No. 698,354. Patented Apr. 22, 1902.

G. L. BADGER.

METHOD OF BURNING OIL.

(Application filed Aug. 2, 1900.)

(No Model.) 3 Sheets—Sheet 1.

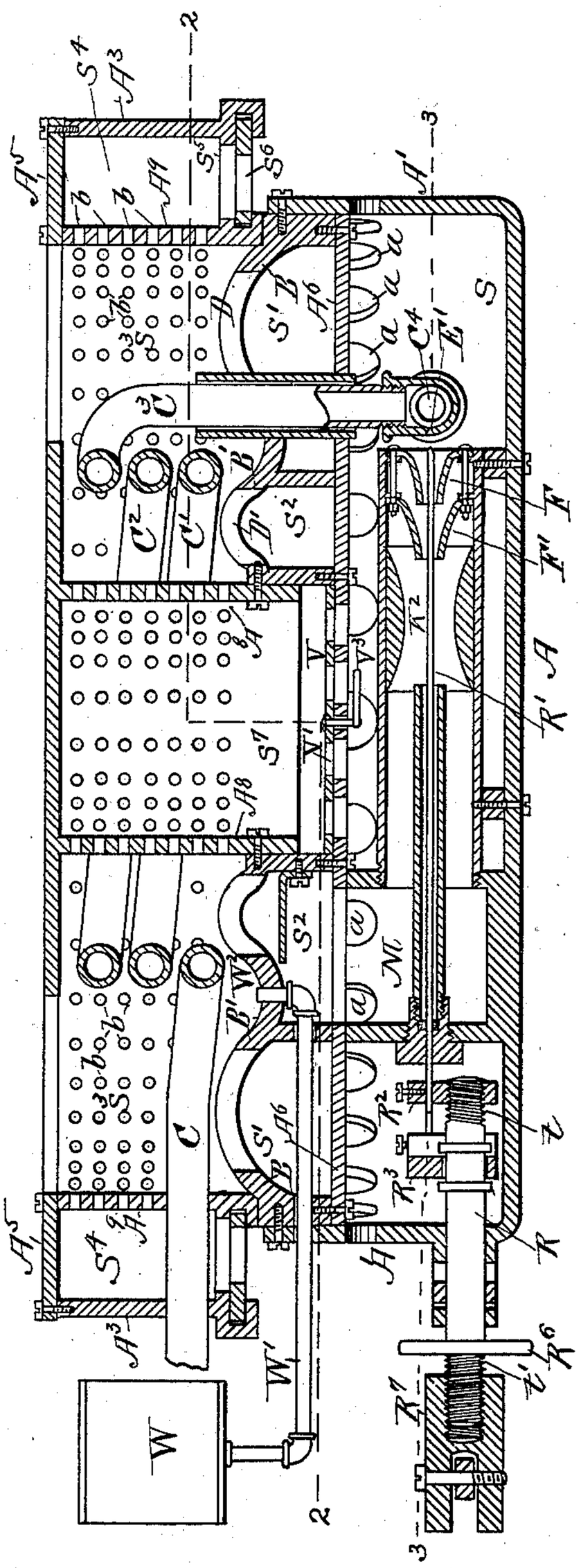

Fig. 1.

WITNESSES:
Frank G. Parker
William C. Pearce

INVENTOR:
George L. Badger

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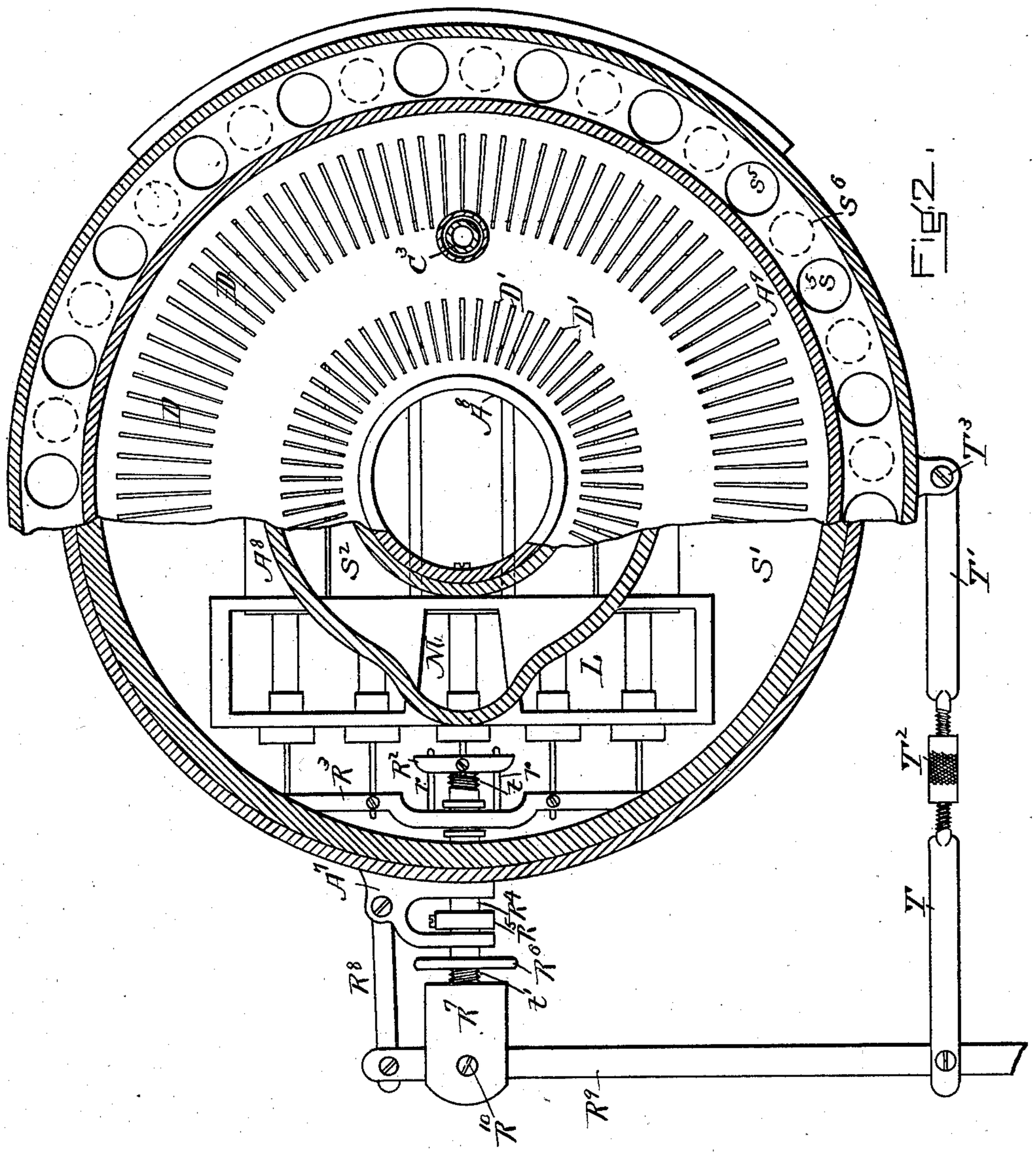

Fig. 2.

WITNESSES:
Frank G. Parker
William E. Pearson

INVENTOR:
George L. Badger

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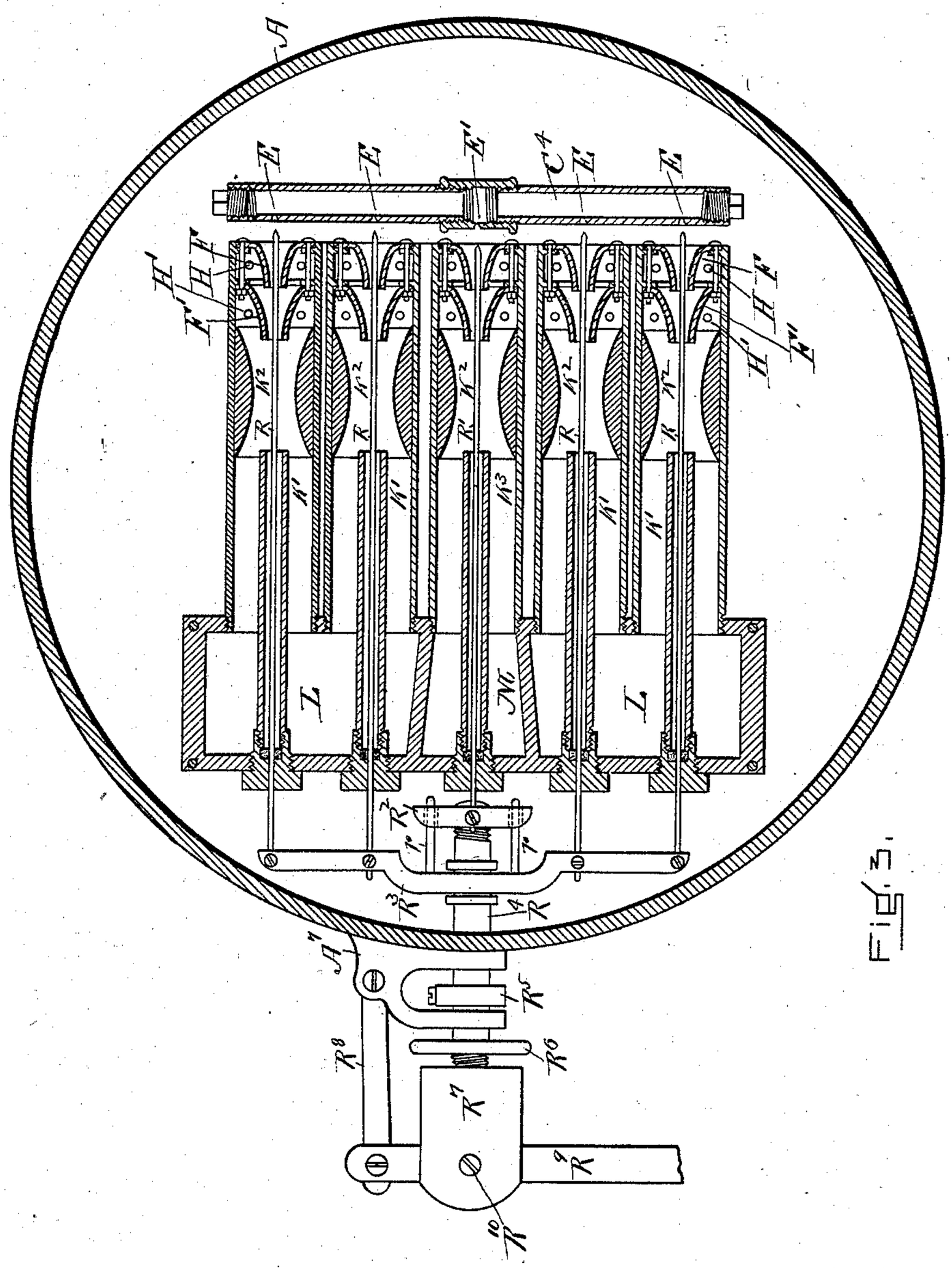

Fig. 3.

WITNESSES:

Frank G. Parker

William E. Pearson

INVENTOR:

George L. Badger

UNITED STATES PATENT OFFICE.

GEORGE L. BADGER, OF QUINCY, MASSACHUSETTS, ASSIGNOR TO EQUITABLE AUTO-TRUCK, POWER AND BURNER COMPANY, OF PORTLAND, MAINE, AND LYNN, MASSACHUSETTS, A CORPORATION OF MAINE.

METHOD OF BURNING OIL.

SPECIFICATION forming part of Letters Patent No. 698,354, dated April 22, 1902.

Application filed August 2, 1900. Serial No. 25,713. (No specimens.)

To all whom it may concern:

Be it known that I, GEORGE L. BADGER, of Quincy, in the county of Norfolk and State of Massachusetts, have invented a new and useful Improvement in Methods of Burning Oil, of which the following, taken in connection with the accompanying drawings, is a specification.

This invention relates to the burning of hydrocarbon fluids; and it consists in a system of vaporization and oxygenating hydrocarbons by which the mixture will produce when ignited complete combustion, with or without the addition of air.

The primary object of this invention is to provide means whereby perfect combustion may be obtained with heavy non-volatile oils when said oils are vaporized at a heat below that at which carbonization occurs.

Heretofore the difficulty of obtaining a Bunsen flame with the heavy and comparatively safe hydrocarbon fluids has prohibited the employment of such fluids where otherwise their use would be advantageous, and this difficulty has led to the general adoption of the more expensive and dangerous volatile oils for certain purposes. With these light oils very good combustion has been secured; but so far as I am aware complete and odorless combustion has not been obtained under various working conditions.

Many attempts have been made to sufficiently oxygenate the vapors of heavy oils by heating the vapor to a high temperature, thereby converting more or less of the vapor into lighter gases. When oil-vapors are employed for obtaining a Bunsen flame, it is not practicable to superheat the vapor to such a high temperature as is usually employed in that type of vapor-burners in which the vapor is ignited at the discharge-orifice.

In a Bunsen burner the temperature of the vapor at the discharge-orifice is necessarily considerably below the temperature to which the vapor has been heated in the vaporizer, and if this heat has been high enough to decompose a considerable part of the vapor a deposit of carbonaceous matter will be formed at the discharge-orifice and in the comparatively cool parts of the vaporizer adjacent thereto.

I have overcome the difficulties connected with the vaporization and oxygenation of hydrocarbon fluids and have developed a system whereby complete combustion can be obtained through the wide range and variations required in the practical application of such a method.

For reducing my method of treating and burning hydrocarbons to practice I have shown the following-described apparatus, as illustrated in the accompanying drawings.

Figure 1 is a vertical section through the burner. Fig. 2 is a horizontal section taken on line 2 2 of Fig. 1, parts being represented as broken out for the purpose of showing other parts which are below them. Fig. 3 is a horizontal section taken on line 3 3 of Fig. 1.

The base or lower part of the casing of my burner is indicated by A, provided with an annular wall A A′, to which is attached a plate A^6 A^6. Below this plate A^6 A^6 a series of perforations *a a* are made for the admission of air into the lower or sub compartment S, in which is located the mechanism for causing and controlling the mixing of the heated oil-vapor and air previous to their passage into the second or outer and inner annular chambers S′ S′ S^2 S^2—that is, the space between the plate A^6 A^6 and the fire-plate B B′ B B′. In these second chambers S′ S′ the mixture as formed in the lower chambers L and M becomes of such a nature as to be completely combustible previous to its passage through the perforated plate B B′ B B′ into the combustion-chamber S^3.

Oil is drawn from any suitable source through the pipe C and made to flow through the coil C′ C^2 to the pipe C^3. Thence it passes downwardly into the horizontal pipe C^4, Figs. 1 and 3, which delivers it in the form of vapor through the small orifices E E E′ E E into the open cone-shaped injector-tubes F F F F F, to which air is supplied at their mouths, and also through the openings H H. As the commingled oil-vapor and air leaves the tubes F F the mixture passes into a second set of similar injector-tubes F′ F′ and gathers additional air

from the mouths of said second set of tubes and also from the openings H′ H′. The mixture now flows through the contracted passages K^2 K^2 K^2 K^2 K^2 into the induction-tubes K′ K′ K^3 K′ K′. Thence the mixture passes from the tubes K′ K′ K′ K′ into the chambers L L, from which it flows into the outer annular chamber S′. (See Figs. 1 and 2.) The oil-vapor which jets from the orifice E′ passes through injector-tubes F and F′, similar in all respects to those already described, into the induction-tube K^3, which is like the tubes K′ already described, and discharges into the central chamber M and thence passes to the inner annular chamber S^2, (see Figs. 1 and 2,) where the mixture becomes ready for complete combustion. The thoroughly-mixed and heated volume of vapor and air passes through the perforations D and D′ into the combustion-chamber above the plate B B′ and immediately beneath the boiler or thing to be heated.

The combustion-chamber S^3 is annular in horizontal section, the inner wall being shown at A^8 and the outer wall at A^9, (see Figs. 1 and 2,) both of these walls being perforated, as indicated by *b b*. A third wall A^3 incloses the whole and is itself closed at the top by the plate A^5 and at the bottom by a register device S^5 S^6, so that the amount of air admitted to the space S^4 and thence through the outer perforated wall A^9 can be regulated or cut off altogether, as may be desired. The inner air-space S^7 has a closed top and a register bottom V V′, the movable part of which is operated by a lever V^3 and any suitable connection therebetween. By the register devices just described the inlet of air to the combustion-chamber S^3 may be regulated at will or entirely cut off.

The oil-vapor inlets E E E′ E E, Fig. 3, are opened and closed by needle-valves R R R′ R R, respectively. These needle-valves pass through protecting-tubes N N. The four needle-valves R R R R are attached directly to the cross-bar R^8 and are operated by the lever R^9, which is connected by the link R^8 to the bracket-piece A^7 and is adapted to actuate the bar R^8 through the sliding rod R^4, head R^7, and pivot R^{10}. The needle-valve R′ is indirectly connected to the bar R^8 by means of the short bar R^2 and steady-rods *r r*. The sliding rod R^4 rotates and is turned by the hand-wheel R^6, its longitudinal motion being limited by the collar R^5 between the arms of the bracket A^7. Screw-threads *t t′* are cut upon the ends of the rod R^4, the screw at one end being a right-hand one and at the other end a left-hand one, so that by turning the rod by the hand-wheel R^6 the distance between the head-block R^7 and the short bar R^2 and the attached needle-valve R′ can be adjusted—that is, the needle-valve R′ can be so adjusted as to have the opening E′ open after the other openings E E E E are closed by their respective needle-valves R R R R. By this device the flow of mixed vapor and air through the central tube K^3 to the chamber M and thence to the perforations D′ D′ can be maintained after the flow through the tubes K′ K′ K′ K′ to the chambers L L and the perforations D D is cut off.

If desirable, the sliding part S^6 of the register device S^5 S^6 may be connected by the pivot T^3, link T′, adjusting-nut T^2, and link T to the lever R^9, so that the air-supply may be governed by the same lever which regulates the vapor-supply. This controlling device can be so adjusted that the air through the perforations *b b* in the wall A^9 may be cut off entirely while the vapor mixture is burning and opened only when it is desired to cool off the apparatus, or any other desirable adjustment may be made to adapt the burner for special purposes.

For the purpose of lighting my burner I have the following-described device: W is a can having a supply of alcohol or some similar fluid, and W′ is a pipe provided with a suitable stop-cock (not shown) and leading to the annular depression W^2 in the perforated fire-plate B B′. By allowing a small quantity of alcohol or other similar fluid to flow into this depression and igniting it heat is generated about the pipe C C′ C^2 and the contained oil is converted into vapor and forced through the pipes C^3 C^4 to the orifices E E E′ E E and, after taking up the desired amount of air, passes into the combustion-chamber S^3, where it will become ignited and maintain an intense heat in the coil C′ C^2, and thus develop great heating power. In the meantime the starting-fire in the depression W^2 can be allowed to go out, as the burner supplies its own generating power from the oil within the pipes as it flows from the source of supply, where it is kept under some pressure or head.

The working of this apparatus may be set forth as follows: The oil (kerosene) flowing in through the pipe C is heated in the coil C′ C^2, so as to form a vapor, which passes down the pipe C^3 and is discharged from the induction-pipe C^4 into the mixing apparatus in the subchamber S. The mixture of air and vapor passes into the small compartments L L and M in the subchamber and from there upwardly through openings in the plate A^6 A^6 into the second chambers S′ S^2, where it receives additional heat from the intense flame above the fire-plate B B′, thence passing through the perforations D D D′ D′ into the combustion-chamber S^3 S^3.

I do not claim in this application the apparatus herein shown and described, as that is claimed in application No. 31,420, filed September 28, 1900.

I claim—

1. The method of converting hydrocarbons for fuel, which consists of vaporizing the hydrocarbon or oil under pressure by heat, dividing the supply of vapor into fine jets, mixing each jet of vapor with air, additionally mixing, by the expansive force of the oil-vapor, with each jet of mixed vapor and air, a fur-

ther supply of air proportional to the amount of vapor supplied by each jet, commingling the several jets of mixed vapor and air, and igniting the mixture, substantially as set forth.

2. The described process of converting hydrocarbons for fuel, which consists of vaporizing the hydrocarbon or oil under pressure by heat, dividing the supply of vapor into fine jets, mixing each jet of vapor with air, additionally mixing, by the expansive force of the oil-vapor, a further supply of air therewith, feeding said additional air-supply successively in separate quantities to the oil-vapor within the mixer-passage, commingling the several jets of mixed vapor and air, and igniting the mixture, substantially as set forth.

3. The method of converting hydrocarbons for fuel, which consists of vaporizing the hydrocarbons or oil under pressure by heat, dividing the supply of vapor into fine jets, mixing each vapor-jet with air, additionally mixing, by the expansive force of the oil-vapor, with each mixed vapor and air jet, an additional air-supply, feeding progressively such additional air-supply with the increased volume of the vapor-jet, proportional to the amount of vapor supplied by each jet, commingling the several mixed vapor and air jets, and igniting the mixture, substantially as set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 11th day of July, A. D. 1900.

GEORGE L. BADGER.

Witnesses:
FRANK G. PARKER,
WILLIAM E. PEARSON.