No. 654,888. Patented July 31, 1900.

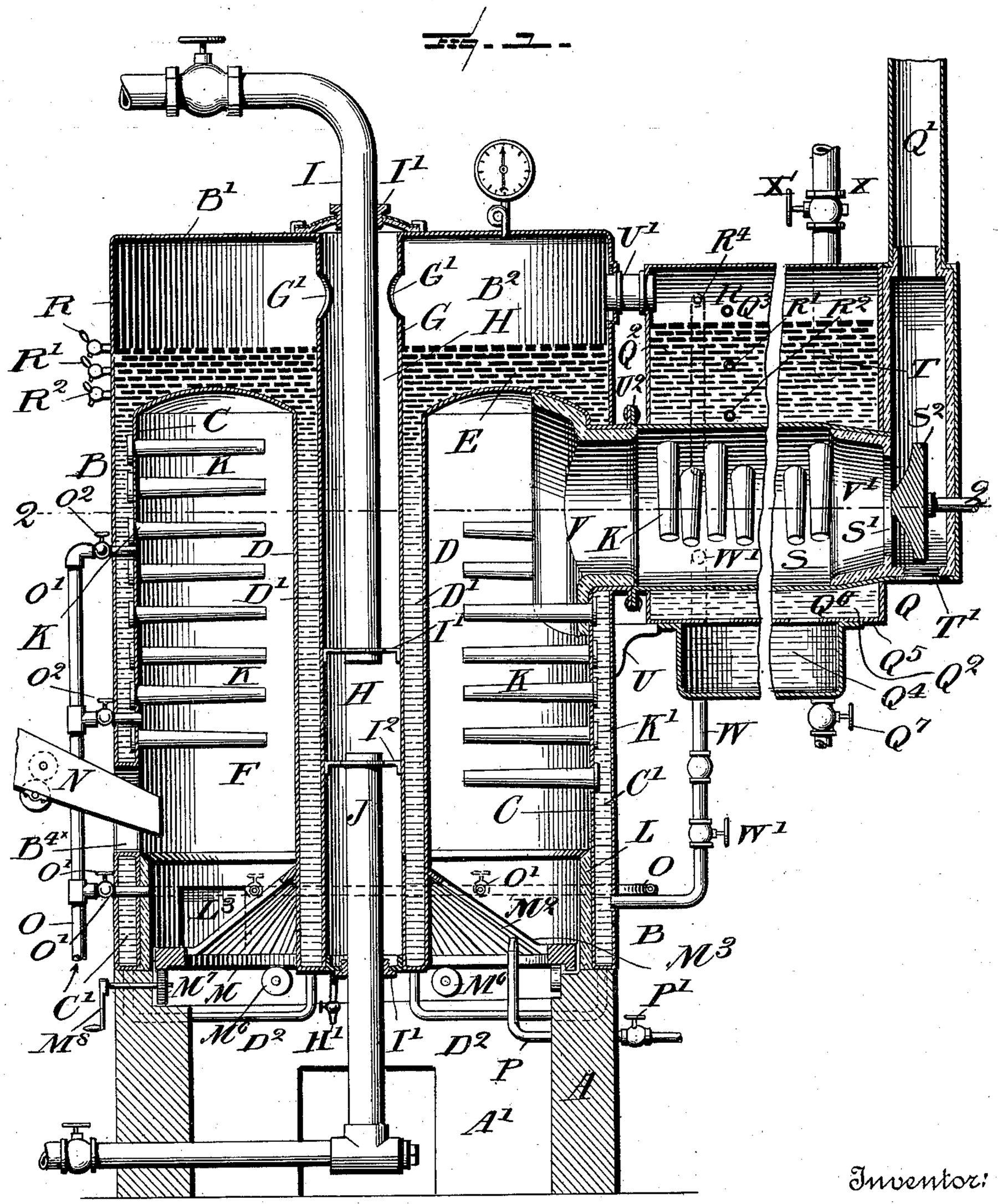
J. GIROUX.

STEAM GENERATOR.

(Application filed Nov. 29, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.



Witnesses
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By

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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

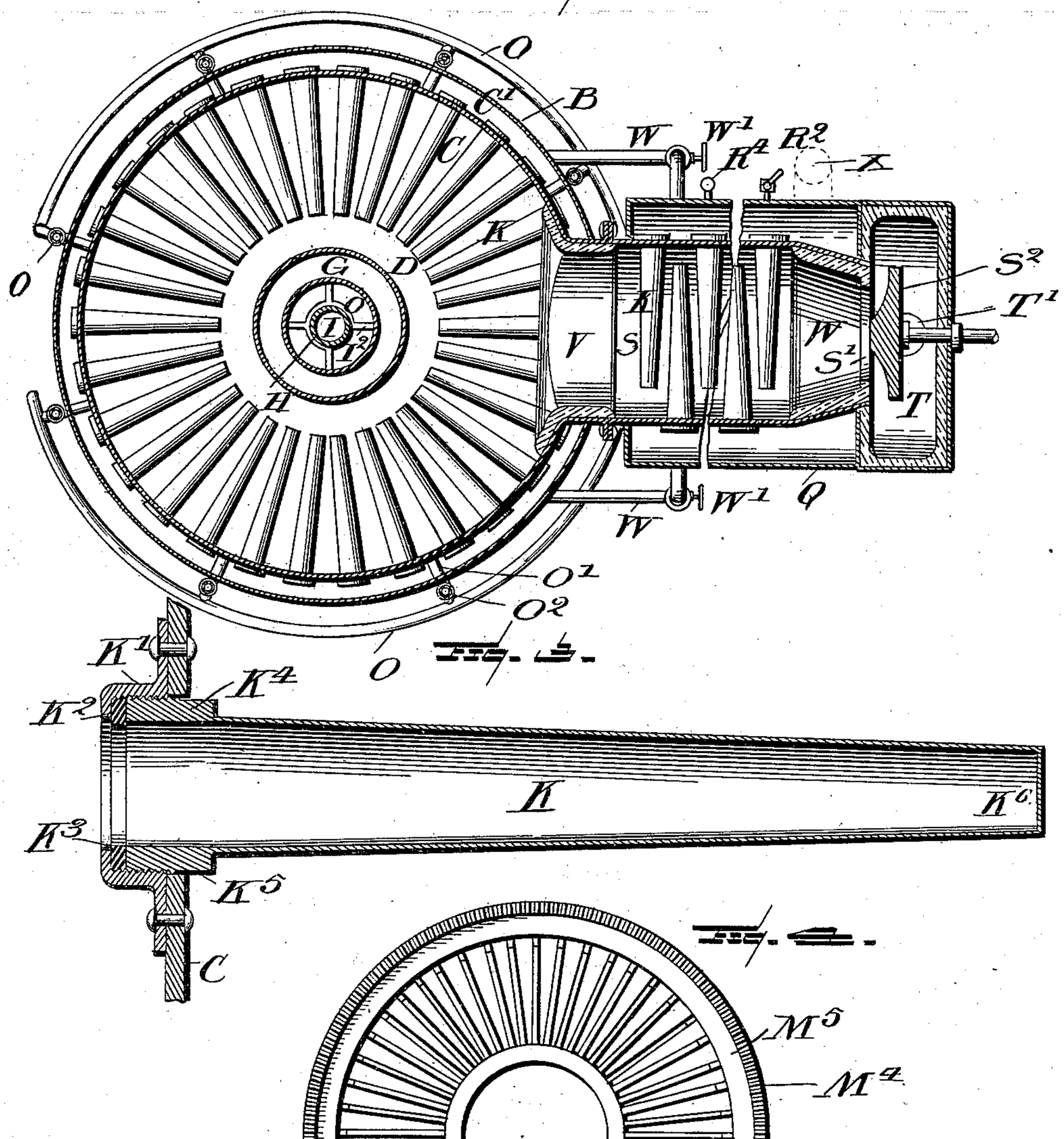
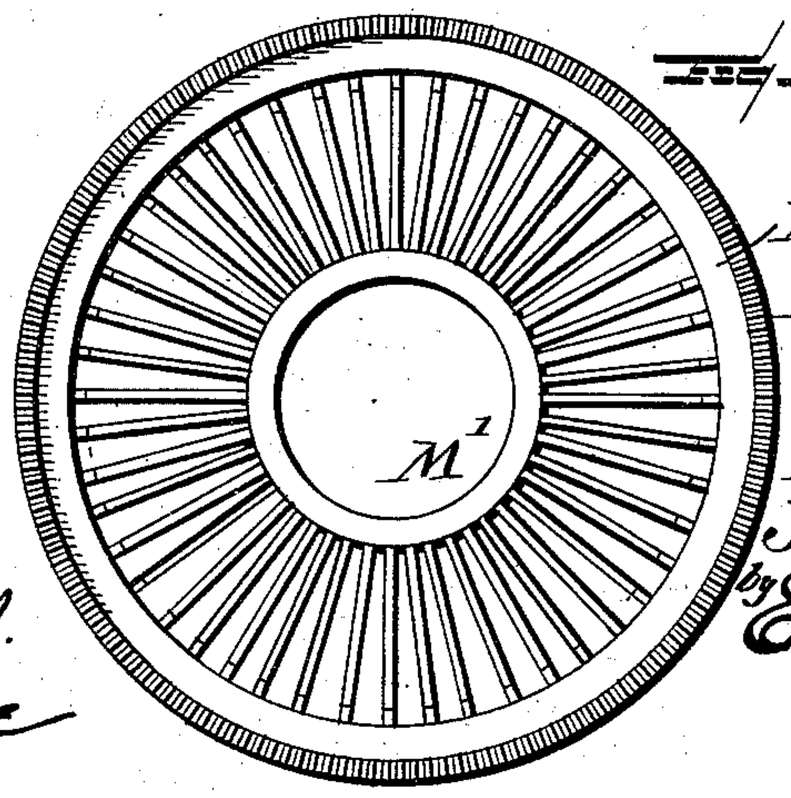


Fig. 3.

Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

JOSEPH GIROUX, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO FREDERIC TETREAU, OF SAME PLACE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 654,888, dated July 31, 1900.

Application filed November 29, 1899. Serial No. 738,725. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH GIROUX, a citizen of the United States, residing at New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to a steam-boiler or steam-generating apparatus; and it has for one object to produce steam in its most effective form for the performance of work to produce what is hereinafter termed "live" steam, meaning not superheated or so-called "dry" steam, but, as indicated, steam in its most perfect or gaseous form.

A further object of the invention is to retain the steam at its normal temperature of generation, and consequently at the greatest degree of elastic force, by surrounding or inclosing the discharge for the steam by a water-space which prevents the temperature of the steam from being raised above that of the surrounding water. This construction also prevents any condensation from reduction of temperature.

Other objects and advantages of the invention will hereinafter appear in the following description, and the novel features thereof will be particularly pointed out in the claims.

In the drawings, Figure 1 is a substantially-central vertical section of an apparatus embodying my invention. Fig. 2 is a horizontal section on the line 2 2 of Fig. 1. Fig. 3 is a vertical longitudinal section, on a larger scale, of one of the water-tubes, showing the manner of removably connecting them with the fire sheet or sheets of the apparatus; and Fig. 4 is an inverted plan of the grate.

Like letters of reference indicate like parts throughout the several figures of the drawings.

Upon any suitable base or foundation A, which may or may not, as desired, form the walls of the ash-pit A′, there is mounted a shell B, which may be cylindrical or of any other configuration. Within this shell is arranged the wall C of the heating-chamber, which in this instance conforms with the outline of the exterior shell, which is cylindrical, so as to form an annular water leg or chamber C′. Of course if the outline of the shell is other than cylindrical the outline of the wall or fire-sheet C would conform therewith, so as to produce a surrounding water-leg. The shell B is provided with a crown or cap sheet B′, which although herein shown as being flat may be dome-shaped or conical or of any other superficial outline desired, and the outlines of the various elements of my invention may be varied to suit the different circumstances under which the invention is used so long as the relative relation of the various heating and steam-containing compartments exists substantially as herein shown. So, also, there may be added to the structure herein illustrated any usual form of stays, bracings, or stay-bolts, as desired.

Within the annular wall or fire-sheet C there is arranged a cylindrical fire-sheet D, and an annular crown-sheet E is employed for closing at the top the space between the sheets C and D, which space constitutes the heating or combustion chamber F of the generator proper of the apparatus. Within the fire-sheet D is arranged a cylinder G, forming a chamber H, which may be termed the "steam chamber or drum" of the apparatus. A space D′ is produced between the sheet D and the cylinder G, which space constitutes a central annular water-leg. Now, if desired, a pipe or pipes D^2 may be employed to provide a connecting-passage from the inner to the outer water-leg, thus facilitating the circulation of water throughout the above-mentioned water spaces or legs. Within the steam cylinder or chamber H there is extended a live-steam pipe, terminating at about the central portion of said chamber and of the fire-chamber of the apparatus. The steam-pipe I may be maintained in a central position by the use of any suitable connections, including a stuffing-box I′ and a spider or spiders I^2. While the pipe I may be alone employed, still, if desired, another similar live-steam pipe J, connected in a similar manner, but passing out under the generator, may be employed either alone or in conjunction with the pipe I, as desired. In the one case live steam will be taken out of the generator at the top and in the other case out at the bot-

tom; but in either case it will be taken from the central portion of the fire-chamber, and herein is an important feature of my invention, because the steam is at the same temperature as the water which surrounds it at the point of its entrance into the discharge-pipe. It is not superheated, whereby a percentage of its elasticity is destroyed. Neither is it wet, whereby the same objection to a certain extent exists; but the steam is in its most perfect or gaseous form, whereby it is enabled to perform its greatest amount of work. A further advantage secured by taking the steam from this point consists in the obviation of hammering resulting from condensation in the supply-pipe and in the cylinders of the engine. It will be noted that as the steam forms in the upper part of the apparatus it gains access to the central steam-chamber through the apertures G′, formed in the wall G thereof, and that any moisture in the steam as it enters the chamber H will be gradually driven therefrom as the steam passes down to or below the central portion. The expulsion of the moisture from the steam is insured by the fact that it is constantly advancing toward the hottest part of the apparatus. Again, this circuitous route of the steam from the upper portion B^2, the ordinary steam-dome of a boiler, down the central chamber G and up the pipe I necessarily prevents the outgoing steam from lifting or carrying the water from the generator into the supply-pipe and cylinder of the motor. In other words, siphoning the water from the boiler is prevented by this circuitous route. While steam will not condense in the chamber H, still after shutting down and cooling off the steam within the cylinder at that time will condense, and therefore I provide a pet-cock H′ for drawing off such water of condensation.

As thus far described an apparatus is provided which will deliver live steam in a most advantageous condition for use; but if it be desired to increase the heating-surface of the apparatus a series of water-tubes K may be employed, and these may be of any desired form and arrangement; but I prefer to use a form of tube illustrated clearly in Fig. 3. These tubes are screw-threaded into sockets K′, riveted or otherwise secured to the outer surface of the fire-sheet C, and these sockets have annular flanges K^2, forming a seat for the packing K^3, of any desired material which will render the joint waterproof. Each of the tubes has an annular thickened wall K^4 at its connecting end which is exteriorly screw-threaded to fit the threaded socket K′. A portion of this thickened wall projects into the fire-space, forming a wrench-hold K^5, which facilitates the removal and introduction of the tube. These tubes may be straight cylinders; but I prefer to taper them, as shown, whereby the lesser body of water at and near the closed end K^6 becomes more readily heated, and this serves to maintain a circulation in the tubes.

The lower portion of the fire-chamber is lined with fire-brick L and is provided with a clinker-door L^3, arranged below the stoke-hole $B^{4\times}$. Within the lower portion of the fire-chamber is the grate M. This grate is annular and has an opening M′ for the passage therethrough of the central annular water-leg, steam-chamber, and supply-pipes hereinbefore described. The central portion of the grate is conical, as shown at M^2, and at the base of the same merges into the horizontal portion M^3, which is provided at its under surface with a series of cogs or teeth M^4 and a plane surface M^5, (see Fig. 4,) which serves, in connection with rollers M^6, to movably support the grate, while a pinion M^7 and a crank or other power-conveying device serve to rotate the grate. By this means it will be seen that fuel may be deposited upon any part of the grate through a single stoke-hole or feed-opening and that any portion of the grate may be brought opposite the clinker door or doors for the removal of clinkers therefrom. The fuel may be fed by hand or by the use of any well-known form of mechanical stoker, (represented at N.)

While it is apparent that the door in the ash-pit A′ may serve as a means of furnishing draft for the consumption of fuel upon the grate, it is not the purpose of my invention to utilize such draft alone to produce the perfect combustion which my invention has in view. To the extent to which I utilize the draft from below the grate it may and will be produced by any suitable connection to any desired uptake directly or indirectly connected with the generator.

As hereinbefore stated, one of the important features of my invention is the provision of means for producing the most perfect combustion possible. With this object in view I provide, in addition to the ordinary under-draft devices, what I denominate an "inflammator," and these devices consist in means for directing upon the surface of the fuel and, if desired, into the body of gases emanating therefrom a substance which will supply oxygen to the fuel and to the gases, whereby a more perfect combustion is produced. The substance or material supplied by the inflammator may be exhaust-steam, air, or any of the hydrocarbons employed in this art. In this instance my inflammator consists of a supply-pipe O, having branches O′, with or without valves O^2, which branches extend from the supply-pipe through the water-leg, so as to conduct the material furnishing oxygen upon the fuel on the grate or into the combustion-chamber of the apparatus, and these branches are arranged and located so that if desired one or more of them may be simultaneously employed. To protect the grate from injury by excessive heat, I provide an atomizer P, having a controlling-

valve P′, through which water or other cooling agent may be conducted and delivered at the under side of the grate either in the form of a spray or solid stream, as desired. It will be noted that more than one atomizer may be employed and also that by rotating the grate a single atomizer may be sufficient, as all parts of the grate can be brought to a point to be acted upon thereby.

In my invention as thus far described any suitable method and means of supplying water to the generator proper may be employed; but as the production of live steam is greatly facilitated by the use of clean water at such a temperature as will not depress the temperature of the water within the generator I have devised another feature, which may be termed a "tender" or a "boiler," additional to and forming a part of the generator heretofore described. This tender is not only adapted to conform to the conditions above designated, but is also adapted and arranged to utilize the products of combustion as they pass from the generator proper to the uptake. Referring to the drawings, Q represents the tender, and Q′ represents the uptake. The tender comprises in its make-up a water-space Q^2, a steam-space Q^3, and a mud-drum Q^4 at its lower portion, the bottom wall Q^5 having openings Q^6 for the passage of sediment into the mud-drum. The usual draw-off cock or valve Q^7 is connected with the bottom of the mud-drum. R, R′, and R^2 represent gage-cocks which are provided upon the tender as well as upon the generator to answer their well-known purposes and functions. A water-glass R^4 may also be provided upon either or both portions of the apparatus for its well-known purposes. The capacity for water of the tender may be at least about one-third more than the capacity of the generator, whereby a surplus is always maintained over the requirements of the generator proper. Through the tender there passes a fire-chamber S, which may or may not, as desired, be provided with water-tubes K, and at the discharge end of the fire-chamber there is a valve-opening S′, which is adapted to be closed, opened, or partially opened by means of the damper S^2, which may be operated either by hand or any suitable system of levers. A heating-chamber T is arranged at the end of the tender and fire-chamber S, so that the products of combustion passing therethrough to the uptake Q′ are utilized in heating water within the tender. A manhole or other suitably-closed aperture T′ is provided at the bottom of the heating-chamber for the removal of ashes and cinders. The tender is attached to and connected with the generator in the following manner, although any desired well-known means of connection may be employed: A bracket U may be employed to support the tender and a pipe U′ is employed to give direct connection between the steam-space B^2 of the generator with the steam-space Q^3 of the tender. The fire-chamber terminates in flanges which may be bolted or riveted or otherwise connected with similar flanges projecting from the generator, as shown at U^2. As a precaution against injury by heat to the fire-sheets of the generator, fire-brick, fire-clay, or any other suitable heat-resisting material is applied as shown at V, the entrance of the fire-chamber S, and at V′, the exit thereof.

W represents the water-supply tube, which extends from the tender at a point W′ below its crown-sheet to the water-leg C′ of the generator. There may be one or more of these water-supply pipes. Now it will be seen that by the connection U′ the pressure of steam upon the body of water in the tender and in the generator is equalized, and it will also be seen that the water from the tender is conveyed to the hottest part of the water within the generator, so that no chilling effects follow. The valves W′ serve to control the water-feed, while a pipe X and valve X′ serve to supply water to the tender or water-supply heater.

The manner of use and the operation of my invention are as follows. A quantity of coal, which, it will be found, will be much less than ordinarily kept upon the grate, will be assumed to be ignited by the usual or natural draft from below the grate, which coal under ordinary circumstances would burn from below—that is, from the grate upward. Now by supplying oxygen through the inflammator upon the surface of the coal ignition takes place, and by extending said supply of oxygen to and within the combustion-chamber F the gases evolved from the coal are rendered combustible, so that the coal and its gases are both burned and the greatest number of heat units possible under the circumstances is evolved from the fuel. The heat thus produced takes effect through the extended heating-surface of the annular fire-chamber and heats the water within the water-legs and body of the water-chamber to the steam-producing temperature, which steam in its passage to the supply-pipe I travels down the steam-chamber H to, or about to, the hottest point in the generator, where it is deprived of any moisture it contained when in the steam-chamber B^2 of the apparatus, and in this dried, though not superheated, condition it passes to the motor possessing its greatest degree of elasticity and effective working force.

The tender or feed-water heater now receives the products of combustion in its heating-chamber, and all of the foaming and priming will take place in the steam-chamber Q^3 of the tender instead of in the steam-chamber B^2 of the generator. This of itself is an important feature of my invention. Furthermore, as the cold water supplied to the apparatus is first brought to the tender it cannot lower the temperature of the water within the generator proper, and all of the separable vegetable and chemical ingredients which ordinarily act to obstruct and scale the fire-sheets of a steam-generating apparatus are

first separated and precipitated in the tender, so that such water becomes not only heated to practically the same temperature as the water within the generator proper, but it is also cleansed, whereby when it passes from the tender into the generator less heat is required to maintain the steam-making function of the generator than where the water is injected in a cold state. Now it is perfectly apparent to any one skilled in the construction of steam-generating apparatuses that the water-supply-heating compartment, which I have denominated a "tender," may be arranged in various relative positions as regards the generator proper, so as to receive the products of combustion as they pass to the uptake, and such an arrangement of the principal elements of the apparatus may be adopted which shall adapt it for use in connection with either stationary or locomotive engines. In fact, in the latter class of engines the preferred dimensions of the water-heating compartment as to its relative capacity can readily be secured without material variance from established forms, so that my invention is fully adapted for use in said forms of steam-generating apparatus. In use and by a proper control of the damper S^2 it will readily be seen that the approach to perfect combustion and complete exhaustion of the heating power of fuel can be maintained. The idea is to extract all or as many as possible of the heat units of a comparatively-small quantity of coal rather than to consume a great quantity of coal and allowing a large percentage of its heat units to escape in an unconsumed or unutilized condition. With a few inches of coal upon the grate ignited below, within, and at the upper surface of the body of coal, and with the gases evolved therefrom supplied from an exterior source with oxygen, and with the damper at the uptake closed or nearly closed it is manifest that the largest possible percentage of the heat units of the fuel will be utilized. Not only will said units be utilized in the combustion-chamber, but the remnant thereof will be retained to perform the additional duty of heating and cleansing the water-supply before they can possibly escape to the uptake.

I have not particularized in detail the ordinary features of steam-boiler construction nor attempted to show the most advantageous form and outline of the various elements of such an apparatus, as these are well known to persons skilled in the art, and I do not therefore limit my invention in these particulars to the exact form and detail illustrated and described.

What I claim is—

1. A steam-generating apparatus having its live-steam discharge at a central portion of its combustion-chamber, and a water-space inclosing said steam-discharge; substantially as specified.

2. A steam-generating apparatus having a steam-chamber located at a substantially-central portion of its combustion-chamber, a water-space surrounding said steam-chamber, and means for delivering steam therefrom; substantially as specified.

3. A steam-generating apparatus having its steam-delivering means terminating at substantially the hottest portion of its combustion-chamber and a water-space interposed between said steam-delivery and combustion chamber; substantially as specified.

4. A steam-generating apparatus having its steam-delivery means projected therein to a point where the steam delivered is of substantially the same temperature as the water within the generator, and a water-space surrounding said delivery means; substantially as specified.

5. A steam-generating apparatus having a central steam-chamber extending through its combustion-chamber and surrounded by an interposed water-space; substantially as specified.

6. In a steam-generating apparatus, means for delivering the steam therefrom and a water-space for preventing the acquisition by the steam of a temperature above that of the water from which the steam was made, whereby superheating of the steam is prevented; substantially as specified.

7. In a steam-generating apparatus, a steam-chamber having an extension projecting into the combustion-chamber, and a circular water-leg arranged within the combustion-chamber and surrounding said extension; substantially as specified.

8. In a steam-generating apparatus, a steam-chamber, a surrounding water-leg arranged within the combustion-chamber, and a steam-supplying pipe projecting into the said steam-chamber; substantially as specified.

9. A steam-generating apparatus comprising an outer shell, a central cylindrical steam-chamber surrounded by a water-chamber, annular inner and outer fire-sheets, an annular crown-sheet connecting the same, and pipes connecting the intermediate spaces between the outer shell and fire-sheets; substantially as specified.

10. In a steam-generator, a central steam drum or chamber depending into the area of the combustion-chamber and having openings communicating with the steam-chamber of the apparatus, and a water-compartment surrounding said steam-chamber; substantially as specified.

11. In a steam-generating apparatus comprising a steam-chamber surrounded by a water-chamber and in combination with the wall of its combustion-chamber, an interiorly-screw-threaded and flanged socket in the wall of said combustion-chamber, a water-tube provided with an exteriorly-threaded thickened wall tapered lengthwise and closed at its end; substantially as specified.

12. In a steam-generating apparatus comprising a combustion-chamber, a steam-chamber projected into the area of the combustion-

chamber and having apertures communicating with the steam-chamber proper, a steam-supply pipe projected into the central steam-chamber and terminating at about the central portion of the combustion-chamber, a water-heating compartment connected with the steam-chamber proper of the generator at a point above its water-line and connected from a point below its water-line with the water-space of the generator; substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

JOSEPH GIROUX.

Witnesses:
ALFRED T. GAGE,
APPLETON P. CLARK.