

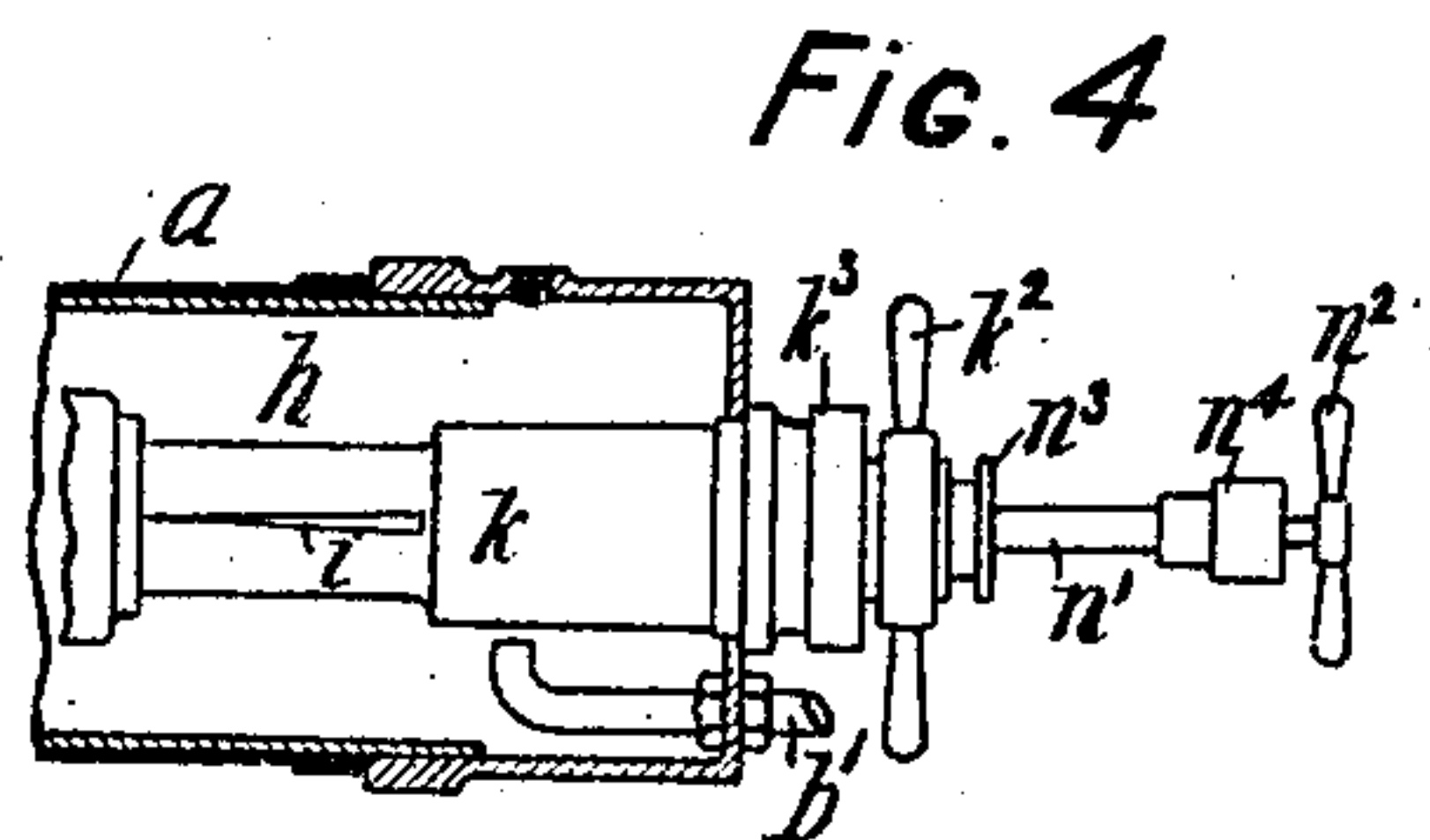
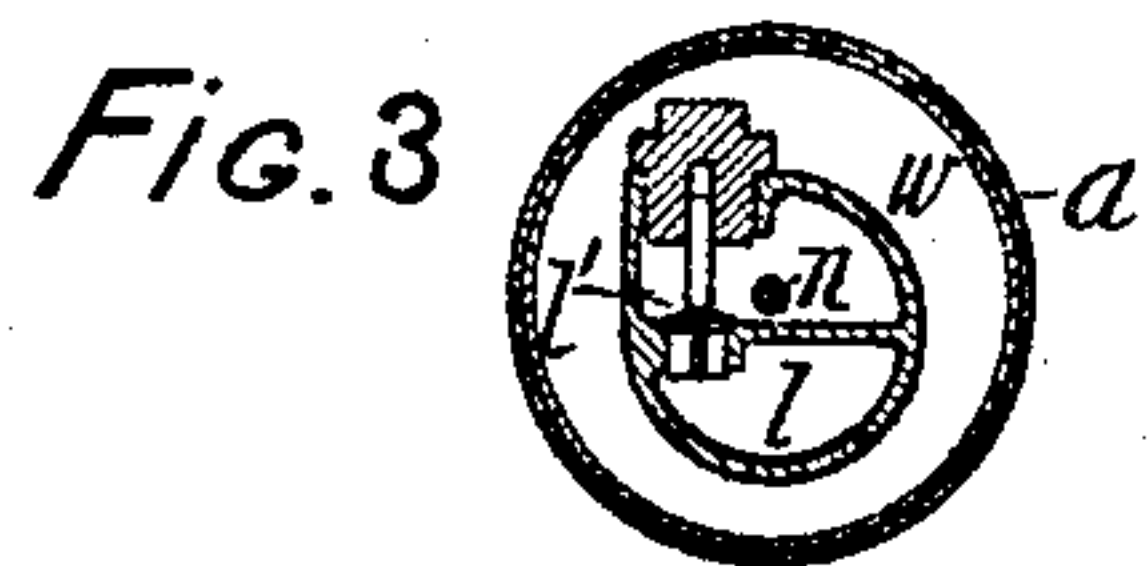
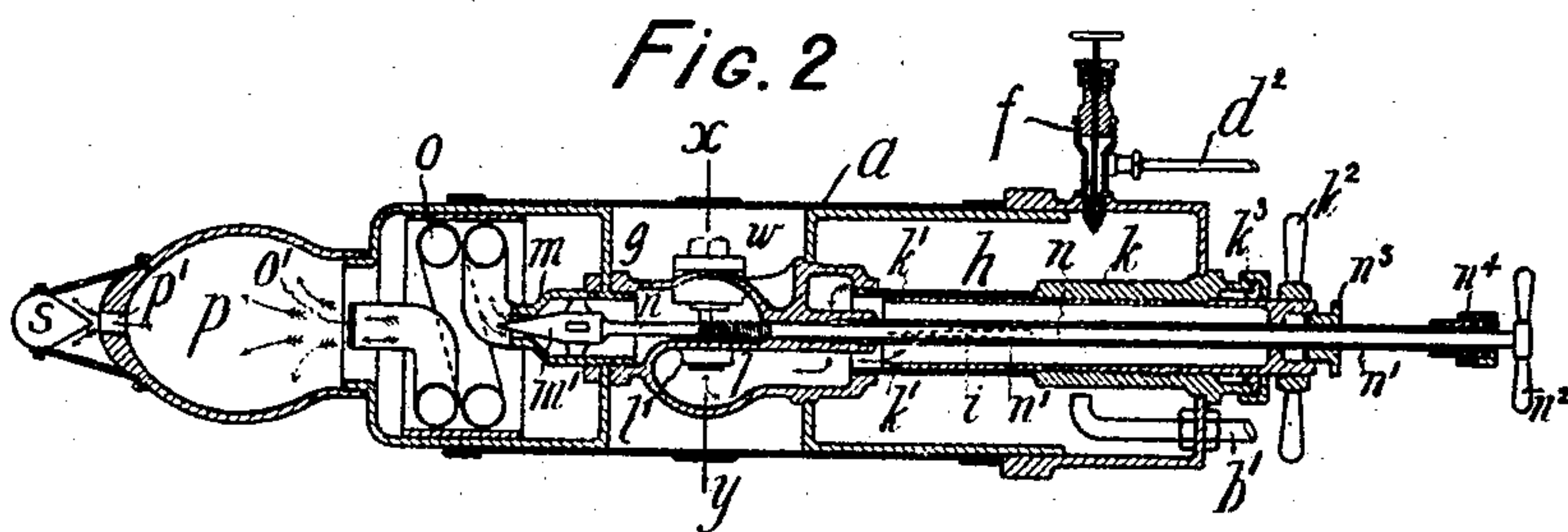
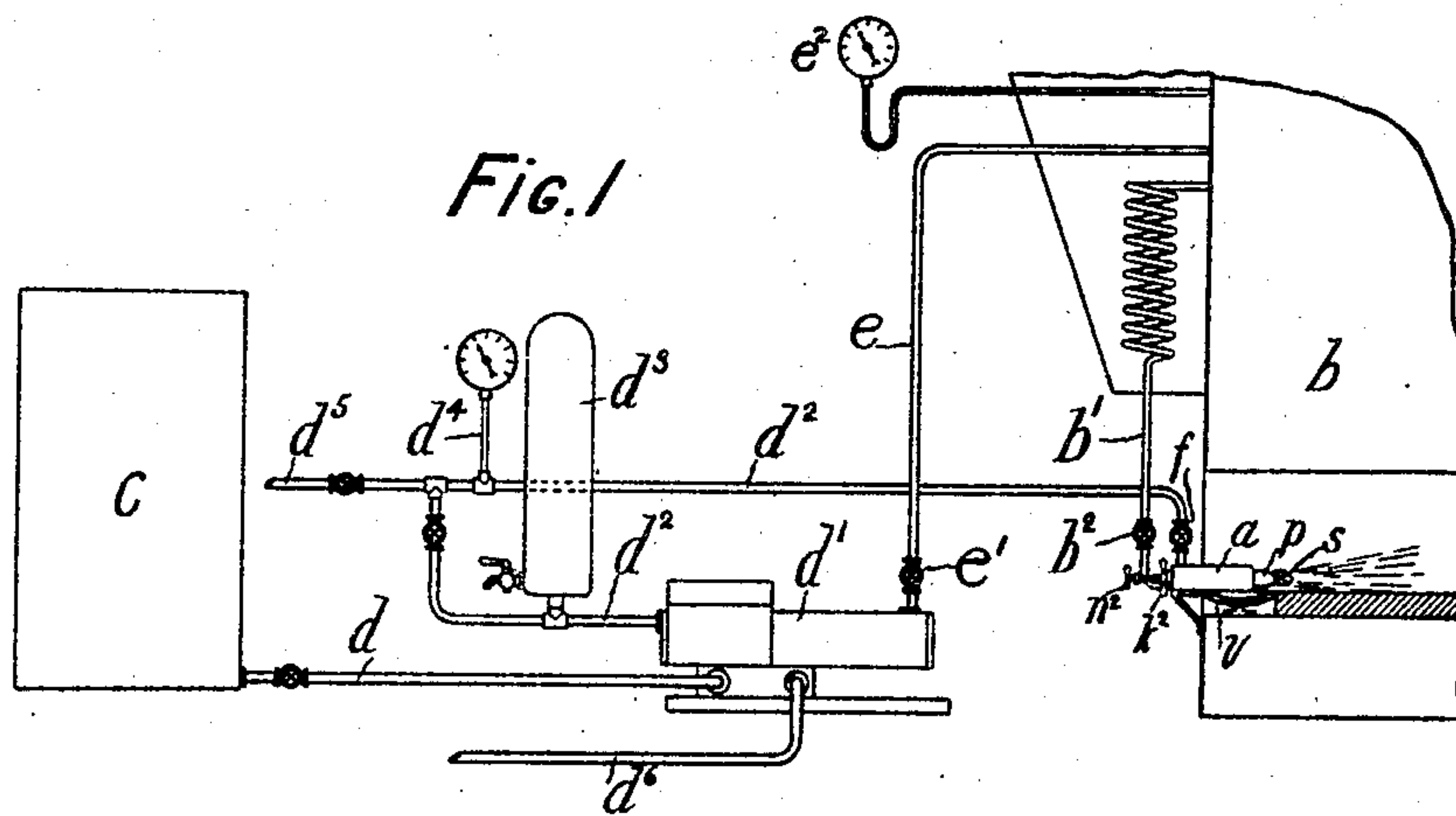
No. 844,004.

PATENTED FEB. 12, 1907.

F. COTTON.

APPARATUS FOR BURNING LIQUID FUEL IN CONJUNCTION WITH STEAM.

APPLICATION FILED MAY 12, 1906. RENEWED JAN. 5, 1907.



**WITNESSES.**

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# UNITED STATES PATENT OFFICE.

FRANK COTTON, OF HORNSBY, NEW SOUTH WALES, AUSTRALIA.

APPARATUS FOR BURNING LIQUID FUEL IN CONJUNCTION WITH STEAM.

No. 844,004.

Specification of Letters Patent.

Patented Feb. 12, 1907.

Application filed May 12, 1905. Renewed January 5, 1907. Serial No. 351,018.

*To all whom it may concern:*

Be it known that I, FRANK COTTON, of Hornsby, in the State of New South Wales, in the Commonwealth of Australia, engineer, have invented an Improved Apparatus for Burning Liquid Fuel in Conjunction with Steam, of which the following is a specification.

My invention relates to an improved apparatus for burning liquid fuel in conjunction with steam.

This invention relates to an apparatus for burning liquid fuel, such as the residuum of petroleum and other liquids of like nature, in conjunction with superheated steam.

The apparatus may be used in connection with steam-boiler or smelting furnaces or any other furnace in which great heat is required.

The essentials in a successful liquid-fuel burner of this class are, first, means for introducing the oil and steam into the mixing-chamber of the burner at the same pressure; second, perfect control of the relative quantities of steam and oil admitted into the burner; third, means for perfectly controlling (a) the emission of emulsion from the mixing-chamber, and (b) the admission of same into the retort; fourth, means for vaporizing the emulsion after it leaves the mixing-chamber and prior to its emission from the burner.

The object of this invention is to provide an apparatus for burning liquid fuel in conjunction with steam which will be capable of perfect control and which will generate a vapor or gas which may be readily burned in any furnace without smoke.

In order to enable others skilled in the art to which this invention pertains to make and use the same, I will now proceed to describe it, referring to the accompanying drawings, in which—

Figure 1 represents diagrammatically the complete apparatus, showing the burner in position in the furnace of a steam-boiler. Fig. 2 is a longitudinal section of the burner. Fig. 3 is a cross-section through line *x y*, Fig. 2. Fig. 4 is a section showing the mixing-chamber of burner with the central controlling tubes in elevation.

In Fig. 1, (which shows the method of introducing the steam and oil into the burner so that the pressure at which the oil is admitted is automatically maintained the same as the steam in the boiler,) *a* is the burner placed in

position in the furnace of a steam-boiler *b*. Steam which has been previously superheated by means of a coil in the smoke-box of the boiler or by any other suitable convenient means is admitted into the burner through the pipe *b'*. *b<sup>2</sup>* is controlling-valve. *c* is the oil or other liquid-fuel reservoir, which is connected, by means of a suction-pipe *d*, to a horizontal pump *d'*. The pump may be of any suitable design. *d<sup>2</sup>* is oil-delivery pipe from pump. *d<sup>3</sup>* is an air vessel in oil-delivery pipe, (hereinafter called the "accumulator.") *d<sup>4</sup>* is a pressure-gage in oil-delivery pipe. *d<sup>5</sup>* is overflow-pipe provided for the purpose of emptying the accumulator and delivery-pipe. *d<sup>6</sup>* is steam-exhaust pipe. The suction and delivery pipes are provided with proper controlling-valves, as shown. *e* is steam-supply pipe to pump *d'*, and *e'* is controlling-valve therein. *e<sup>2</sup>* is boiler-pressure gage. *v* is a dished metal stand on which the burner is supported in the furnace. This stand is attached to the front plate of the furnace and projects within the fire-box. The portion within the fire-box is dished and adapted to hold kerosene or other inflammable oil and is provided for the purpose of heating the coil and retort prior to starting the apparatus.

When considered more convenient, the preliminary heating of the retort may be accomplished by the substitution for the kerosene dish of one or more jets of gas.

In Figs. 2, 3, and 4, which show the details of the burner, *f* is the controlling-valve for the inlet of oil to the burner, and *b'* is the steam-inlet with its controlling-valve *b<sup>2</sup>*, Fig. 1.

The burner is subdivided into four compartments, namely:

First. The mixing-chamber *h*, into which the oil or other liquid fuel and superheated steam are admitted.

Second. An insulated valve-chamber *l*, containing a check-valve *l'*.

Third. A heating-coil *o*, and, fourth, a retort *p*. *k* is a centrally-placed fixed tube within the mixing-chamber *h*. This tube is screwed or otherwise attached at its forward end to the valve-chamber *l*, while its free end passes through the end of the mixing-chamber. *i i* are a pair of tapered slots cut in the tube *k*, one on each side. *k'* is a sleeve fitting within the tube *k*. This sleeve is partially screw-threaded and engages corresponding threads within the tube *k* and is thus adapted to be moved backward or forward by



means of the wheel or handle  $k^3$ .  $k^3$  is stuffing-box on the end of tube  $k$ .

The emulsion formed by the admixture of steam and oil within the mixing-chamber  $h$  passes through the slots  $i i$  into the valve-chamber  $l$ , the area of these apertures being controlled by the position of the sleeve  $k'$ . In the drawings the slots  $i i$  are shown completely closed by the sleeve  $k'$ . The forward end of the valve-chamber  $l$ , containing the check-valve  $l'$ , passes through the diaphragm  $g$  and terminates in a nozzle  $m$ , while the rearward end of the valve-chamber projects into the mixing-chamber  $h$ . The emulsion after passing through the slots  $i i$  into the valve-chamber then passes through the check-valve  $l'$  and thence through the nozzle  $m$  into the heating-coil  $o$ , from which it passes through the perforated plate  $o'$  into the retort  $p$ , and finally escapes through the aperture  $p'$  into the furnace.

$w$  is insulating material, such as asbestos or the like, surrounding the valve-chamber.

The aperture in the nozzle  $m$  is controlled by a spear-valve  $m'$ , which is operated by means of a longitudinal spindle  $n$ , which passes through a fixed tube  $n'$  to the rear of the burner. The spear-valve and spindle is adapted to be operated in a similar manner to the sleeve  $k'$ —that is to say, by having a portion of the spindle  $n$  screw-threaded and engaging corresponding threads in its containing-tube  $n'$ , so that by revolving the spindle by means of the wheel or handle  $n^2$  the valve will be moved either backward or forward, as desired. The tube  $n'$  is provided with suitable stuffing-boxes  $n^3$  and  $n^4$ . The coil  $o$ , into which the emulsion passes from the nozzle  $m$ , is for the sake of space shown in the drawings with only two turns; but in practice it may be extended to any desired length and may be carried on the outside of the burner-casing and returned to the position shown, the object being to give the emulsion time to get heated before reaching the retort  $p$ , where it is converted into a gas.

$s$  is a cone-shaped spreader or lighter which is placed in front of the retort-aperture  $p'$  at any desired distance therefrom. This spreader or lighter may be of any suitable material, such as fire-clay, compressed carbon, or the like. The object of this spreader is that the vapor or gas escaping from the nozzle may be lighted and kept alight as near the outlet as possible.

The operation of the apparatus is as follows: The dished metal stand  $v$ , on which the burner is supported in the furnace, is filled with kerosene or other inflammable oil, which is lighted, and the coil  $o$ , retort  $p$ , and spreader  $s$  allowed to become thoroughly heated. Steam is now turned onto the pump  $d'$  and oil pumped from the oil-reservoir  $c$  into the accumulator  $d^3$  until the pressure therein, as indicated by the gage  $d^4$ , corre-

sponds with the steam-boiler gage  $e^2$ . The valves  $b^2$  and  $f$  are now opened to admit, respectively, steam and oil into the burner  $a$ . The steam-valve  $e'$ , admitting steam to the pump  $d'$  is now adjusted so that the pump will automatically maintain the oil-pressure equal to the boiler steam-pressure. The relative quantities of oil and superheated steam admitted into the mixing-chamber are controlled by manipulating the valves  $f$  and  $b^2$ , while the quantity of emulsion passing through the heating-coil to the retort is regulated and controlled by the sleeve  $k'$  and the valve  $m'$ . As the emulsion passes through the coil  $o$  its temperature is gradually raised, so that when it escapes into the retort  $p$  through the perforated disk  $o'$  it is at once vaporized and passes through the aperture  $p'$  in the form of gas, which lights and burns with an intensely hot flame and without smoke. The independent heater  $v$  underlying the burner in the furnace may be kept alight until the reflected heat from the furnace is sufficiently intense to maintain the temperature of the retort  $p$  at from  $800^\circ$  to  $1,000^\circ$  Fahrenheit.

Having now fully described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare what I claim is—

1. An apparatus for burning liquid fuel in conjunction with steam, having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, and means for the admission of steam and oil into the mixing-chamber.

2. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, and a valve controlling the means of communication between the valve-chamber and heating-coil.

3. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling



the means of communication between the valve-chamber and heating-coil, and a spreader opposed to the outlet of the retort.

4. An apparatus for burning liquid fuel in conjunction with steam, having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, in combination with means for introducing steam into the mixing-chamber and other means for introducing oil into the mixing-chamber at the same pressure as the steam.

5. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil, in combination with means for introducing steam into the mixing-chamber and other means for introducing oil into the mixing-chamber at the same pressure as the steam.

6. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil, a spreader opposed to the outlet of the retort, in combination with means for introducing steam into the mixing-chamber, and other means for introducing oil into the mixing-chamber at the same pressure as the steam.

7. An apparatus for burning liquid fuel in conjunction with steam, having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, means for the admission of steam and oil into the mixing-chamber, and auxiliary means for heating the coil and retort.

8. An apparatus for burning liquid fuel in conjunction with steam having a burner com-

prising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil, and auxiliary means for heating the coil and retort.

9. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil and a spreader opposed to the outlet of the retort, and auxiliary means for heating the coil and retort.

10. An apparatus for burning liquid fuel in conjunction with steam, having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, in combination with means for introducing steam into the mixing-chamber, other means for introducing oil into the mixing-chamber at the same pressure as the steam, and auxiliary means for heating the coil and retort.

11. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments namely, a mixing-chamber with inlets for the steam and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil, in combination with means for introducing steam into the mixing-chamber other means for introducing oil into the mixing-chamber at the same pressure as the steam, and auxiliary means for heating the coil and retort.

12. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising a tubular shell divided into four intercommunicating compartments, namely, a mixing-chamber with inlets for the steam



and oil, an insulated valve-chamber, a heating-coil, and a retort having an outlet for the emulsion, a regulating-valve for controlling the means of communication between the mixing and valve chambers, a check-valve for the valve-chamber, a valve controlling the means of communication between the valve-chamber and heating-coil, a spreader opposed to the outlet of the retort, in combination with means for introducing steam into the mixing-chamber, other means for introducing oil into the mixing-chamber at the same pressure as the steam, and auxiliary means for heating the coil and retort.

13. An apparatus for burning liquid fuel in conjunction with steam having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, in combination with means for introducing steam into the mixing-chamber, and other means for introducing oil into the mixing-chamber at the same pressure as the steam, consisting of an

oil-reservoir, a pump connected therewith and an accumulator connected with the pump and oil-inlet of the mixing-chamber.

14. An apparatus for burning liquid fuel in conjunction with steam, having a burner comprising four compartments namely, a mixing-chamber, an insulated valve-chamber containing a check-valve, a heating-coil, a retort, a controlling-valve for regulating the supply of emulsion from the mixing-chamber, a valve for regulating and spraying the emulsion into the heating-coil, in combination with means for introducing steam into the mixing-chamber, and other means for introducing oil into the mixing-chamber at the same pressure as the steam, consisting of an oil-reservoir, a pump connected therewith and an accumulator connected with the pump and oil-inlet of the mixing-chamber, and auxiliary means for heating the coil and retort.

Signed at Sydney, New South Wales, this 23d day of March, 1905.

FRANK COTTON.

Witnesses:

WALTER SIGMOND,  
ARTHUR GRIFFITH.