No. 744,373. PATENTED NOV. 17, 1903.

L. D. LOVEKIN & V. F. LÄSSOE.

SYSTEM FOR BURNING OIL FOR HEATING PURPOSES.

APPLICATION FILED JULY 30, 1902.

NO MODEL. 8 SHEETS—SHEET 1.

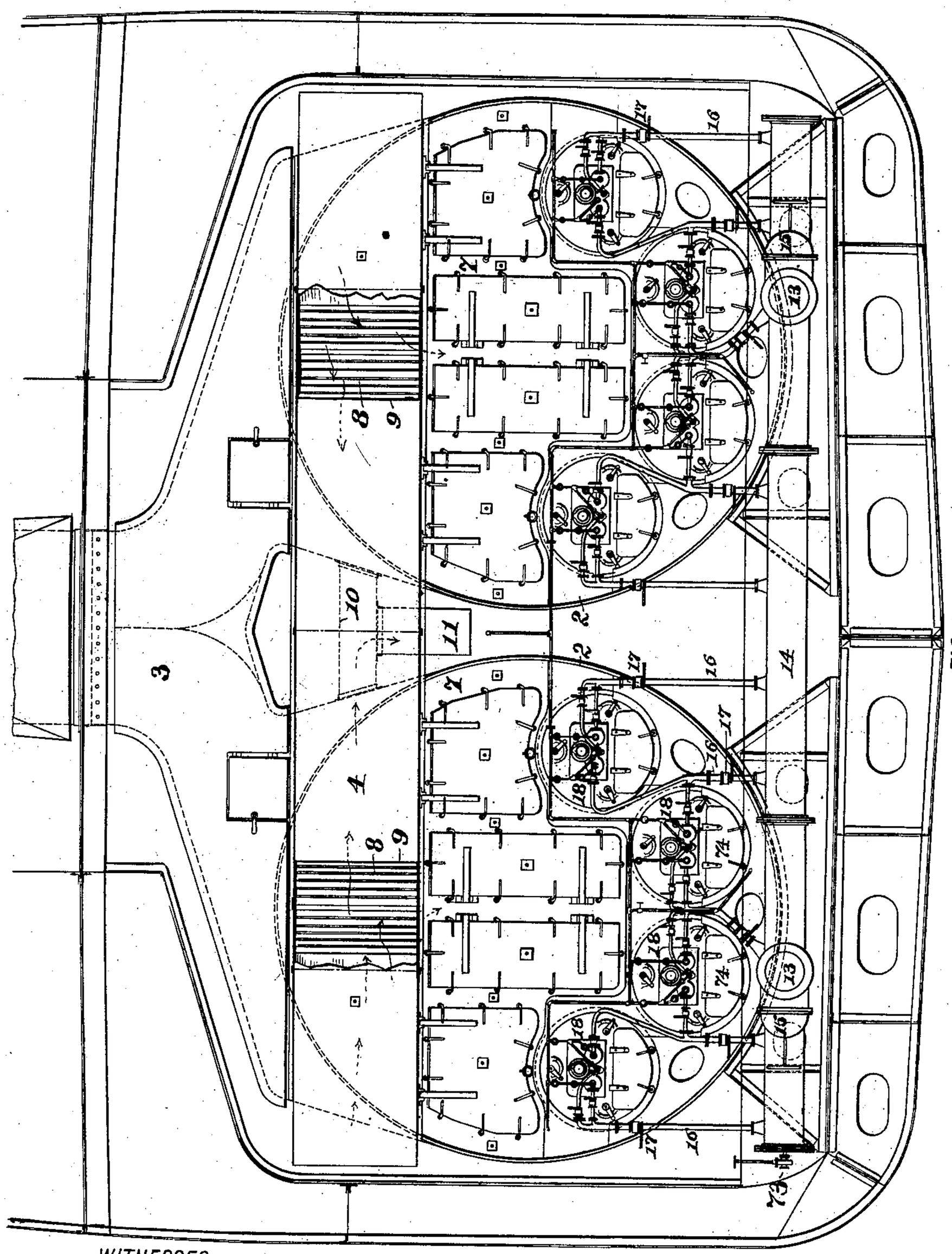

FIG. 1

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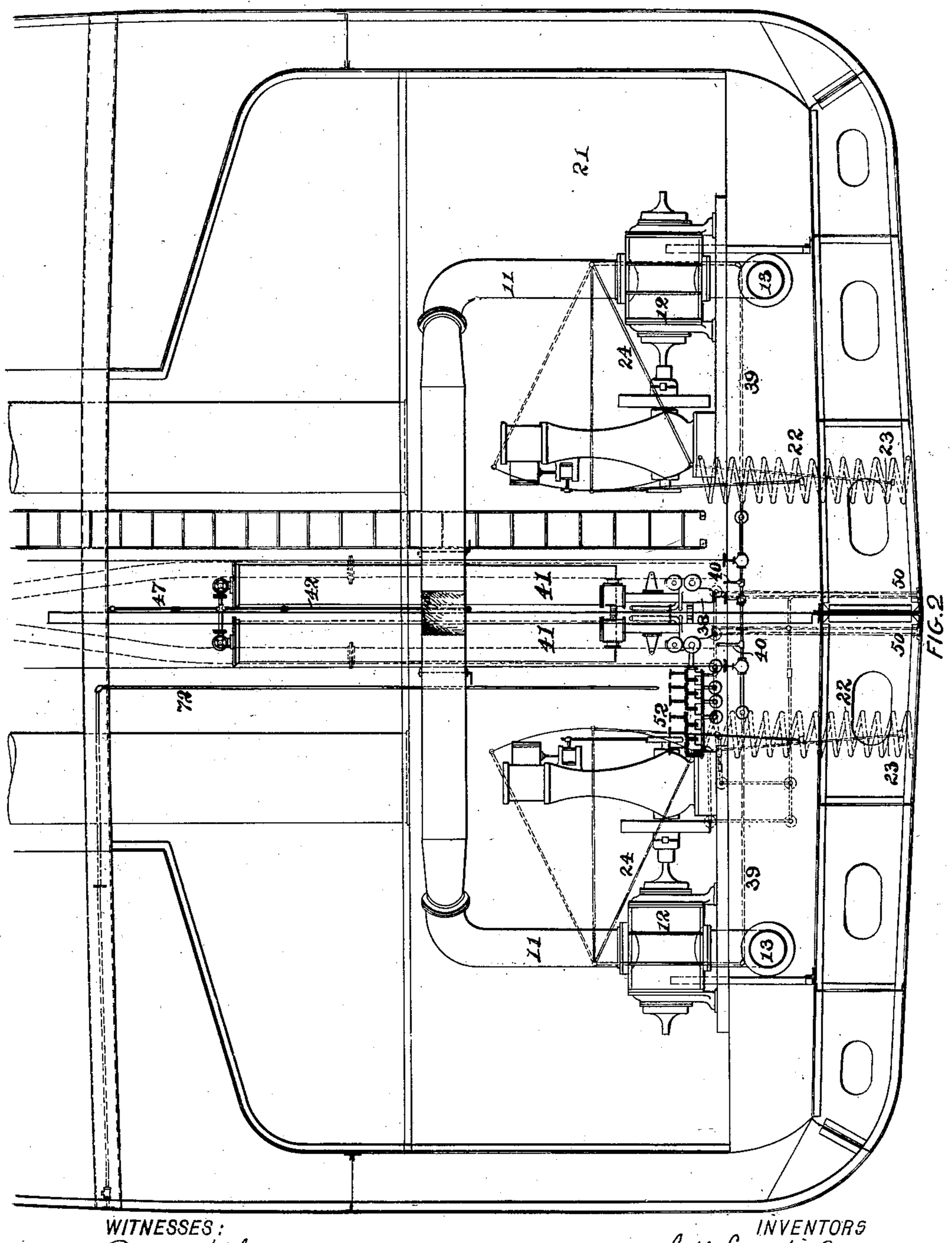

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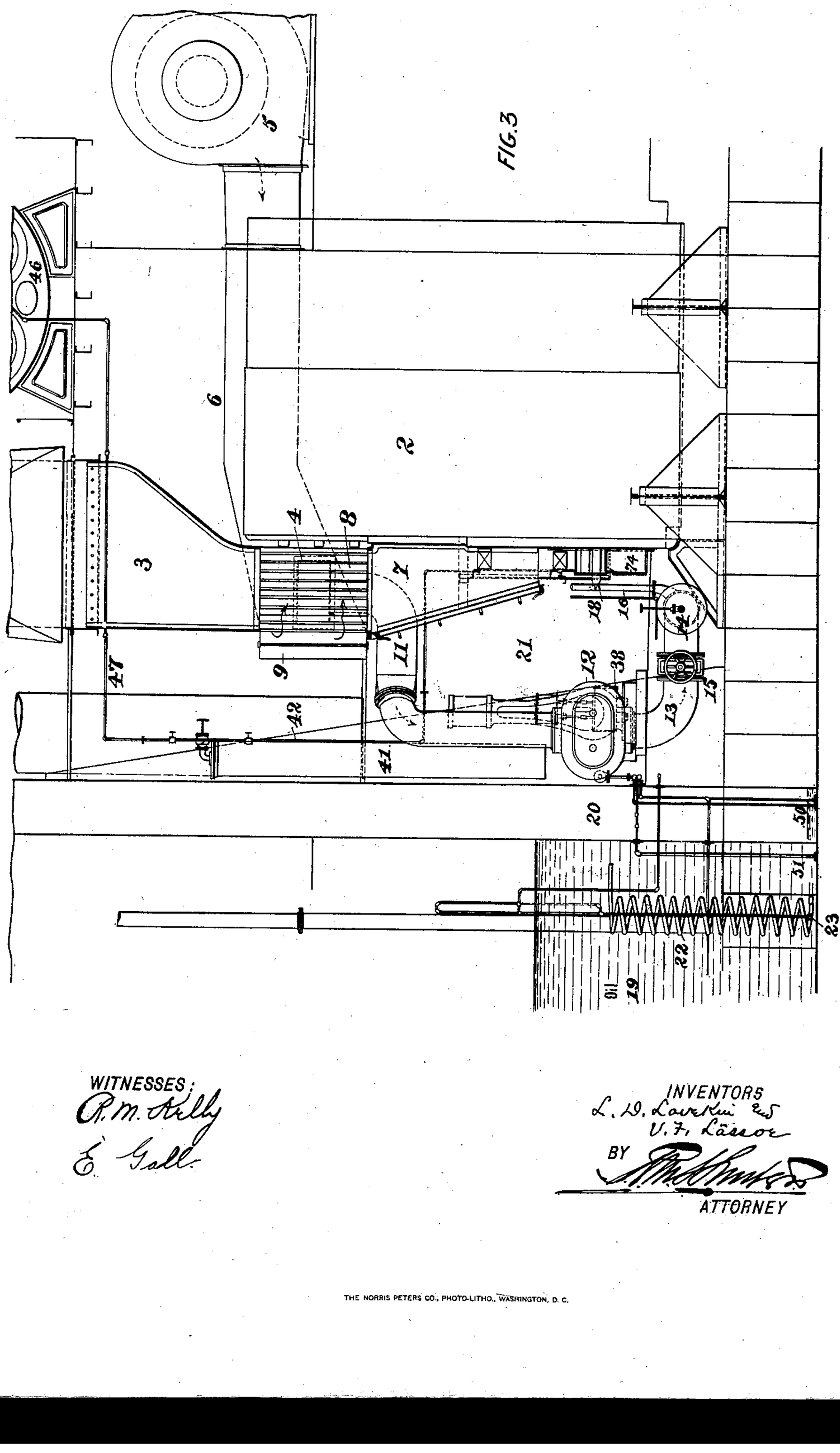
NO MODEL. 8 SHEETS—SHEET 3.

FIG. 3



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NO MODEL. 8 SHEETS—SHEET 4.

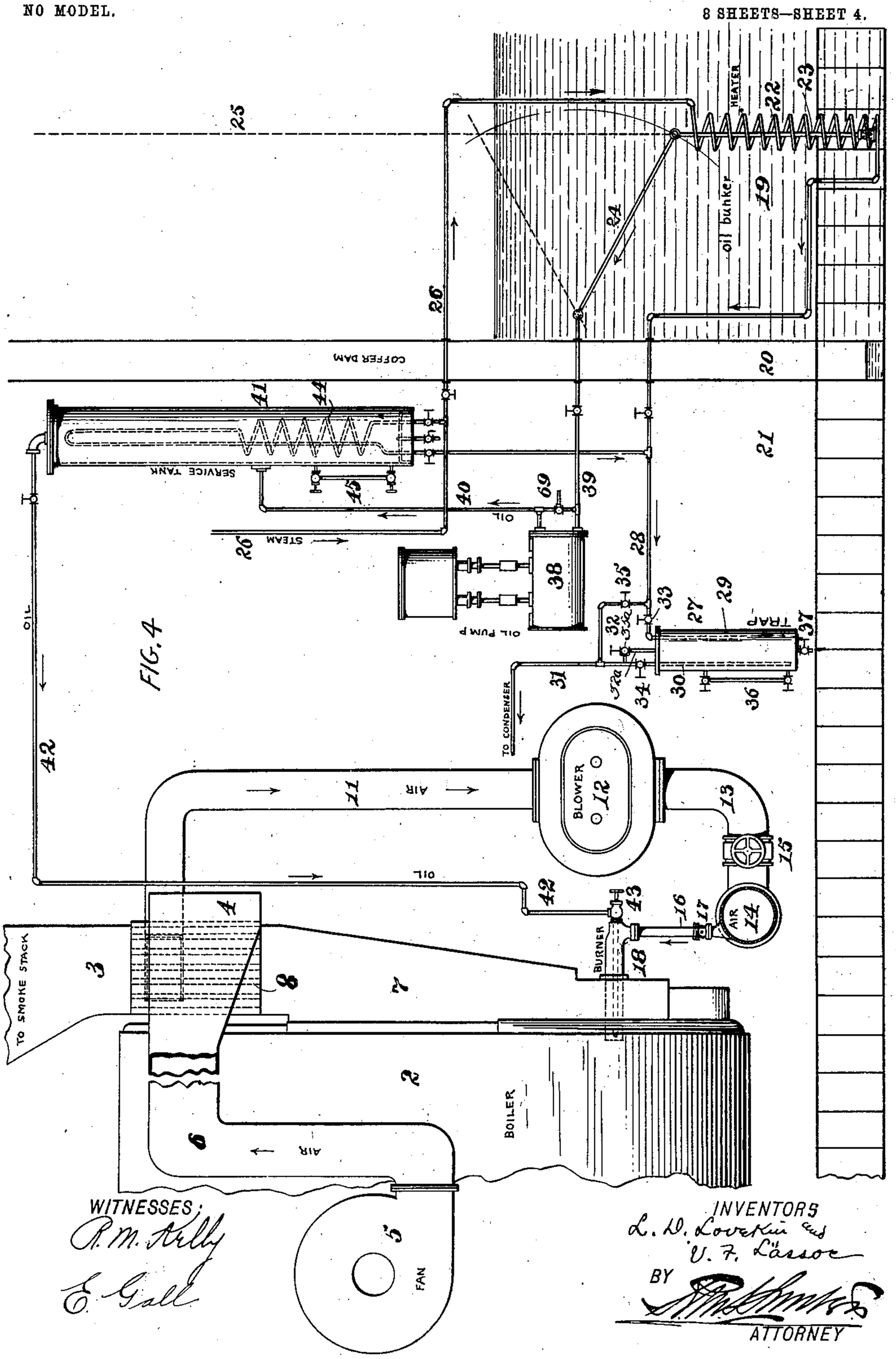

FIG. 4

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NO MODEL. 8 SHEETS—SHEET 5.

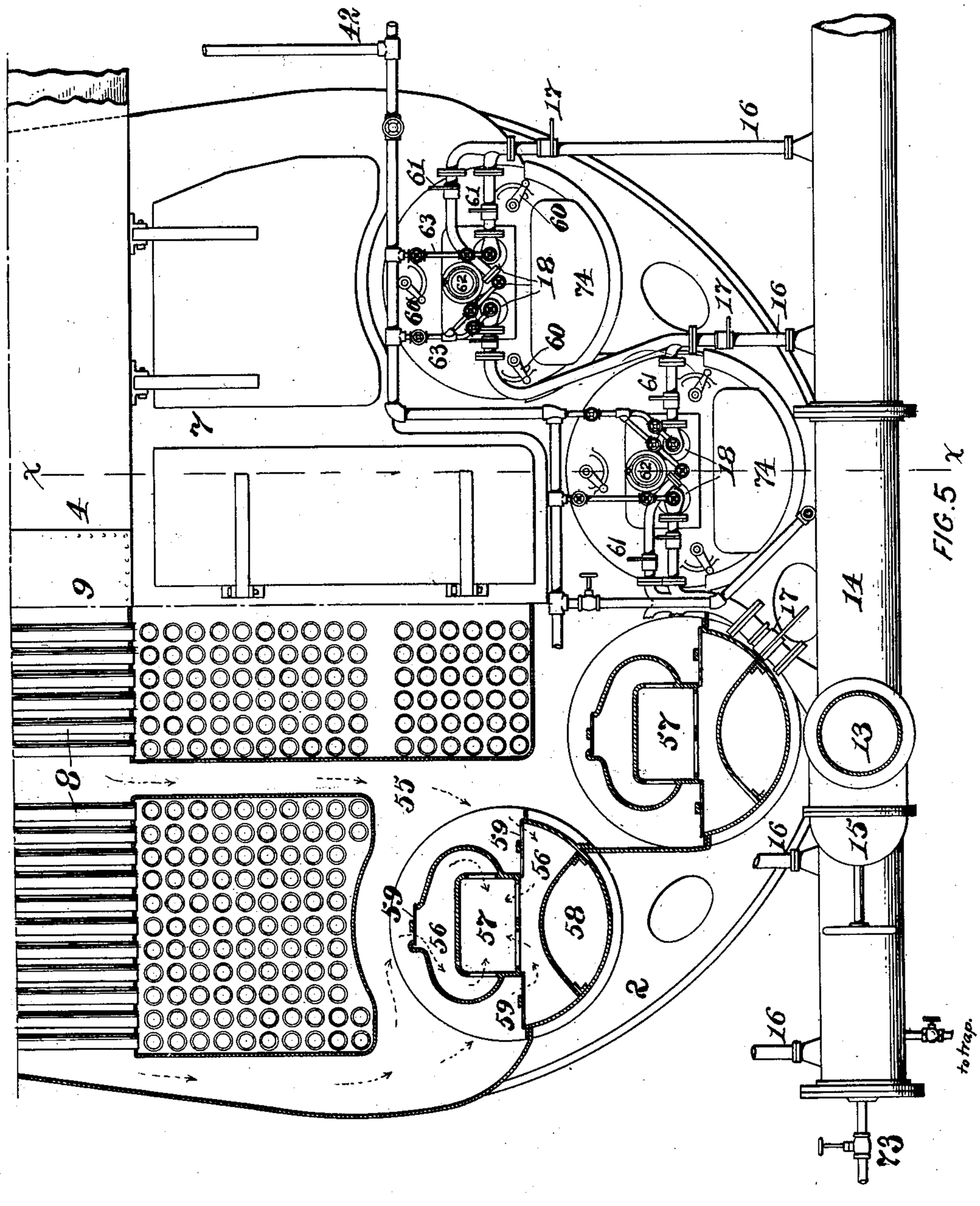

FIG. 5

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NO MODEL. 8 SHEETS—SHEET 6.

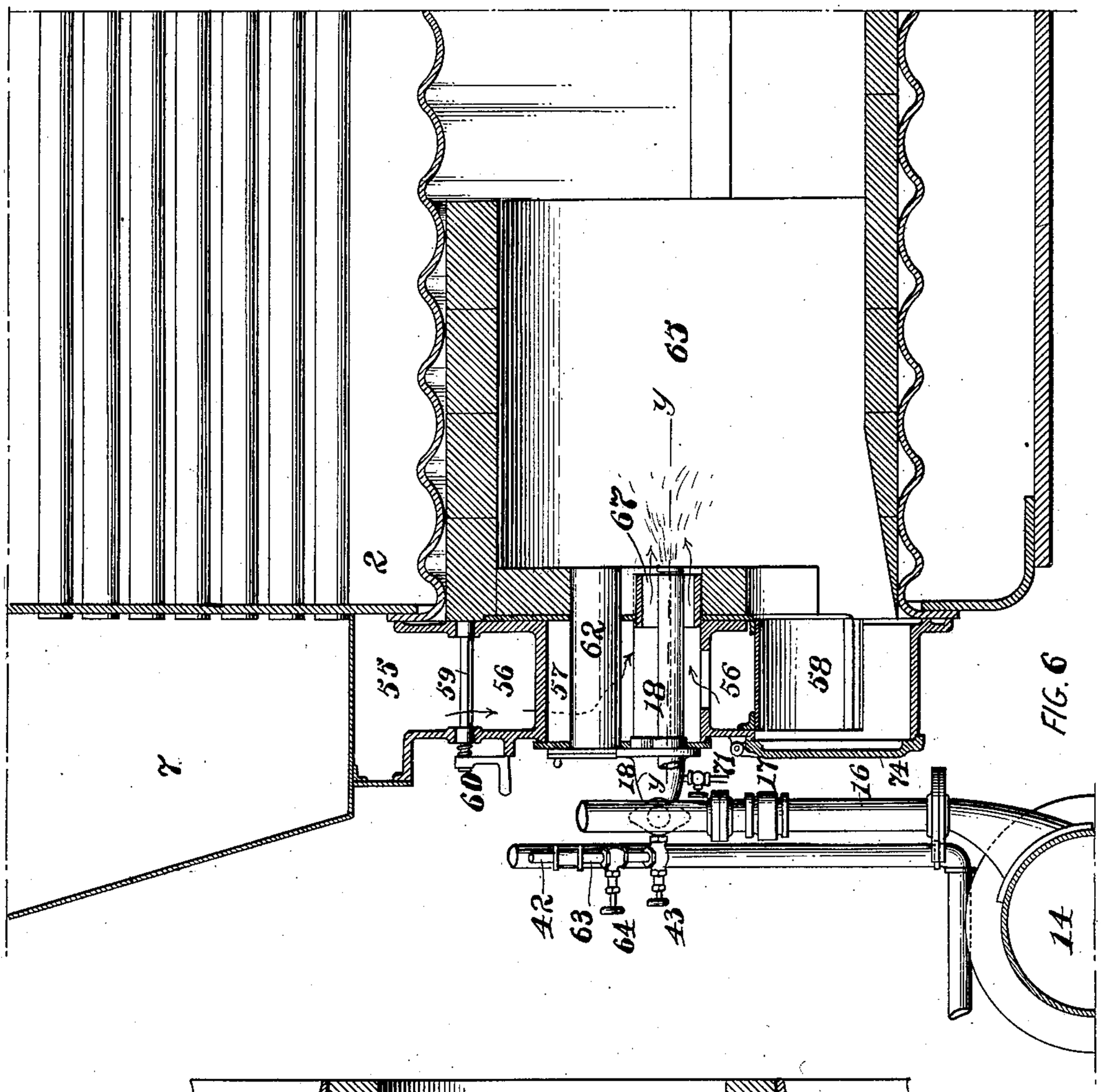

FIG. 6

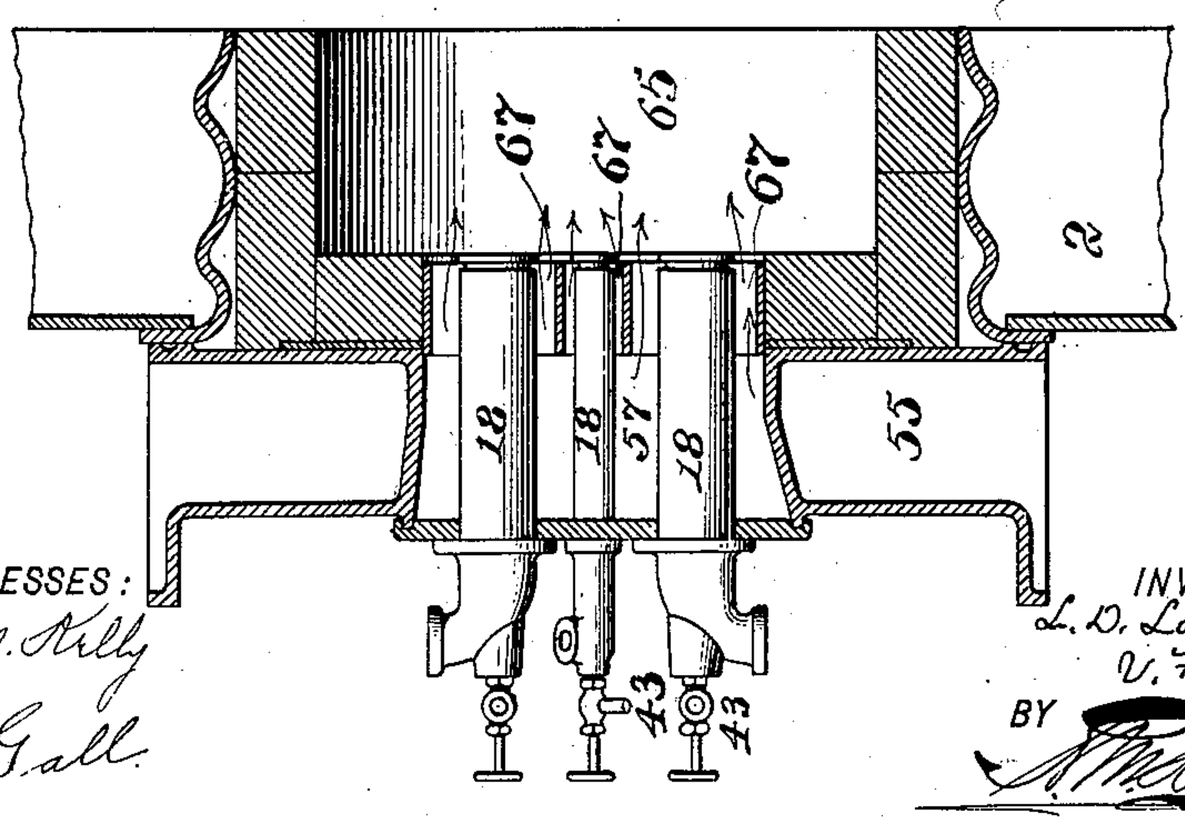

FIG. 7

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NO MODEL. 8 SHEETS—SHEET 7.

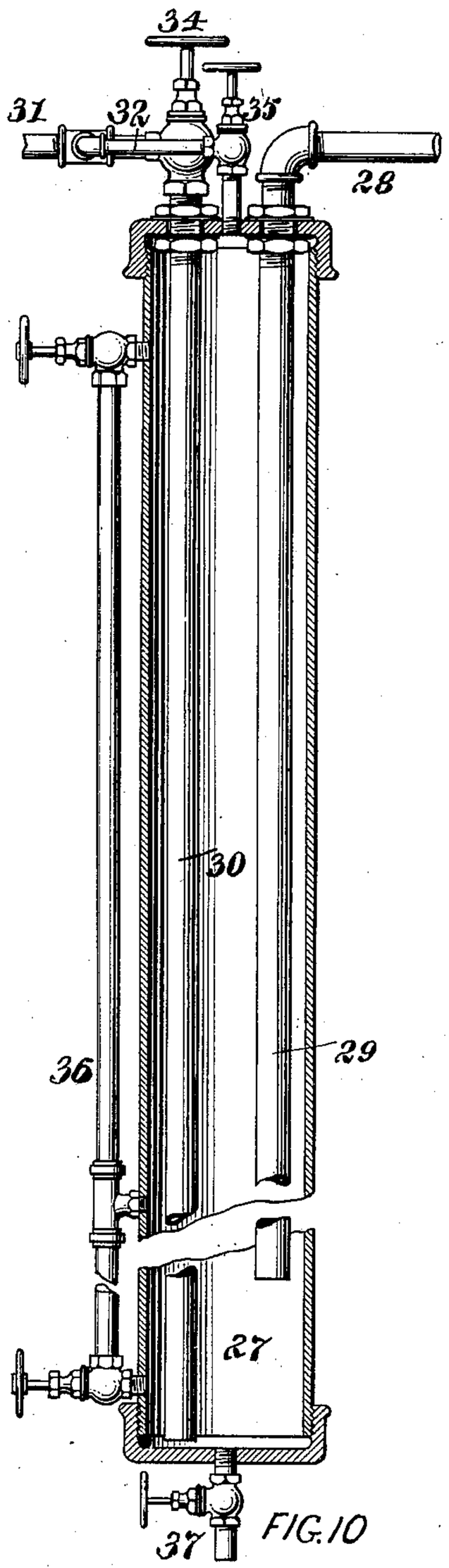

FIG. 10

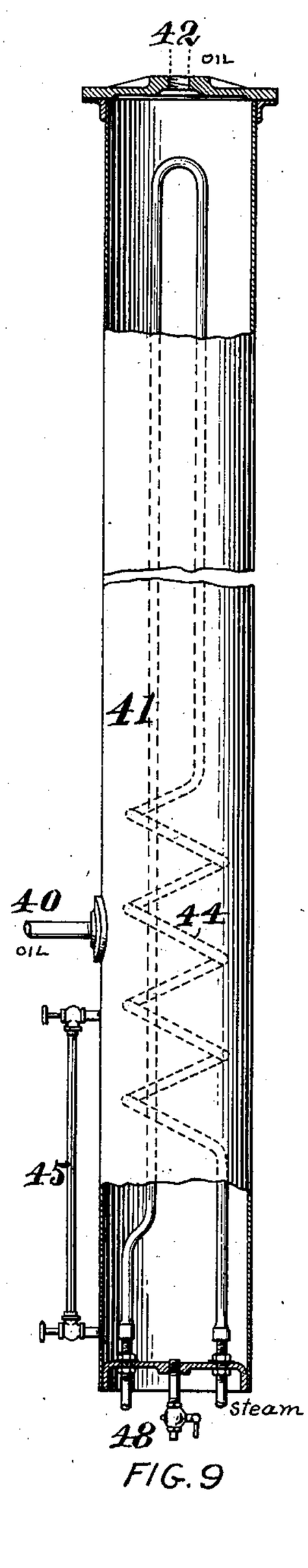

FIG. 9

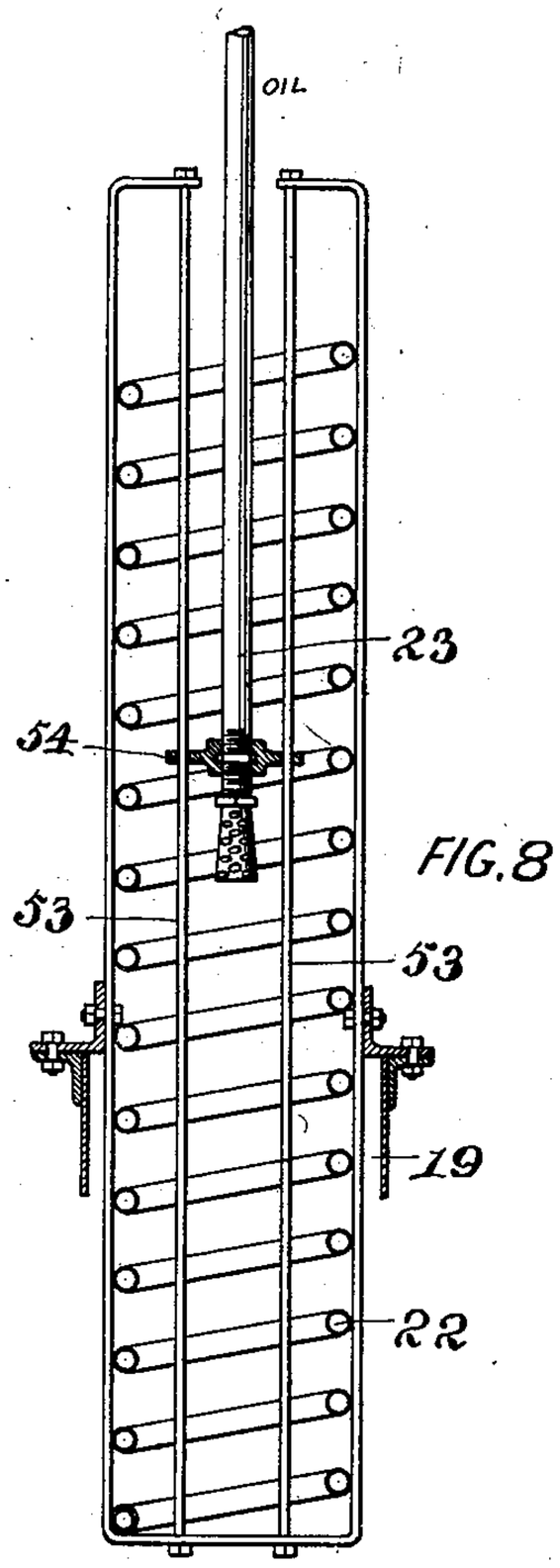

FIG. 8

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SYSTEM FOR BURNING OIL FOR HEATING PURPOSES.

APPLICATION FILED JULY 30, 1902.

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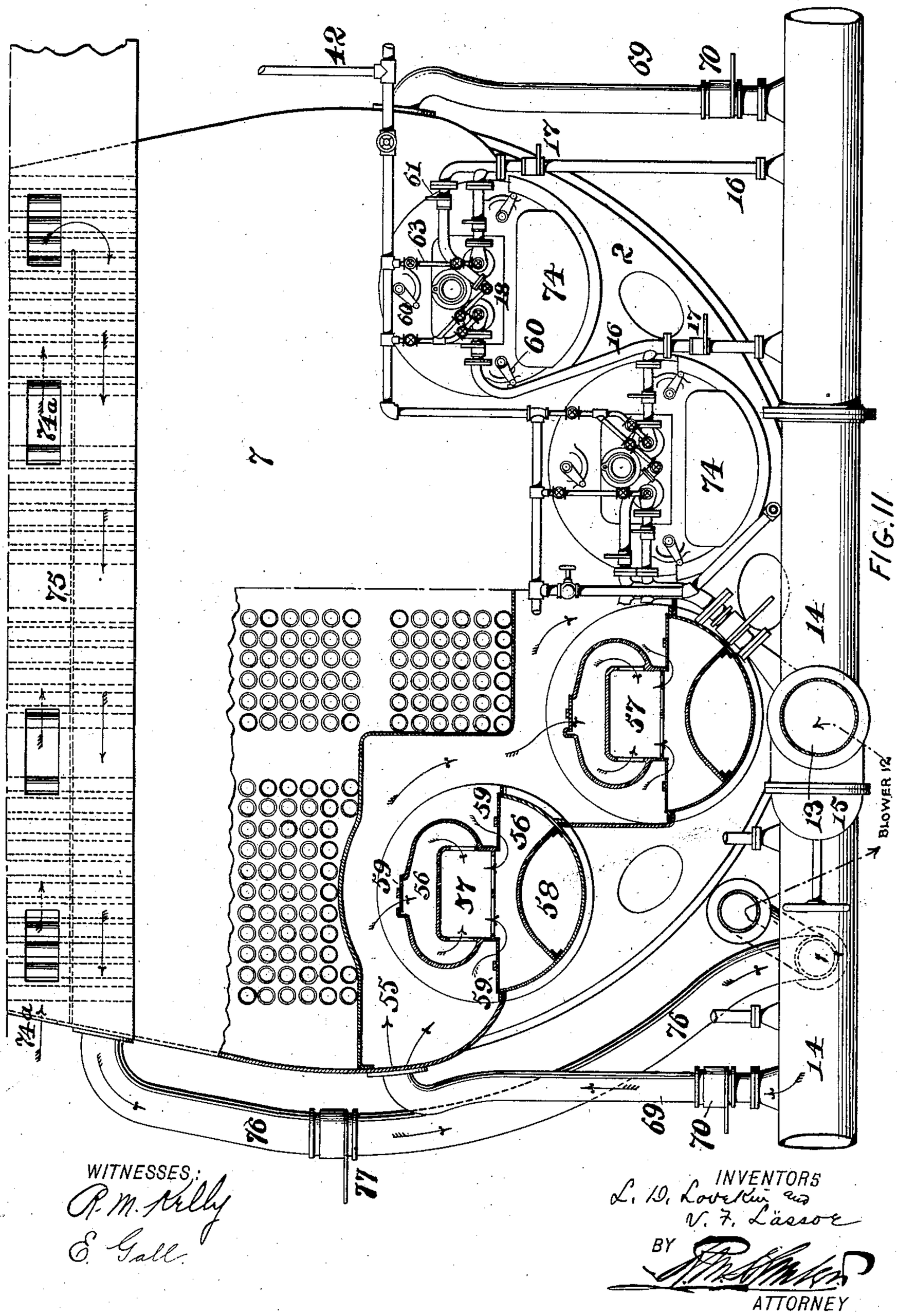

FIG. 11

WITNESSES:
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No. 744,373. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

LUTHER D. LOVEKIN, OF ARDMORE, PENNSYLVANIA, AND VALDEMAR F. LÄSSOE, OF NEW YORK, N. Y.

SYSTEM FOR BURNING OIL FOR HEATING PURPOSES.

SPECIFICATION forming part of Letters Patent No. 744,373, dated November 17, 1903.

Application filed July 30, 1902. Serial No. 117,673. (No model.)

To all whom it may concern:

Be it known that we, LUTHER D. LOVEKIN, of Ardmore, Montgomery county, State of Pennsylvania, and VALDEMAR FREDERIK LÄSSOE, of the city, county, and State of New York, have invented an Improvement in Systems for Burning Oil for Heating Purposes, of which the following is a specification.

Our invention has reference to systems for burning oil for heating purposes; and it consists of certain improvements, all of which are fully set forth in the following specification and shown in the accompanying drawings, forming a part thereof.

The object of our invention is to provide an efficient means and method of burning oil as fuel, especially in connection with steam-boilers, where it is desirable to provide great heating effect without intense concentration, the aim being to furnish a practically even distribution of caloric within the furnaces, so that it may be uniformly absorbed and produce great evaporation without danger of burning the iron of the boiler.

Our invention is more particularly designed for use in steamships, where we have found by practical experience that it is more economical and effective to employ oil in lieu of coal—first, because it is cheaper as a fuel; second, is less in weight per effective heat units, and, third, requires less labor in operating the boilers.

Briefly stated, we employ crude oil and force it under pressure through the burner and from which it is sprayed or atomized by the jet or jets of air under pressure and the resulting mixture burned by an adequate supply of heated air within the furnace-compartment or fire-box.

Our invention in its preferred form comprehends in such a method of burning the oil the following features: an oil-pump for delivering the oil from the oil-bunkers under pressure to the burners, a service-tank for temporarily storing and heating the oil and at the same time separating it from any water that may have been mingled with it, a positive blower which furnishes the necessary air for atomizing the oil, a fan or blower to furnish sufficient air for complete combustion, and a series of burners fitted to the furnaces of the boilers, through which the oil and air supply is regulated, the oil and air being mechanically mixed to insure ignition and the flame distributed in the furnace so as to give the best results. In addition to this organization of parts arrangements are made for heating the oil in the bunker so as to make it flow more readily through the pipes—a feature of importance in cold weather and in case of the oil having too great a viscosity, and this is accomplished by a steam coil or heater adjacent to the suction-pipe of the oil-pump. In order to avoid any water that may have collected at the bottom of the bunker being drawn by the oil-pump, the suction-pipe is provided with a capacity for vertical adjustment for raising or lowering the suction end at will, thereby making it possible always to keep the suction-strainer above the water. In order to prevent waste of the oil by leaking out unobservedly through the steam-coils in the bunker and service-tank to the condenser in case of a leak in said coils, a trap may be installed, which after proper adjustment of the valves only allows the vapor from the exhaust of the coils to pass to the condenser, while the heavier fluids will collect in the trap and be indicated by the gage-glass, the oil being shown floating upon the water. In such a case the water may be drawn off through a pipe leading from the bottom of the trap to the condenser, and the oil after the removal of the water is drained off through a valve at bottom of trap.

The foregoing statement embodies the more essential parts of our invention, and while the use of all are most desirable in the organized apparatus it is not essential that they all shall be so employed.

Our invention also comprehends many details of construction, which, together with the above features, will be better understood by reference to the drawings, in which—

Figure 1 is a transverse section of a ship looking toward the boilers and embodying our invention. Fig. 2 is a similar section, but looking toward the blowers and oil-bunkers. Fig. 3 is a longitudinal section through the center of the ship at its middle and shows the application of our improvements. Fig. 4 is a diagrammatic view corresponding to

Fig. 3, illustrating the various features of our invention. Fig. 5 is a front elevation of one of the boilers, with part of the burner structures in elevation and part in section. Fig. 6 is a longitudinal section of the burners on line $x\,x$ of Fig. 5. Fig. 7 is a sectional plan view of same on line $y\,y$ of Fig. 6. Fig. 8 is a sectional elevation of the heater and suction-pipe of the oil-bunker. Fig. 9 is an elevation of the service-tank with part in section. Fig. 10 is a sectional elevation of the oil-trap; and Fig. 11 is a view similar to Fig. 5, showing the pressure-blowers alone used for handling the air.

2 represents the boilers, which may be of any ordinary construction, having the furnaces or fire-boxes preferably lined at the front and bottom with fire-brick 65, as shown in Fig. 6. The smoke-box 7 for receiving the products of combustion from the boilers connects with the flues 3, leading to the smoke-stack, by heating-tubes 8 within a heater-box 4, through which air is forced by a fan or blower 5. The fan or combustion-blower 5 supplies the necessary air for obtaining complete combustion of the oil in the furnaces and may be of any of the usual types. It draws the hot air from above the boilers, forces it through a duct 6 into the hot-air box 4, in which the temperature of the air is raised by the waste gases from the furnaces passing through tubes 8, and from the hot-air box the air passes through ducts 55 in the smoke-box 7 and through valves 59 to chambers 56 in the furnace-fronts, from where it emerges under pressure into the furnace through annular openings 67, provided around the burners.

By sufficiently increasing the capacity of the positive blower 12 the fan 5 of the heated forced draft system can be entirely dispensed with and the positive blower not only made to furnish the air for atomizing the oil at the burners, but also to supply the air for completing the combustion in the furnace. In this case the hot-air box 4 would receive air by pipe 6 or by openings 74^a, Fig. 11, from the top of the boilers, which will pass, preferably guided by one or more diaphragms 75, between the hot-air tubes 8, through the hot-air box, and then be drawn off by pipe 76, having valve 77 and the blower 12, and discharged under pressure into the air-main 14, from which the burners 18 are supplied with atomizing-air through the tubes 16, led to them, and the furnaces with sufficient air for completing the combustion of the oil through ducts 69, led to the furnace-fronts and having regulating-valves 70, Fig. 11. We prefer, however, to use both the blowers 12 and fan 5.

The oil is normally atomized by air under pressure, and this air may also be received from the box 4 in heated condition. The blower 12 furnishing the air for atomizing the oil may be of any type or design capable of discharging a sufficient quantity of air under pressure high enough to insure satisfactory atomization of the oil when mixed with the air from the blower; but a distinct feature of this system is the connection by pipe 11 of the suction of the blower to the hot-air system, which involves a higher efficiency of the plant—first, on account of the direct saving due to the fact that hot air instead of cold air is blown into the furnaces of the boiler, and, secondly, on account of hot air being a much better atomizer for oil than cold air would be. The discharge 13 of the blower 12 is lead directly to an air-main 14, from which all the burners are fed with air for atomizing purposes. The high-pressure air in heated condition is delivered by pipes 16 and branch pipes (having valves 61) to the burners 18, so that each burner has capacity for independent regulation. Valves 17 in the pipes 16 may be used to regulate or control the supply of air passing through the said pipes 16 and are also useful in case of repair to the burner structures beyond said valves while the boilers are in operation.

The blowers 12 and 5 may be operated by any convenient power, steam-engines being shown in Figs. 2 and 3 for operating the former.

Having now indicated the course and means for controlling the air, we will describe the oil-supply. Briefly stated, the oil is drawn from tank or bunkers 19 by pump 38, forced through a service-tank 41, in which it is heated, and delivered to the burners 18 by pipe 42 and branch pipes 63, provided with independent valves 64. This part of the apparatus embodies novel features in the suction devices in the service-tank to adapt them to handle oil of viscous nature, whether from cold or natural density and also when admixed with more or less water. These features we will now refer to.

The suction-pipe 23 and its strainer in the oil-bunker 19 are adapted to be raised or lowered, so as to keep the nozzle or strainer out of the water which may have settled in the bottom of the bunker or tank, but still be able to draw out all the oil from the bunker. A bracket fastened conveniently in the bunker has two vertical rods 53, which serve to guide the suction-nozzle 23 vertically in the center of the heating-coil 22, this being accomplished by a fitting 54, screwed to the end of the suction-pipe and having holes adapted to the guide-rods. To enable the raising and lowering of the suction strainer and pipe 23, the pipe 24, leading to the upper end of suction-pipe 23, is hinged to the suction-pipe at one end and to the fixed pipe 39 at the other. A chain 25, fastened to the vertical suction-pipe, is run over pulleys to the fire-room 25, from where the adjustment of the height of the suction-nozzle may take place according to soundings taken to determine the level of the oil in the bunker. To insure the oil being maintained in fluid condition and adapted to flow freely to the suction-strainer when not

normally of that character, we would surround the suction-pipe by a vertical coil of steam-pipe 22, steam thereto being supplied by a pipe 26 and the waste steam and water of condensation being carried away by a pipe 28, leading to the condenser after passing through a steam-trap 27. The trap 27, installed in the exhaust-steam line 28 from the heating-coil 22 in the bunker, consists of a closed vessel fitted on the side with a gage-glass 36 to show the contents of the trap. The exhaust-steam pipe 28 from the coils 22 is led through the top of the trap, reaching to within eight to twelve inches of its bottom, and through this pipe 29 the drain fluids from the coils, which in case of a leak in the coils would contain water and oil, are admitted to the trap. Another pipe 31, connected to the condenser (not shown) and having a valve 34, is fitted near the top of the trap with a pipe 30, which is run almost clear down to the bottom of the trap, and a by-pass connection 32 is provided, having a valve 35 and extending from the top of the trap to the pipe 31, leading to the condenser. Ordinarily the small by-pass valve 35 is kept open, so as to allow the vapor from the exhaust to pass to the condenser, while the heavier fluids, in case of a leak being water and oil, will be collected in the trap and show in the glass 36. By opening the large valve 34 and closing the small one 35 on top of the trap the water by its greater density will settle at the bottom and may be drawn off by the action of the vacuum of the condenser. When the water is all removed, the valves 34 and 35 on the top are both closed, and then the oil can be drained off through the drain-cock 37, fitted in the bottom of the trap. A by-pass 32^a, having a valve 35^a, Fig. 4, may also be provided to cut the trap 27 out of action, this result being accomplished by closing the valves 33 and 34. The use of this by-pass would take place when it was desired to draw off the oil from the trap without stopping the circulation of steam in the heating-coils 22.

The service-tank 41 is pressure-tight and fitted with a gage-glass 45 near the bottom to show the contents of the tank, a connection 40 near the center of the tank for receiving the oil from the oil-pump 38, a connection 42 on top for delivering the oil to the burners, a drain-cock 48 in bottom of tank, and a steam-coil 44 for heating the oil and allowing it to separate from the water. By this means the oil sucked from the oil-bunker through pipe 39 is forced by the pump 38 through pipe 40 into the middle of the tank 41, so as to be above any water that might collect. The oil already somewhat heated is still further heated to about 160° Fahrenheit by the steam-coil 44 and then forced under a pressure of about fifteen pounds per square inch through the oil-supply pipe 42 to the burners, where it is atomized by the air-jets of about one and one-half pounds pressure.

69 is a relief-valve in a by-pass about the pump 38 between its suction-pipe 39 and discharge-pipe 40, the function of which is to enable the pump to run continuously and maintain a constant pressure in the service-tank 41. All excess of oil pumped will automatically return to the suction side of the pump.

It being practically impossible to avoid some water finding its way into the oil-bunkers 19 and some oil and water leaking into the coffer-dam 20, we provide suction-pipes 51 and 50, Fig. 3, respectively, for these chambers, by which to draw off the water from below the oil in the bunker 19 and the water and oil from the coffer-dam. This bilge-water from the bunker thus collected may be pumped overboard through pipe 72, Fig. 2, by one of the pumps 38 (of which there are preferably two) by simply opening the proper valve 52, Fig. 2. The oil and water sucked from the coffer-dam may be delivered to the trap and the oil thus separated.

46, Fig. 3, is a donkey-boiler and is supplied with the oil under pressure by pipe 47, leading from the service-tank 41. This donkey-boiler is used to supply steam for the donkey-engines and other devices when the main boilers 2 are not under steam-pressure, and hence resort may be had to this boiler 46 to supply steam to the engines to run the pumps, blowers, and fan and to heat the oil in the initial steps of firing the main boilers. It is a convenience rather than an essential to our invention, because, if desired, the initial steam may be had from one of the main boilers by heating it with its own furnace.

The burners 18 are principally constructed to give the best results when using air for atomizing the oil; but arrangements are preferably made on the burners so that steam may be immediately used in place of the atomizing-air in case the blower should break down. When steam is used, it may be supplied by a valved pipe 71 (indicated in Fig. 6) or by pipe 73, Fig. 1, into main 14, and thence by pipes 16 to the burners. In this case the steam is relied upon in the well-known manner to spray the oil by direct action upon the said oil at its nozzle. Ordinarily the oil under the pressure of fifteen pounds is forced through the burner-nozzle and meets a jet or jets of air under high pressure, with the result that it is instantly atomized and then burned with the heated air from the fan 5. We have not shown these burners in detail, as their specific construction is not claimed in this application, they forming subject-matter of other applications.

In starting the fires in the boilers 2 it is only necessary to insert a piece of oily waste through the valved opening 62 in the furnace-front, having previously opened the dampers 74 in the projection of the furnace-front. This causes the oil from the burners to ignite and burn. The oil in the service-tank being under the proper pressure, the blowers 12 and fan 5 are put into operation. If the fan is in

operation, the dampers 74 should be closed. The oil and air are first admitted slowly and carefully and gradually increased until the full flame is secured, after which it is readily maintained.

The openings 62 in the burners may be used for sight-holes when it is desired to observe the nature of the combustion. The openings 58 in the lower part of the furnace-fronts provide access for a workman when necessary and for cleaning out the furnaces when required in addition to admitting air in the initial step of firing the boiler.

While we prefer the construction shown as having been found excellently adapted for carrying our invention into practice, nevertheless we do not confine ourselves to the details thereof, as they may be modified in various ways without departing from the spirit of the invention.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, an air-tight service-tank normally completely filled with oil and water and containing means for heating the oil within it without vaporizing the oil, a positively-acting device such as a pump to suck the oil from the reservoir and force it under pressure into the service-tank at a point below its top so as to deliver the incoming oil into the body of oil in the tank intermediate of its top and bottom portions, a suction-pipe leading from the reservoir to the pump, a discharge-pipe from the pump to the service-tank opening into the tank intermediate of its top and bottom, and an oil-pipe from the upper part of the service-tank to the burner to deliver the oil to the burner under pressure to spray it.

2. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, air-tight service-tank having means to heat the oil within it, a pump to suck the oil from the reservoir and force it into the service-tank below the top, a suction-pipe leading from the reservoir to the pump, a discharge-pipe from the pump to the service-tank, a by-pass around the pump connecting the suction and discharge pipes and containing a relief-valve, and an oil-pipe from the upper part of the service-tank to the burner.

3. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, an air-tight service-tank having means to heat the oil within it, a pump to suck the oil from the reservoir and force it into the service-tank under pressure, a suction-pipe leading from the reservoir to the pump having an adjustable suction end, means to raise or lower and support the suction end of the oil-pipe in the oil, a discharge-pipe from the pump to the service-tank, and an oil-pipe from the upper part of the service-tank to the burner to supply it with oil under pressure.

4. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, a service-tank having means to heat the oil within it, a pump to suck the oil from the reservoir and force it into the service-tank, a suction-pipe leading from the reservoir to the pump having an adjustable suction end adapted to be raised or lowered in the oil to assume different suction-levels, a heater adjacent to the suction end of the suction-pipe to heat the oil and render it fluid, a discharge-pipe from the pump to the service-tank, and an oil-pipe from the service-tank to the burner.

5. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, a service-tank having means to heat the oil within it, a pump to suck the oil from the reservoir and force it into the service-tank, a suction-pipe leading from the reservoir to the pump, a heater adjacent to the suction end of the suction-pipe within the body of oil in the reservoir, a discharge-pipe from the pump to the service-tank, and an oil-pipe from the upper part of the service-tank to the burner.

6. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, a pump to suck the oil from the reservoir and force it into the burner, a suction-pipe leading from the reservoir to the pump, a vertical section of suction-pipe having a strainer at the bottom, a hinged section of pipe hinged at one end to the top of the vertical section of suction-pipe and at the other end to the suction-pipe connecting with the pump, means leading to a distance for raising or lowering the vertical section of suction-pipe.

7. In apparatus for supplying and burning oil as fuel, the combination of a burner, a blower for supplying air to the burner under pressure to atomize the oil, an oil-reservoir, a pump to suck the oil from the reservoir and force it into the burner, a suction-pipe leading from the reservoir to the pump, a vertical section of suction-pipe having a strainer at the bottom, a hinged section of pipe hinged at one end to the top of the vertical section of suction-pipe and at the other end to the suction-pipe connecting with the pump, and means leading to a distance for raising or lowering the vertical section of suction-pipe, a heating steam-coil surrounding the vertical section of suction-pipe within the oil-reservoir.

8. In an apparatus for supplying and burning oil as fuel, the combination of a burner, an oil-reservoir, a pump to suck the oil from

the reservoir and force it into the burner, a suction-pipe leading from the reservoir to the pump, a steam-coil heater adjacent to the suction end of the suction-pipe within the body of oil, an oil-trap, a pipe leading from the steam-coil to the trap, a discharge suction-pipe leading from the trap to draw off the water, and a by-pass to cut the oil-trap out of action when drawing off the oil.

9. In apparatus for supplying and burning oil as fuel, the combination of a burner, an air-heater, a fan or blower to force air into the heater, a duct for leading a portion of the heated air from the heater to the burner for combustion purposes, a pump for forcing oil under pressure to and through the burner, a steam-heated tank for heating the oil prior to its entering the burner and after leaving the pump, and a pressure-blower for drawing a portion of the air from the heater and forcing it into the burner to spray the oil.

10. In apparatus for supplying and burning oil as fuel, the combination of a boiler, a burner to heat the boiler, a smoke-box, an air-heater in the smoke-box, a fan or blower to force air into the heater, a duct for leading a portion of the heated air from the heater to the burner for combustion purposes, a pump for forcing oil under pressure to and through the burner, a steam-heated tank for heating the oil prior to its entering the burner and after leaving the pump, and a pressure-blower independent of the fan or blower first mentioned for drawing a portion of the air from the heater and forcing it into the burner to spray the oil.

11. The combination of a burner, an oil-reservoir, a service-tank to contain a solid body of oil consisting of an air-tight tank having steam heating-coils to heat the oil within the tank, means for forcing oil from the reservoir into the tank below its upper part so as to keep it filled with fluid oil, a pipe extending from the extreme upper part of the service-tank to the burner and continually filled with oil, and means for supplying air to the burner.

12. The combination of a burner, an oil-reservoir, a service-tank to contain a solid body of oil consisting of an air-tight tank having steam heating-coils to heat the oil within the tank, a gage on the lower part of the tank to indicate the presence of oil and water within the tank, means for forcing oil from the reservoir into the tank below its upper part so as to keep it filled with fluid oil, a pipe extending from the extreme upper part of the service-tank to the burner and continually filled with oil, and means for supplying air to the burner.

13. The combination of a boiler, a burner therefor, an oil reservoir or bunker, a suction-pipe extending to the lower part of the reservoir or bunker, a pump to suck the oil from the suction-pipe and force it into the burner, a steam-heater for heating the oil arranged adjacent to the suction-pipe within the reservoir or bunker, an oil-trap into which the discharge-pipe of the steam-heater enters, an exhaust suction-pipe from the trap both near the bottom and top respectively, and valves to control the suction from either the top or bottom at will to enable the water to be drawn off at intervals.

14. The combination of a boiler, a burner therefor, an oil reservoir or bunker, a suction-pipe extending to the lower part of the reservoir or bunker, a pump to suck the oil from the suction-pipe and force it into the burner, a steam-heater for heating the oil arranged adjacent to the suction-pipe within the reservoir or bunker, an oil-trap into which the discharge-pipe of the steam-heater enters, an exhaust suction-pipe from the trap both near its bottom and top respectively, valves to control the suction from either the top or bottom at will to enable the water to be drawn off at intervals, and a by-pass about the trap also having a valve and adapted for use when the trap is completely shut off for purpose of drawing the oil therefrom.

15. The combination of a burner, an oil-reservoir, an oil-pump for forcing oil to the burner, a jointed suction-pipe extending from the pump into the oil-reservoir, hand-controlled means to elevate and lower the end section of the jointed suction-pipe, vertical guides within the oil-reservoir, and means connected to the suction-pipe guided upon the guide-rods.

16. The combination of a burner, an oil-reservoir, an oil-pump for forcing oil to the burner, a jointed suction-pipe extending from the pump into the oil-reservoir, means to elevate and lower the end section of the jointed suction-pipe, vertical guides within the oil-reservoir, means connected to the suction-pipe guided upon the guide-rods, and a steam heater-coil extending around the end section of the suction-pipe and extending to near the bottom of the reservoir.

17. The combination of a boiler, a burner therefor, an oil-reservoir, a pump to force oil from the reservoir to the burner, and a service-tank kept continually filled with fluid oil and through which the oil is forced on its way to the burner consisting of a closed tank having an oil-supply at or about its middle part, a discharge at its top, a gage at its lower part below the oil-supply, a steam heating-coil within the tank, and means to draw water from the bottom of the tank when the same separates from the oil and is collected within the tank.

In testimony of which invention we have hereunto set our hands.

LUTHER D. LOVEKIN.
VALDEMAR F. LÄSSOE.

Witnesses:
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R. M. KELLY.