hold six quarts or more of water. The upper portion of this boiler is shaped to provide the outwardly divergent skirt 37 which is provided at its extreme upper edge with a bead 38 which, if desired, may be reinforced by a stiff wire ring. This bead is designed to rest upon the upper edge of the shell 32 and thereby to support the boiler 36 in depending relation within the shell—the diameter of the boiler proper being such as to provide a space 39 of substantial radial thickness between the boiler and the lining 33.

The cover 2^a of the boiler preferably comprises the lower wall 40 and the upper wall 41, said walls being of sheet material and both being domed up-

wardly, the upper wall 41 being domed more deeply than the lower wall so as to provide between them a space 43, for example two inches or more in depth, within which is packed suitable insulation, for example glass wool. The walls 40 and 41 are permanently united at their outer edges as indicated at 42, and the margin of the lower wall 40 is preferably bent upwardly as indicated at 40^a (Fig. 4) to provide a deep annular recess or channel containing resilient packing material 40^b and which receives the rim bead 38 of the boiler.

The cover 2^a is provided at suitable intervals about its circumference with outstanding brackets 44 to which are pivotally secured clamping bolts 45 which normally project down through open-ended slots in brackets 46 fixed to the shell 32 and which carry wing nuts 47 at their lower ends by means of which the cover may be drawn down toward the boiler so as to form a leak-tight joint between them. Brackets 48, similar to brackets 44, are carried by the shell 32 near its lower edge and form pivotal supports for the clamping bolts 49 which normally engage open-ended slots in brackets 50 projecting from the upper part of the shell 7 and which carry wing nuts 51 at their lower ends by means of which the boiler unit may be releasably secured to the burner unit.

A pipe or conduit 52 passes through the cover 2^a from the interior to the exterior hereof, the inner end of the pipe being provided with packing and locking means 53 thereby to prevent escape of steam between the pipe and the cover. At its outer end the pipe 52 is provided with means for the reception of a union 54 by means of which the upper end of the flexible steam tube 5 may be removably secured to the pipe 52.

The condenser 4 is here shown as a fluid-tight receptacle of suitable rigid material, preferably sheet metal, of a size such that it may be nested within the boiler, as illustrated in dotted lines at 4^a (Fig. 2) and of a capacity of two quarts or more. This condenser 4 is provided with an outwardly projecting nipple 55 having provision for removably securing to it a union 56 at the lower end of the flexible steam tubing 5. The condenser 4 is also provided with a projecting nipple 55 to which the lower end of the flexible vent 6 may be secured. This vent permits the escape of air or gas which may be released from the water during distillation. Preferably the condenser 4 is provided with a ring 58 for use in attaching the condenser to some appliance, for example a boat oar, by means of which the condenser may be thrust below the surface of the sea and held there during the distilling operation. The length of the flexible steam tube 5 will be such as to permit such location of the condenser, while at the same time the burner and boiler units are supported in upright position within the boat. The vent tube 6 is also of such length as to reach at least above the surface of the sea when the condenser is in use, and preferably to reach to the interior of the boat, although it is contemplated that the upper end of this vent tube 6 may be supported by a float if preferred. It is evident that if the water be permitted to accumulate in the vessel 4 until the latter is full, the continued operation of the device will generate steam pressure sufficient to force some of the water up through the tube 6 and into the boat where it may be collected in any appropriate receptacle.

Preferably, for convenience in carrying the device, a bail 58 is attached to ears 59 secured to the upper part of the boiler unit 2.

When the device is not in use the condenser 4 and the flexible tubes 5 and 6 are housed within the boiler unit, thus providing a very compact and readily portable device. When the still is to be used, the condenser 4 is removed from the boiler, the tubes 5 and 6 are connected and the condenser is placed overboard and held immersed in the sea. A quantity of sea water is placed in the boiler 36 and the cover 2^a is clamped in position. A receptacle 16 containing solid fuel being provided, the fuel is ignited and the receptacle is placed on the platform 4 within the compartment 10, and the door 11 is closed. The burning of the fuel produces a flow of hot gases up through the flue 21, and this stream of hot gases, impinging upon the under side of the boiler and passing up along the sides of the latter quickly raises the sea water in the boiler to boiling temperature. To facilitate the transfer of heat from these hot gases to the contents of the boiler, the under portion of the boiler may be provided with heat transferring fins 60 if desired. If desired, the outer edges of these fins may be united, integrally or otherwise, with an annulus, coaxial with the boiler, and operative both to reinforce the fins and to reflect the hot gases back against the boiler. However, such annulus forms no necessary element of the present invention, and accordingly is not illustrated. A flint lighter, not shown, is desirably attached to the outside of the apparatus.

The steam which is evolved from the boiling sea water passes out through the pipe 52 and down through the steam tube 5 into the condenser 4 where it is condensed by the surrounding cooler sea water. A device such as that herein disclosed is readily capable of producing as much as three pounds of potable water per hour measured from the time of ignition of the fuel—starting with sea water having a salinity of at least 4% when the cooling water available is at a temperature not exceeding 90° F. The salt in the distilled water resulting from this operation will not exceed six grains per gallon for the first pint of water distilled and will not exceed two grains per gallon for the remainder of the water distilled during the operation. Furthermore, the device will produce as much as ten pounds of water for every pound of fuel consumed by the burner, assuming that the fuel is of the type above referred to. Obviously such portion of the tube 5 as is immersed in the sea water acts as a condenser and by the use of a sufficiently long tube 5, coupled directly to or itself constituting the vent pipe 6, adequate condensation could be insured even though the vessel 4 were injured or lost.

When not in use as a still, the boiler unit may be removed from the burner unit, and the grid 29 may be removed and placed on top of the burner unit and employed as a cooking surface. While a fuel container and fuel such as above referred to are preferable, other types of fuel may be burned in the compartment 10, if desirable or necessary. However, the fuel selected should be safe to use; preferably solid; explosion and leakproof; it should not melt as it burns; and should have a high B. t. u. value.

While one desirable embodiment of the invention has herein been disclosed by way of example, it is to be understood that the invention is not necessarily limited to this precise embodiment but is to be regarded as broadly inclusive of any and all equivalent constructions falling within the scope of the appended claims.

I claim:

1. A portable still comprising a burner unit, a boiler unit, a condenser, a conduit connecting the interior of the boiler unit with the condenser when the still is in use, said units being independent and separable, means releasably uniting the burner and boiler units, the burner unit having therein provision for removably supporting a container for solid fuel and the boiler unit including an outer shell having a covered boiler removably supported therein, the boiler and condenser being of such shape and dimensions that the condenser may be housed within the boiler for storage.

2. A portable still comprising a condenser and a boiler unit, the latter including an insulating substantially rigid shell and a boiler removably supported upon the upper edge of the shell, the boiler having a steam-tight removable cover, and a conduit connecting the interior of the boiler unit with the condenser when the still is in use the boiler and condenser being so shaped and dimensioned as to permit storage of the condenser within the boiler when the device is not in use.

3. A portable still of the kind in which a boiler unit is supported by and is removably united to a burner unit, and wherein a condenser is so connected to the boiler unit as to receive steam evolved in the boiler unit, the burner unit comprising a substantially cylindrical outer shell open at its lower end, means operative to support a fuel container within the shell, and a grid normally closing the lower end of the shell, the grid having a flange portion upon which the lower edge of the shell normally rests and a portion which fits frictionally within the lower end of the shell, the grid being designed for application to the upper end of the shell upon removal of the boiler unit.

4. A portable still of the kind in which a boiler unit is supported by and is removably united to a burner unit, and wherein a condenser is so connected to the boiler unit as to receive steam evolved in the boiler unit, the boiler unit comprising a substantially cylindrical shell, the upper portion only of the boiler engaging the shell, the boiler proper depending from its upper portion and being spaced from the inner surface of the shell, the latter having a cylindrical lining in that portion which surrounds the boiler, and insulating means between the lining and shell, the latter having vent openings in its upper part through which gaseous products of combustion rising along the sides of the boiler may escape to the atmosphere.

5. A portable still of the kind in which a boiler unit is supported by and is removably united to a burner unit, the boiler unit comprising a substantially cylindrical shell, a removable cover for the boiler, means providing a steam-tight joint between the cover and boiler, a conduit leading from the interior to the exterior of the cover, a condenser of a shape and size such that, when not in use, it may be nested within the covered boiler, and means connecting the condenser and said conduit thereby to permit steam evolved in the boiler to pass to the condenser.

6. A portable still of the kind in which a boiler unit is supported by and is removably united to a burner unit, the boiler unit comprising a substantially cylindrical shell, a removable steam-tight cover for the boiler, a condenser consisting of a fluid-tight receptacle of a size and shape such that it may be nested within the covered boiler when not in use, said receptacle having a pair of

outwardly directed nipples each designed for the reception of the end of a flexible tube, the cover having a conduit leading from its inner to its outer side, said conduit having provision for attaching thereto one end of one of said flexible tubes.

7. A portable still of the kind in which a boiler unit is supported by and is removably united to a burner unit, the boiler unit comprising a substantially cylindrical shell, a removable steam-tight cover for the boiler, a condenser consisting of a fluid-tight receptacle of a size and shape such that it may be nested within the covered boiler when not in use, said receptacle having a pair of outwardly directed nipples each designed for the reception of the end of a flexible tube, the cover having a conduit leading from its inner to its outer side, said conduit having provision for attaching thereto one end of one of said tubes, the receptacle being provided with connecting means whereby an implement may be attached to it for holding it wholly submerged in sea water.

8. A portable still for use in a lifeboat or the like, said still comprising a burner unit, a boiler unit and condensing means arranged to receive steam from the boiler unit and designed to be immersed in sea water alongside the lifeboat, the boiler and burner units being independent and separable, releasable clamping means normally uniting the boiler and burner units with the boiler unit resting upon the burner unit, the burner unit having therein provision for removably supporting a container for solid fuel, and the boiler unit including an outer shell having a covered boiler receptacle removably supported therein, the boiler and condensing means being of such shape and dimensions that the condensing means may be housed within the boiler for storage.

9. A portable still as set forth in claim 8, further characterized in that the boiler and burner units are of substantially cylindrical shape and of substantially the same diameter and disposed in coaxial relation, each of said units having a

double walled shell with insulation interposed between its walls.

10. A portable still for use in a lifeboat and the like, as set forth in claim 8, further characterized in that the outer shell of the boiler unit is open at both ends and has vent openings at its upper part, the boiler receptacle being disposed within said shell and having an upwardly flaring skirt portion designed to engage and to be supported by the upper edge of the shell, a removable cover for the boiler receptacle, and means operative to clamp the cover tightly to the skirt portion of the receptacle.

11. A portable still for use in a lifeboat or the like as set forth in claim 8, further characterized in that the boiler receptacle has an upwardly flaring skirt portion provided at its edge with a bead designed to rest upon the upper edge of the shell of the boiler unit, a removable cover, packing interposed between the cover and said bead, and clamping means operative to draw the cover toward the bead thereby to compress the packing.

12. A portable still for use in a lifeboat, as set forth in claim 8, further characterized in having means for suspending the boiler receptacle from its upper edge within the upper part of the shell of the boiler unit, the boiler receptacle having a steam-tight cover, and heat conducting fins projecting from the outer surface of the lower portion of the boiler receptacle.

13. A portable still for use in a lifeboat, as set forth in claim 8, further characterized in that the boiler receptacle has a removable domed cover, the cover including upper and lower walls united at their edges and spaced apart inwardly of their edges to provide a chamber for the reception of insulation, means providing a steam-tight joint between the cover and the receptacle, a conduit passing through the cover from the interior thereof to the outside, and means operative for removably securing a flexible steam tube to the outer end of said conduit.

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