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APPARATUS FOR THE ATTAINMENT OF REGULAR BURNING OF LIQUID FUEL

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Fig. 1.

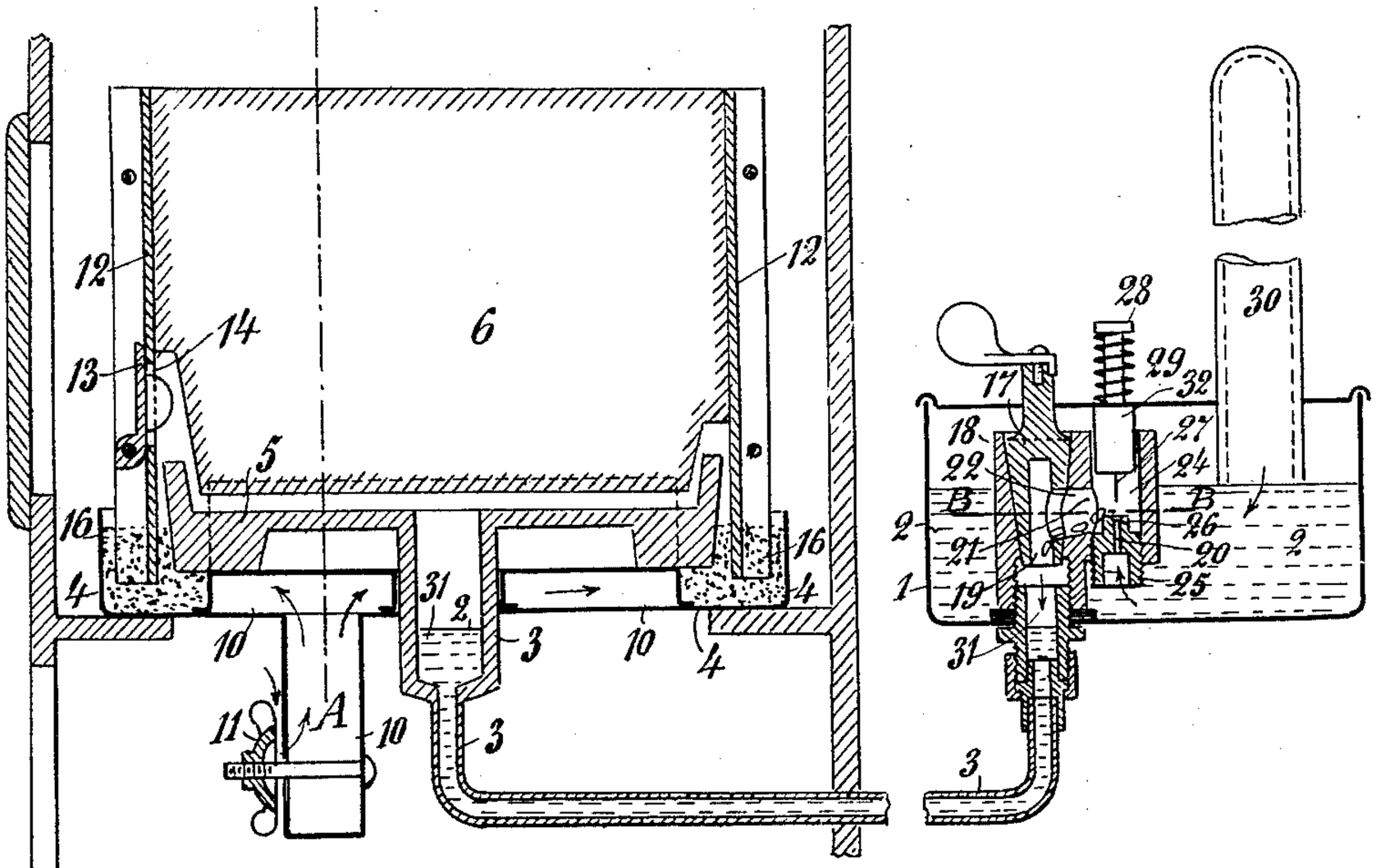


Fig. 2.

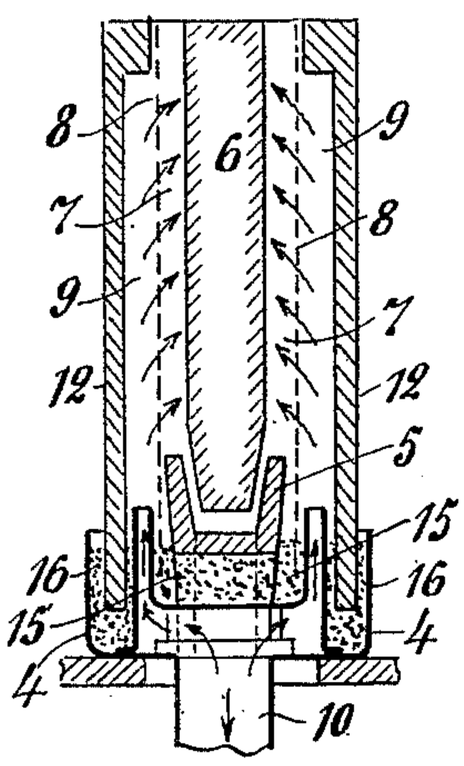
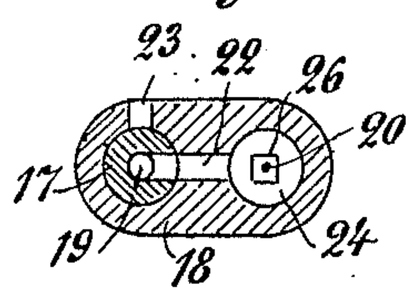


Fig. 3.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR THE ATTAINMENT OF REGULAR BURNING OF LIQUID FUEL.

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The invention comprises a method for burning liquid fuel, e. g. oil, together with an apparatus for the accomplishment of the method. The object of the invention is to obtain regular and complete burning of oil, particularly heavy oils such as solar-oil or the like, in such a way that these oils may be advantageously employed for heating purposes. Through the invention it becomes possible to burn these oils without the formation of soot, and thus the burning of them can be done in stoves, kitchen-ranges and the like appliances erected in private houses and dwellings, with no risk of soiling these latter.

According to the invention this regular and complete burning is accomplished mainly through burning the vapours of the liquid fuel along the surface of an incombustible body which does not touch the liquid fuel, in such a way that this body through the burning will become heated and will be kept at a temperature sufficiently high for allowing its heat radiation to evaporate the liquid fuel from the liquid surface, the liquid fuel being conveyed from below and being kept below the incombustible body. The vapours produced will become ignited by the body and through their burning will keep it at red heat. Thus the process once commenced will continue uninterrupted.

In order to obtain a homogeneous burning all over the surface of the body and thereby a perfect combustion, the air for combustion must be conveyed fairly homogeneously to the surface of the body, and this is accomplished through the air-supply being forced to pass very close along the sides of the said body, after being conveyed into the space in which the body is placed through the walls of this space, these being made in the form of front-grates.

It is necessary for the regular working of the apparatus that a fixed but otherwise adjustable quantity of liquid fuel (oil) is supplied per unit of time. A stationary condition will then appear in which the burning vapours will maintain a temperature in the body, just allowing for the evaporation per time unit of the liquid fuel (oil) supplied. The apparatus is accordingly furnished with an arrangement of the feedcock with various possibilities for adjustment, as described below.

A main feature of this arrangement is that the oil under the cock will have a free surface, and that the pressure of the oil which has not yet passed the cock cannot be transmitted to that part of the oil, which has passed the cock on its way to the combustion chamber. The fact is, that if a contrary condition could be supposed, a slight increase in the combustion of the oil would cause an increased supply of oil through the increased pressure of the oil column, and a regular combustion would then be excluded.

With the arrangement proposed here, however, the free surface under the cock would move parallel with the free surface in the combustion chamber, and any variation in the oil-supply would accordingly not occur spontaneously, but only when the cock adjustment is altered.

The oil is supplied from a reservoir in which the level of the fluid can be kept at a constant height, for instance through supply from a barometrical pipe, possibly with an extension in width at the top, in which the oil is stored.

To obtain an additional regulation step by step, of the amount of heat produced, several burners can be connected to each other to vary the amount of heat produced, with separate regulation for the burners. Combustion cells will then have cocks for separate regulation of the quantity of fluid.

The apparatus can be arranged so that it will serve as a stove, kitchen-range or the like, or for fitting into already erected furnaces and fire-places.

The drawing shows an example of an apparatus constructed in accordance with the invention, viz:

Fig. 1 represents a vertical section through the apparatus, showing also the corresponding arrangement for fuel supply.

Fig. 2 a vertical section through the apparatus on line A—A, and

Fig. 3 a horizontal section through the cock arrangement, on line B—B in Fig. 1.

6 is an incombustible body, for instance kieselguhr (moler stone), placed in a chamber which has a bottom 5 into which leads an inlet channel 3 for the combustible fluid 2, so arranged, that the latter is conveyed to the chamber from below. The body 6 which may be shaped otherwise than the rectangular flag shown or may be made up

of several, may be suitably supported on projections from the bottom 5 or made to hang up, so that its bottom side is situated a convenient distance above the bottom 5.

The walls 8 (front grates) of the chamber have openings for the air for combustion, suitably distributed. These are always placed in such distance from the body that a comparatively narrow combustion space 7 is left along the surface of the body. Hereby an intense mixing of oil-vapours and air is obtained, to secure a perfect combustion without the formation of soot. The grate openings in the walls 8 should preferably be distributed evenly all over the surface of the wall, and as these openings should most suitably be comparatively small and be present in a large number, the walls 8 can be executed in some convenient material, reticulated, perforated or porous.

The air for combustion is conveyed to the bottom of the apparatus through an air passage 10, which can be provided with a suitable draught regulation 11, and from here the air goes upwards to the space 9 between the grate walls 8 and the outer walls of the apparatus 12, then passing into the combustion chamber through the grate openings.

The grate walls 8 as well as the outer walls 12 may be placed and packed in sand (sand-locks) at the bottom of the apparatus, see 15 and 16. Thus it is made possible without trouble to lift the upper part of the apparatus, consisting of the body 6, the grate walls 8 and the outer walls 12, these in themselves forming a complete part of the apparatus, away from the bottom of the apparatus for inspection or cleaning.

The apparatus described above represents a combustion chamber or combustion cell, and to obtain the above mentioned connection of the apparatus for additional step by step regulation of the amount of heat produced, several of these cells can be arranged side by side in the same furnace or fireplace. The cells may be totally independent of each other, or they may be built together, for instance through neighbouring cells having common outer walls. The cells may be provided with separate air supply passages and fuel supply arrangements for each cell.

The regulation arrangement is shown in Fig. 1 at the right side. It consists of a cock fitted into the reservoir with body 18 and head and plug 17. In the plug is drilled a hole 19 which at the bottom leads into the supply pipe 3 to the combustion cell, the hole having also an opening 21 through the side of the plug. This opening corresponds with two apertures in the body of the cock, viz an aperture 23 leading direct into the reservoir and used when lighting the fire, and an aperture 22 having connection with a space 24, open at the top and closed at the bottom with a screwed in plug 25, in which is drilled a narrow passage right through (20) this being brought into service for adjustment of the quantity of oil supplied when working the apparatus.

The cock can be adjusted into three main positions, viz, position I, in which the opening 21 corresponds with the aperture 23, position II in which the opening 21 corresponds with the aperture 22, and position III in which the opening 21 is closed by the body of the cock, this latter position being applied for stopping the working of the apparatus.

The oil-stream will proceed as follows:

On account of the difference in height the oil will pass upwards through the passage 20 into the space 24 and from here in a constant stream through the aperture 22 and the hole 19 into the supply pipe 3 with free surface of the oil 31.

The level of the fluid in the reservoir 1 is kept at a constant height through supply from a main reservoir 30 arranged in the form of a barometrical pipe, or through other suitable arrangements.

The amount of fluid supplied depends upon the difference in height between the fluid level in the reservoir and the overflow height above the surface 31. The amount of fluid supplied to the pipe 3 depends on the difference in height between the fluid level in the reservoir 1 and the upper end 26 of the narrow passage 20. Accordingly, the amount of fluid supplied is adjusted by altering this difference in height, and this is possible either by adjusting the fluid level in the reservoir by raising or lowering the outlet of the barometrical pipe 30, or by adjusting (raising or lowering) the plug 25.

The drilled plug 25, however, may be replaced for instance by an ordinary cock, the adjustment of the fluid supplied being then produced by turning the plug of the cock.

In the apparatus described here the adjustment of the plug 25 up or down may be done, for instance, by means of a socket-wrench.

For cleaning the passage 20 is fitted the needle 27 which by pressing a button 28 and in co-operation with a spring 29 can be brought down through the passage 20. The guiding part of the cleansing needle (32) is furnished with a number of longitudinal furrows, not shown in the drawing, which allow for free admission of the air to the space 24.

When a cell shall start working the corresponding cock is adjusted into position I. The oil will then pass direct from the reservoir 1 through the aperture 23, the hole in the cock plug 19 and the supply pipe 3 to the bottom 5, and will fill this latter with oil, and the lowermost part of the body 6 will become moistened with oil. In order to avoid any oil waste in the furnace the reser-

voir is situated at such a height as compared to the combustion cell, that the oil cannot rise above the edge of the bottom 5. The cock is then adjusted into position II, and the ignition can now take place by lighting the oil on the moistened part of the body 6 through an opening 14 in the outer wall of the apparatus, this opening being under normal conditions closed with the lid 13. Through the burning the body will now become heated locally and get red hot, in which condition it will radiate heat to the liquid surface below, partly through direct radiation, and partly, but in a less degree, through indirect radiation, and the oil in the supply pipe 3 will commence to evaporate. The rising vapours will meet the inflow of air at the lower surface of the body 6 and thereby become ignited, so that a rise in the temperature of the body is obtained and with that an accelerated evaporation. The level of the fluid in the supply pipe 3, however, will through this be lowered, and thereby the evaporation and combustion diminish, and as a result the temperature of the body will decrease. A balanced condition will therefore soon appear, in which per time unit the same quantity of fluid fuel will evaporate and burn as is supplied.

By means of the above described regulating device the fuel supply, and, consequently, the combustion may be regulated, a new balanced condition entering at every velocity of the fuel supply.

The necessary quantity of air to obtain a complete and regular combustion may be regulated by the draught regulating device 11.

When a cell is to be put out of action, the cock is turned to the position III, whereby the supply of fuel is cut off, so that the combustion will successively cease, whereupon the air draught may be cut off by the draught valve 11.

Experiments have shown that molér bricks form an extraordinarily well adapted material for the body 6. This material is so well heat insulating that it permits a limited local heating, which may be explained thereby that its inner heat-conducting coefficient, which is about .06, is more than ten times as favourable as the heat-conducting coefficient of chamotte and the like, which is about .7. Moreover, its very spongy surface leads to an increased density of the air along the same and, consequently, to a higher combustion temperature.

We claim:

1. Apparatus for attaining regular combustion of liquid fuel, comprising a fuel container, a combustion chamber positioned above the fuel container, a refractory body positioned in the combustion chamber, a fuel inlet pipe for the fuel container, a source of fuel connected to the inlet pipe and arranged to supply fuel to the container at a line below the bottom of the refractory body, and air inlet ports in the combustion chamber, the walls of the combustion chamber being positioned closely adjacent the refractory body to have a mixing space between the walls and the body for fuel vapor and air.

2. Apparatus for attaining regular combustion of liquid fuel, comprising a fuel container, a combustion chamber positioned above the fuel container, a refractory body positioned in the combustion chamber, a fuel inlet pipe for the fuel container, a source of fuel connected to the inlet pipe and arranged to supply fuel to the container at a line below the bottom of the refractory body, and numerous air inlet ports in the combustion chamber distributed over the entire surface of the walls of the chamber, the walls of the combustion chamber being positioned closely adjacent the refractory body to have a mixing space between the walls and the body for fuel vapor and air.

3. Apparatus for attaining regular combustion of liquid fuel, comprising a fuel container, a combustion chamber positioned above the fuel container, a refractory body positioned in the combustion chamber, a fuel inlet pipe for the fuel container, a source of fuel connected to the inlet pipe and arranged to supply fuel to the container at a line below the bottom of the refractory body, an outer casing for the combustion chamber and a sealing base detachably receiving the outer casing and combustion chamber, whereby the chamber, casing, and refractory body can be removed as a unit from the base for permitting cleaning.

4. Apparatus for attaining regular combustion of liquid fuel, comprising a fuel container, a combustion chamber positioned above the fuel container, a refractory body positioned in the combustion chamber, a fuel inlet pipe for the fuel container, a source of fuel connected to the inlet pipe and arranged to supply fuel to the container at a line below the bottom of the refractory body, air inlet ports in the combustion chamber, the walls of the combustion chamber being positioned closely adjacent the refractory body to have a mixing space between the walls and the body for fuel vapor and air, and the upper part of the fuel container surrounding the lower part of the refractory body being spaced a small distance apart from this, and means for supplying air for the combustion to the lateral surfaces of the part of the refractory body above the fuel container, so that the combustion only will take place at the said lateral surfaces.

In testimony whereof we affix our signatures.

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GEORG ERNST FALKENTORP.