

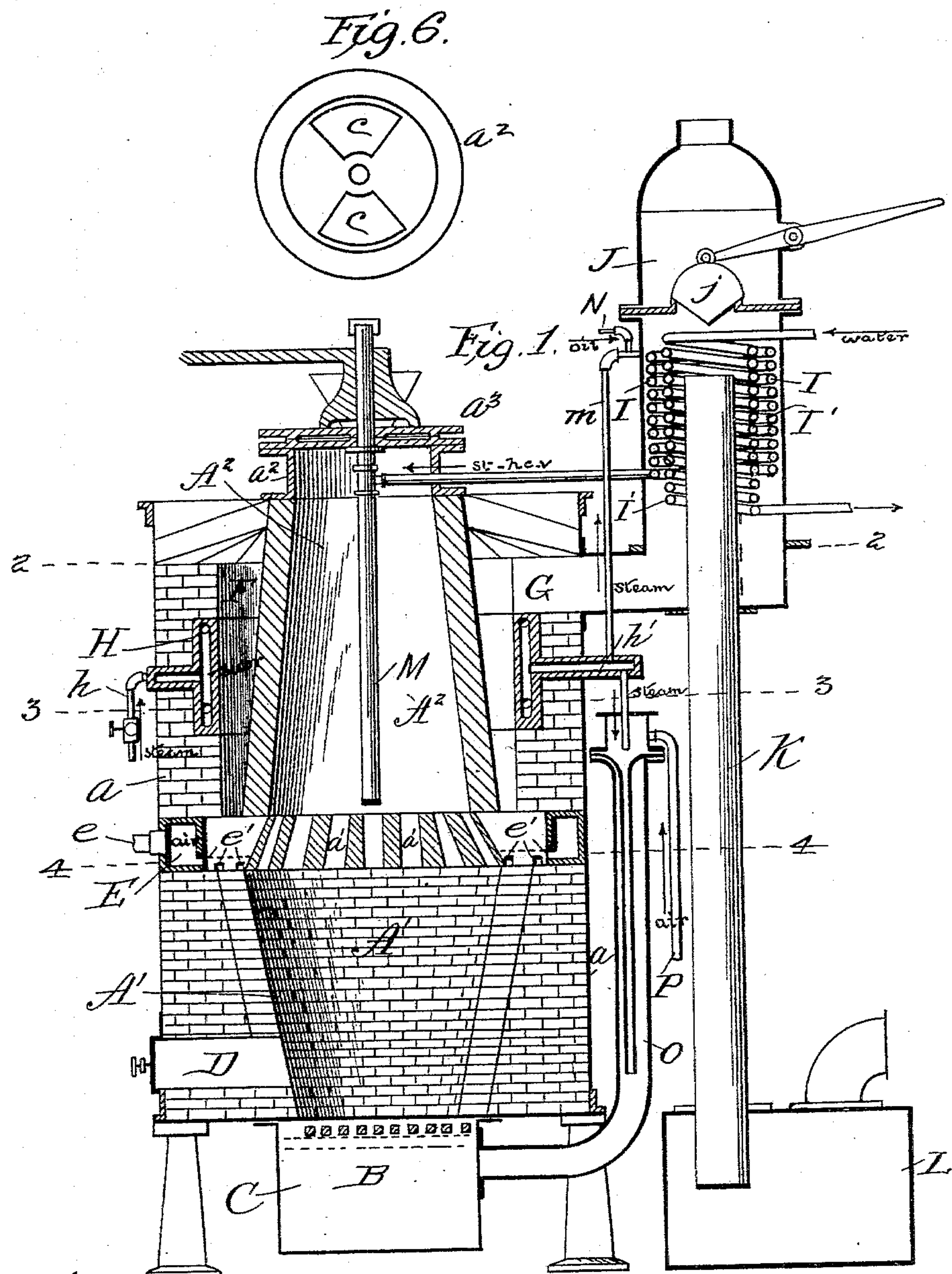
(No Model.)

2 Sheets—Sheet 1.

L. STEVENS.  
GAS APPARATUS.

No. 563,891.

Patented July 14, 1896.



Attest

Wm. D. Mearns  
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Inventor

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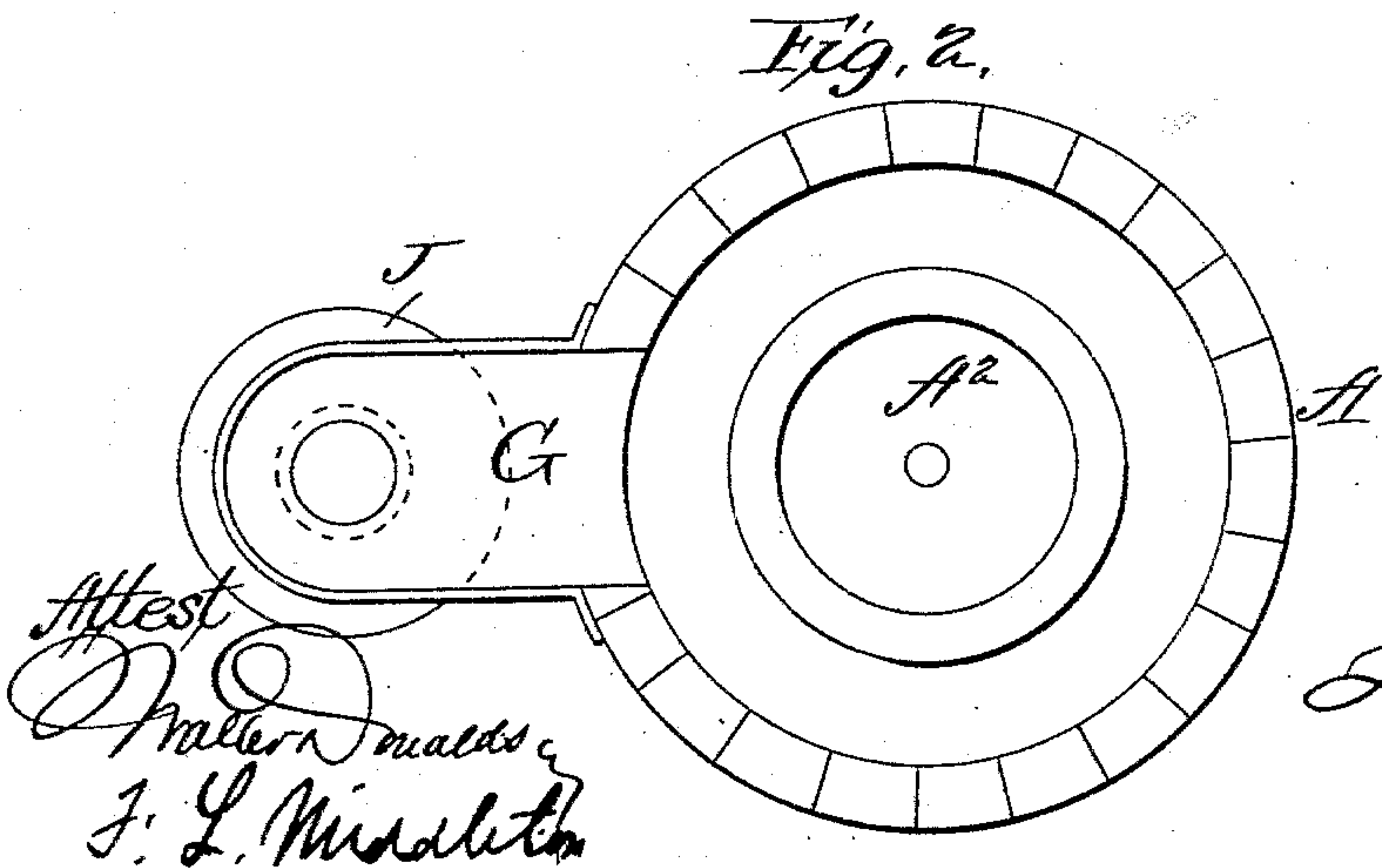
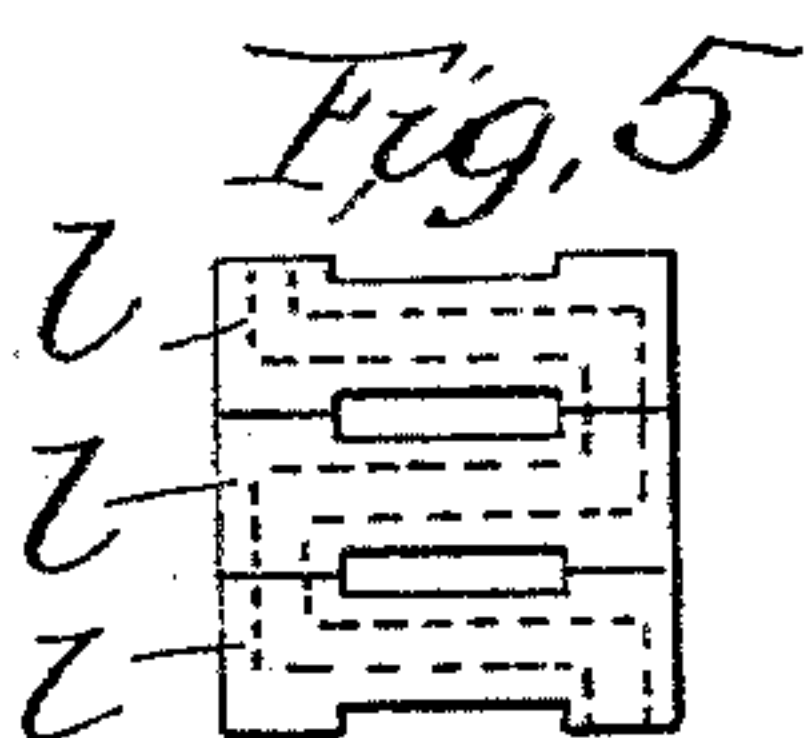
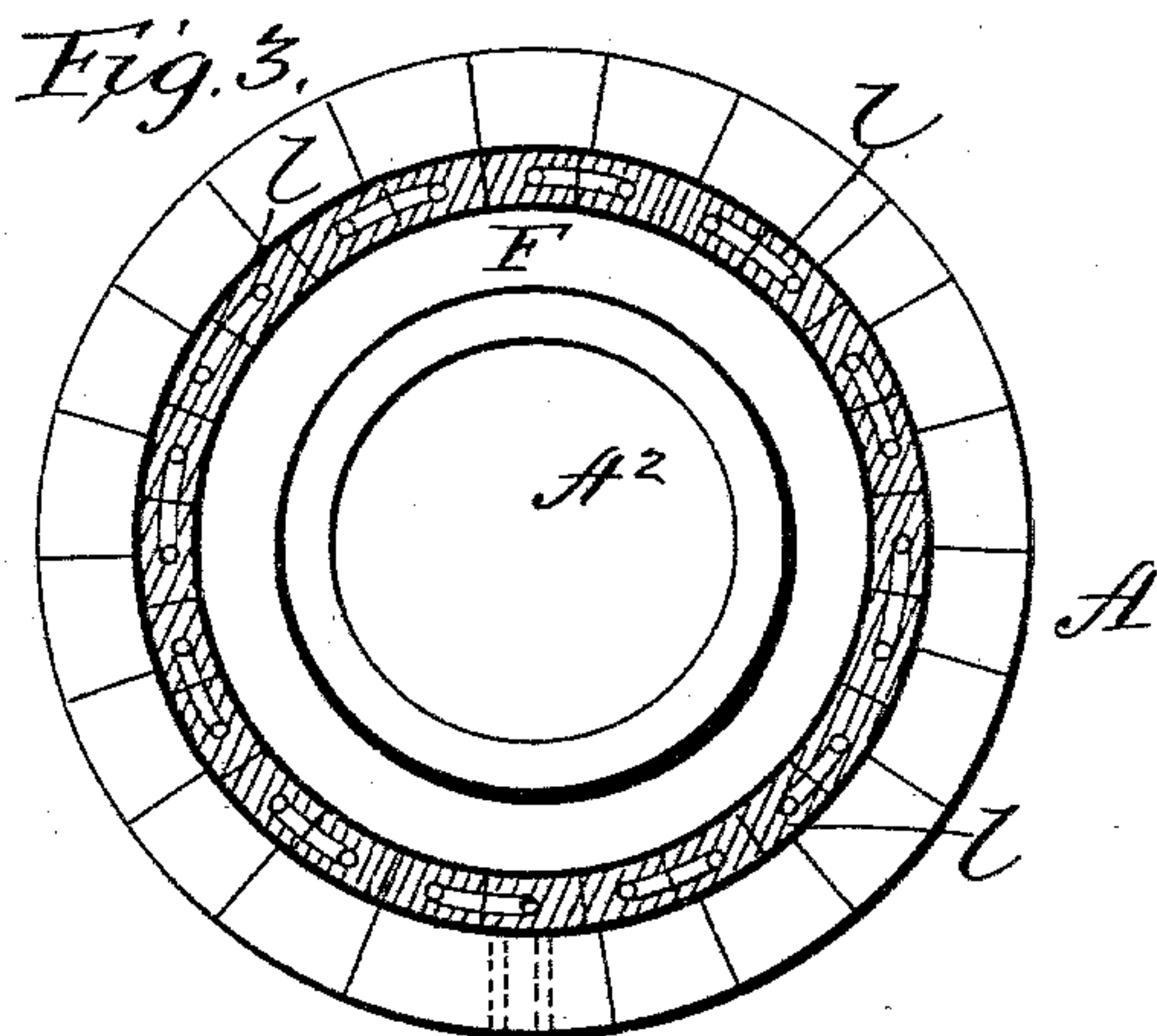
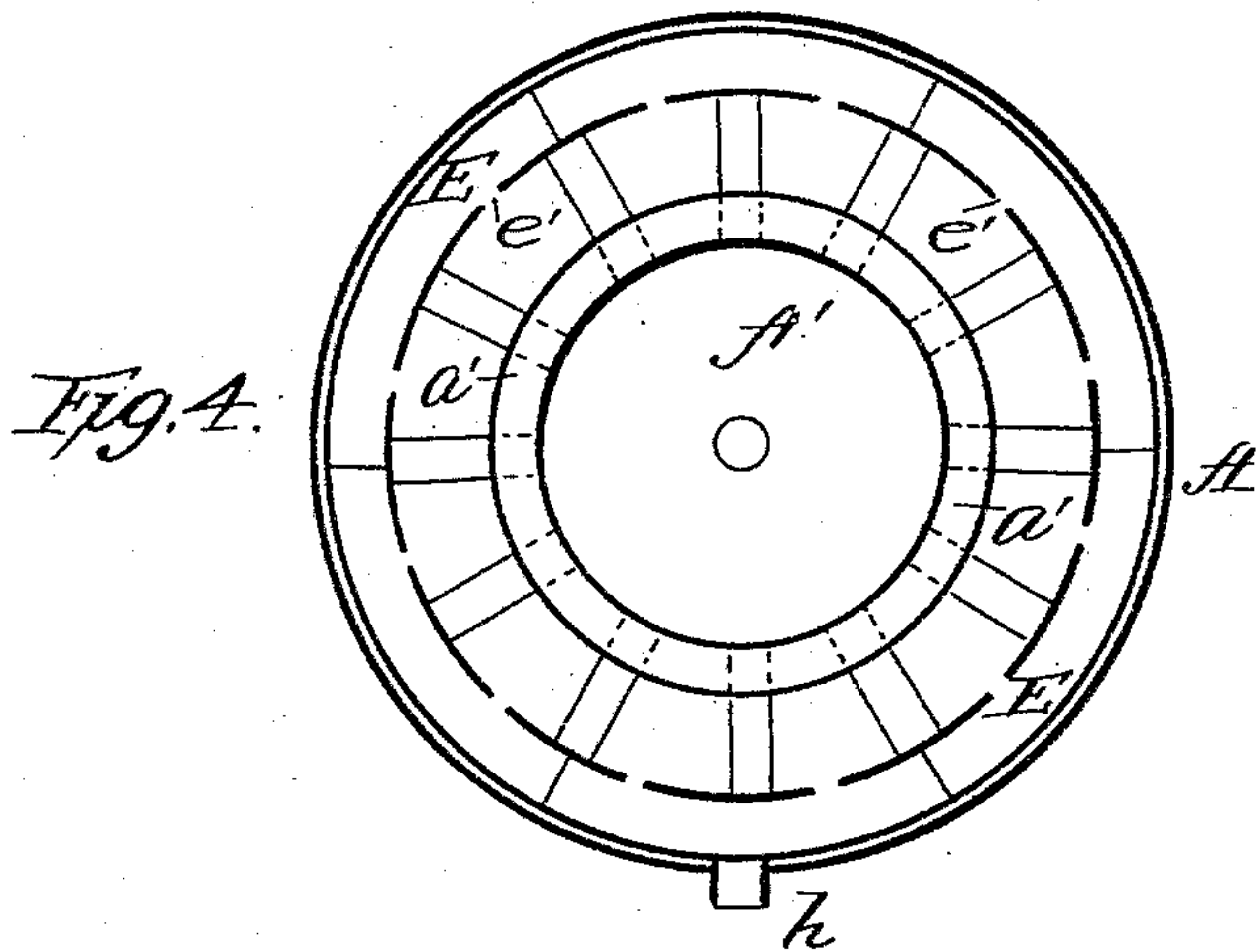
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2 Sheets—Sheet 2.

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GAS APPARATUS.

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*Attest*  
*Miller & Madsen*  
*J. L. Madsen*

*Inventor*  
*Levi Stevens*



# UNITED STATES PATENT OFFICE.

LEVI STEVENS, OF TRENTON, NEW JERSEY.

## GAS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 563,891, dated July 14, 1896.

Application filed April 5, 1893. Serial No. 469,108. (No model.)

*To all whom it may concern:*

Be it known that I, LEVI STEVENS, of Trenton, county of Mercer, and State of New Jersey, have invented a new and useful Improvement in Gas Apparatus, of which the following is a specification.

My invention relates to an improved water and oil gas generator inclosed in one shell; and it consists in a water-gas generator composed of two sections divided by outlet-ports, a superheater for steam, an oil or oil-vapor delivery-pipe which conveys oil or oil-vapor through the upper section to the center of the lower section of the generator.

My invention further consists in the combination of a coil for heating or vaporizing the oil, a coil for heating the feed-water, the exit-valve, and the gas-discharge pipe.

My invention further consists in utilizing the heat of the escaping gases to heat the coal supply in the upper section of the generator, and in depositing the residual products from crude oil in the lower section of the water-gas generator where they are utilized as carbon in making water-gas.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a central vertical section through a gas-generator and its connections constructed and arranged according to my invention. Figs. 2, 3, and 4 are horizontal sections taken, respectively, in the planes indicated by the broken lines 2 2, 3 3, and 4 4 in Fig. 1. Fig. 5 is an elevation of a section of the superheater; and Fig. 6 is a plan view of the top of the charging-chamber with the top plate or valve removed.

Referring to the drawings, A designates the generator, constructed of brickwork and incased in a sheet-metal casing *a* to render it impervious. Centrally within the generator is the vertical producing-chamber having at or near its mid-height a series of outlet-ports *a'*, which divide it horizontally into two sections *A' A''*, the lower section constituting the furnace-chamber and the upper section a reservoir and heating-chamber through which the coal descends to the furnace-chamber, and in which, during its gradual descent, it is highly heated by the ascending hot gases, as will be hereinafter more fully described.

B designates the grate, C a closed chamber below the furnace-chamber and communicating therewith through the grate, and D an opening or passage leading to the base of the furnace-chamber from the outside, to afford access to the furnace for cleaning out the same, or to serve as a draft-opening in starting the furnace.

E designates an annular chamber set into the walls of the generator opposite the outlet-ports *a'*. This chamber is provided with an inlet *e*, through which air is supplied from any suitable source, and it has in its interior face a series of ports *e'* through which the air escapes to consume the carbonic-oxid gas produced when heating up the generator.

Between the heating-chamber *A''* and the surrounding brick walls of the generator is an annular space or chamber F, communicating at the bottom with the open space into which the ports *a'* and *e'* discharge, and having at the top the discharge-flue G, through which the gas escapes from the generator.

H designates an annular superheater set into the brick wall of the generator near the top thereof and substantially flush with the inner face of said wall. This superheater is made in sections *ll*, &c., as shown in Fig. 5, of cast metal lined with non-oxidizable material. Each section has through it a passage the ends of which open out through opposite edges and at opposite ends, as represented in broken lines in Fig. 5, the arrangement being such that when the sections are placed together, as represented in Fig. 3, the passage in each section will communicate with those of the adjacent sections, the whole forming an endless sinuous passage. This superheater is connected by a pipe *h* with any suitable steam supply (not shown) and by a pipe *h'* with a vaporizing-coil I.

J designates the valve-chamber into which the discharge-flue G delivers, and from which the gas passes through a gas-pipe K to the main L. The valve-chamber is open at the top and is fitted with an interior valve *j*, adapted to be operated from the outside, as shown. This valve is opened to give a direct draft in starting the furnace, and is closed as soon as the fire is well started. The gas-pipe projects up into the valve-chamber through



the bottom thereof, as represented, and in the annular space between the gas-pipe and the walls of the valve-chamber I locate two coils I I' of pipe, one disposed within the other, so that both will be in the direct path of the gases passing through the valve-chamber and subjected to the heat carried thereby.

The coil I is connected at one end by a pipe *m* with the outlet-pipe *h'* of the superheater and at the opposite end with a vertical pipe M, which passes down centrally within the heating-chamber to a point well within the charge of coal under treatment. An oil-supply pipe N connects with the coil I, whereby oil is introduced as required.

The gas-valve is located in close proximity to the generator with a short connection between the two, as indicated in Fig. 1 of the drawings, so that there is very little, if any, loss of heat by radiation during the passage of the gas through said connection. The gas thus enters the valve-chamber without appreciable loss of heat, and enveloping and surrounding the coils within the chamber heats them to a high degree. The oil introduced is thus immediately vaporized, and mixed with steam at a high temperature passing through the coil, and is delivered with the latter into the charge of coal, so that the carbon contained in the residual products of crude oil is utilized as carbon in making water-gas.

The coil I' is a water-coil for heating feed-water for the steam-generator used in operating the plant, and has no necessary connection with the gas-apparatus. I simply locate it in the valve-chamber for the purpose of utilizing the heat carried by the gases.

O is a pipe connection between the superheater and the chamber C below the grate for the purpose of introducing steam, air, or free oxygen into the bottom of the producing-chamber. A pipe P connects with the pipe O for the introduction of air or free oxygen with the steam when desired.

The heating-chamber A<sup>2</sup> is provided with a valved cap *a*<sup>2</sup>, through which the coal is introduced. This cap (shown in Fig. 6) has feed-openings *c c*, which are opened and closed by a revoluble valve-plate *a*<sup>3</sup>, having similar openings. The valve-plate is clamped down by a screw connection, as usual.

In starting the apparatus a fire is started on the grate and the valve *j* opened to give a direct draft. The gaseous products of combustion passing out through the ports *a'* into the annular chamber F rise through the latter and pass therefrom through the discharge-flue G into the valve-chamber and through the latter into the open air. The heat carried by the products of combustion heats the superheater II and the coils I I'.

When the fire has been well started, and the apparatus sufficiently heated for the manufacture of gas, the producer is filled to the top with coal (if not previously filled) and tightly

closed, the valve *j* is closed, and the various stop-cocks opened and properly adjusted for the admission, in proper quantities, of steam into the superheater, oil into the coil I, air into the annular chamber E, steam and air (either or both, or free oxygen in lieu of air) into the chamber B below the grate, and oil-vapor through the pipe M into the interior of the gas-producing charge. The apparatus is now in operation.

The air admitted into the annular chamber E escapes therefrom through the ports *e'* into the base of the annular chamber F, where it meets the carbonic-oxid gas issuing from the producer through the ports *a'*, and supplies the oxygen necessary for the combustion of said gas.

The intense heat evolved by this operation heats the chamber A<sup>2</sup> and the coal contained therein to a high degree, so that when the coal reaches the point of combustion it is already heated almost, if not altogether, to incandescence, so that its conversion into gas begins at once. The chamber A<sup>2</sup> thus subserves the purpose of a heating-reservoir to hold a supply of coal already highly heated when it reaches the point at which combustion is carried on; and by thus utilizing the heated gases for heating the coal in advance of, and preparing it for combustion, the operation is carried on much more rapidly and economically.

By the peculiar arrangement of parts the heat carried by the gases is further utilized for heating the superheater, the oil-vaporizing coil I, and the feed-water-heating coil I, so that all the heat required, except that for heating the steam-boiler, is furnished by the hot gases in their passage through the apparatus.

The steam admitted into the superheater from the supply-pipe *h* passes around in either or both directions to the outlet at the back, from whence a portion passes through the pipe O to the base of the producer, as already explained, the remainder passing through the pipe *m* into the coil I, which is also highly heated. The oil entering the coil from the supply-pipe N is immediately vaporized and the vapor mixed with and carried forward by the steam-vapor. After traversing the coil the mixed steam and oil vapor passes into the vertical pipe M, which conveys it to the center of the charge and delivers it at the point where combustion is going on, so that the carbon contained therein is immediately absorbed and taken up by the gases and utilized in enriching the same.

The heating-chamber A<sup>2</sup> should be kept filled, coal being introduced through the valved top as fast as it is consumed at the bottom, to the end that a constant supply of heated coal may be kept on hand and a steady and uninterrupted operation maintained.

Having thus described my invention, what I claim is—

1. In a gas-producing apparatus the combi-



nation of a furnace-chamber, a superposed heating-reservoir of substantially the same sectional area of the furnace-chamber and forming a continuation of the same, an annular inclosing chamber wholly surrounding the heating-reservoir, a series of outlet-ports forming a direct communication between the base of the annular chamber and the base of the heating-reservoir, a steam-surperheater located in the inclosing chamber, a valve-chamber connected with the inclosing chamber, an oil-vaporizing coil in said valve-chamber, connections for mixing the superposed steam and oil, and connections for introducing the mixed steam and vaporized oil into the gas-producing charge at the point of combustion.

2. In a gas-producing apparatus the combination of a furnace-chamber, a superposed heating-reservoir forming a continuation thereof, an annular inclosing chamber wholly surrounding the heating-reservoir, a series of outlet-ports forming a communication between the base of the annular chamber and the base of the heating-reservoir, an annular air-chamber surrounding said ports and provided with a series of openings facing the same, a steam-superheater located in the inclosing chamber, a valve-chamber connected with the inclosing chamber, an oil-vaporizing coil in the valve-chamber, connections for mixing the superheated steam and oil, and

connections for introducing the mixed vaporized oil and superheated steam into the gas-producing charge at the point of combustion. 35

3. In a gas apparatus the combination of a furnace-chamber, a superposed heating-reservoir, a chamber surrounding and inclosing the latter, gas-ports leading into the base of said inclosing chamber, a steam-superheater set into the walls of the inclosing chamber, connections for introducing steam into the superheater, and connections for introducing the superheated steam into the base of the furnace-chamber. 45

4. In a gas-producing apparatus the combination of the producer or generator divided by a series of gas-ports into upper and lower sections, an inclosing chamber around the upper section, a steam-superheater in said inclosing chamber, a valve-chamber connected with said inclosing chamber, an oil-vaporizing coil in said valve-chamber, means for introducing steam into said superheater and suitable connections for introducing superheated steam, air, and coal, oil or oil-vapor into the producer. 55

In testimony whereof I hereunto set my hand this 1st day of April, 1893, in the presence of two attesting witnesses.

LEVI STEVENS.

Witnesses:

S. WALKER, Jr.,  
BAYARD STOCKTON.