

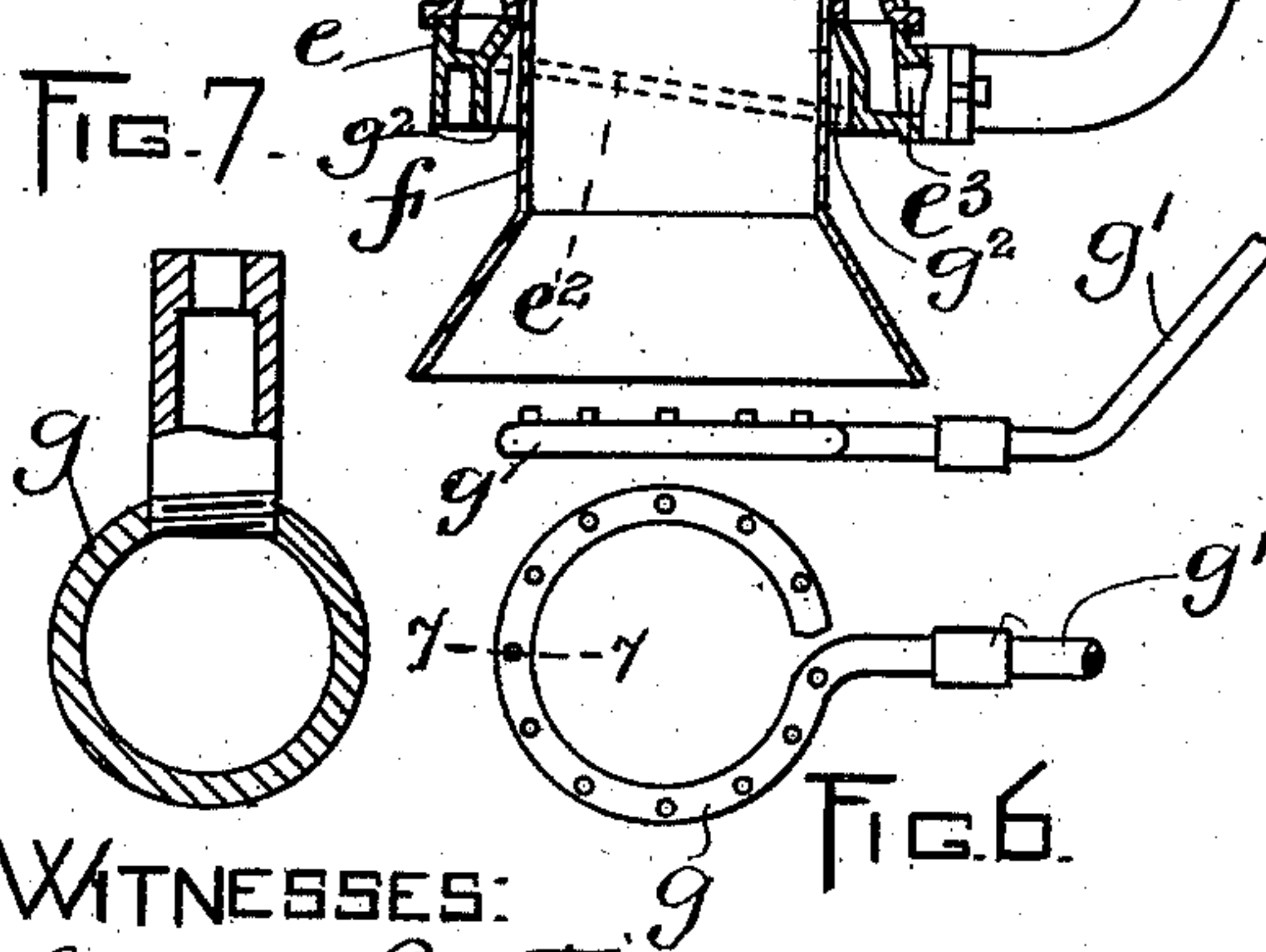
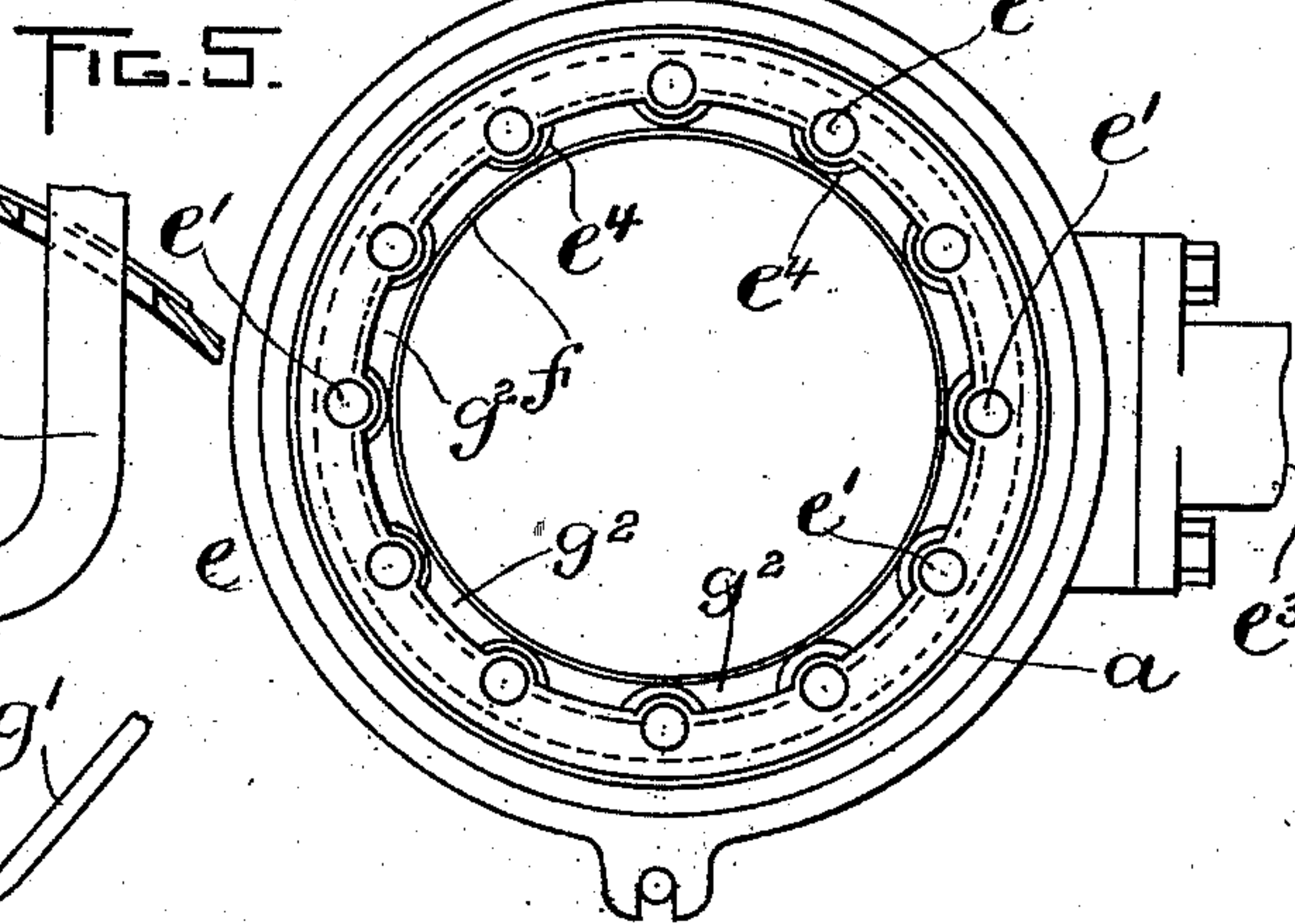
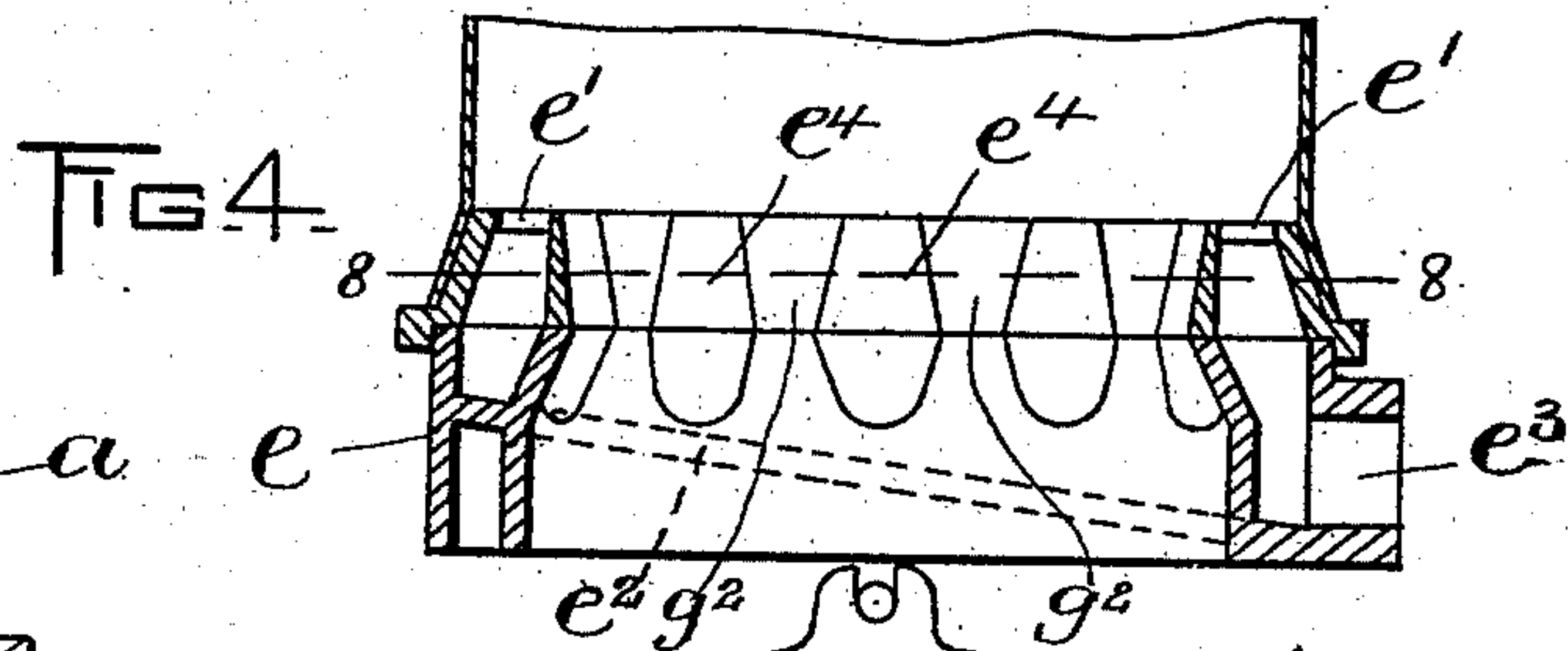
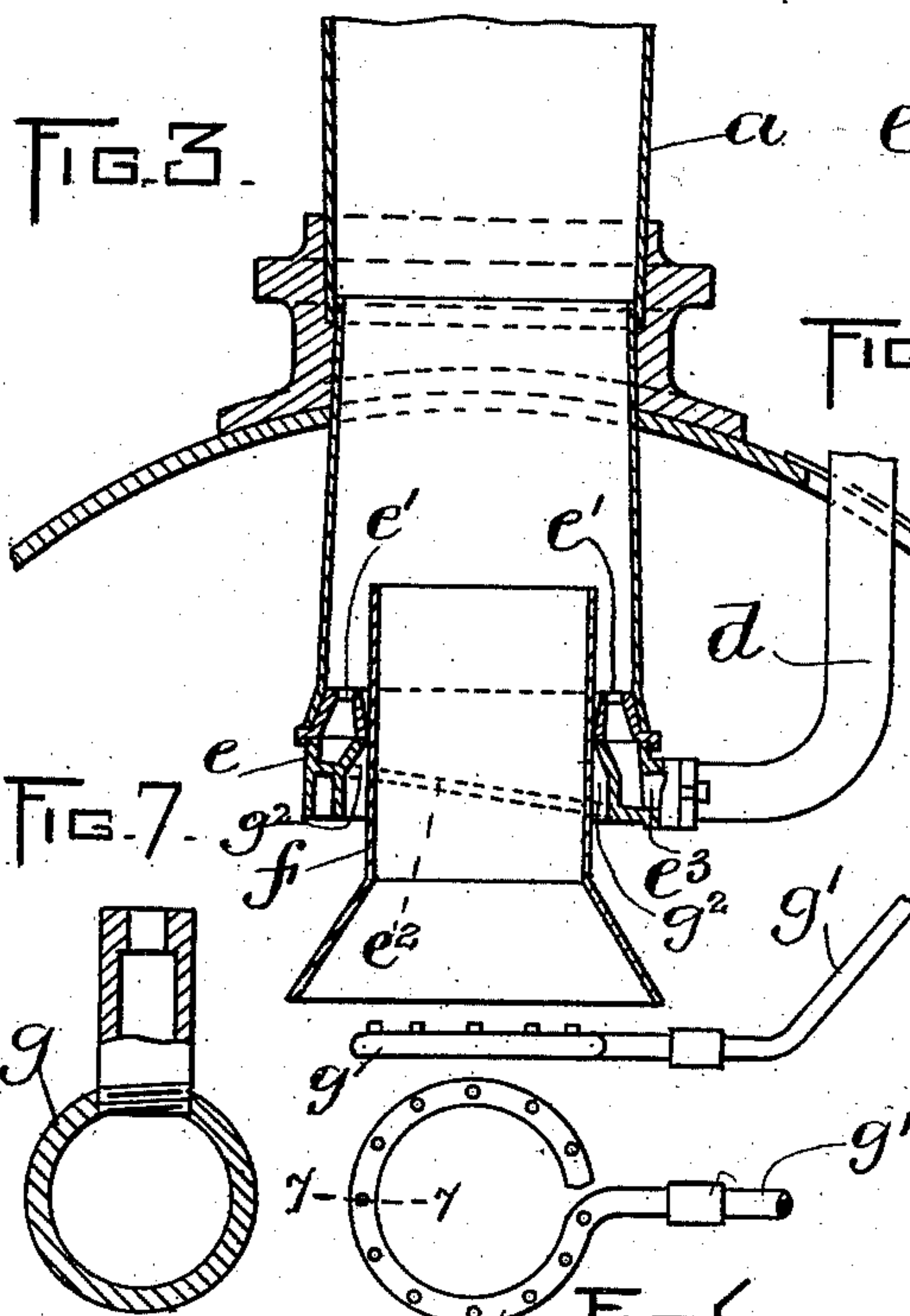
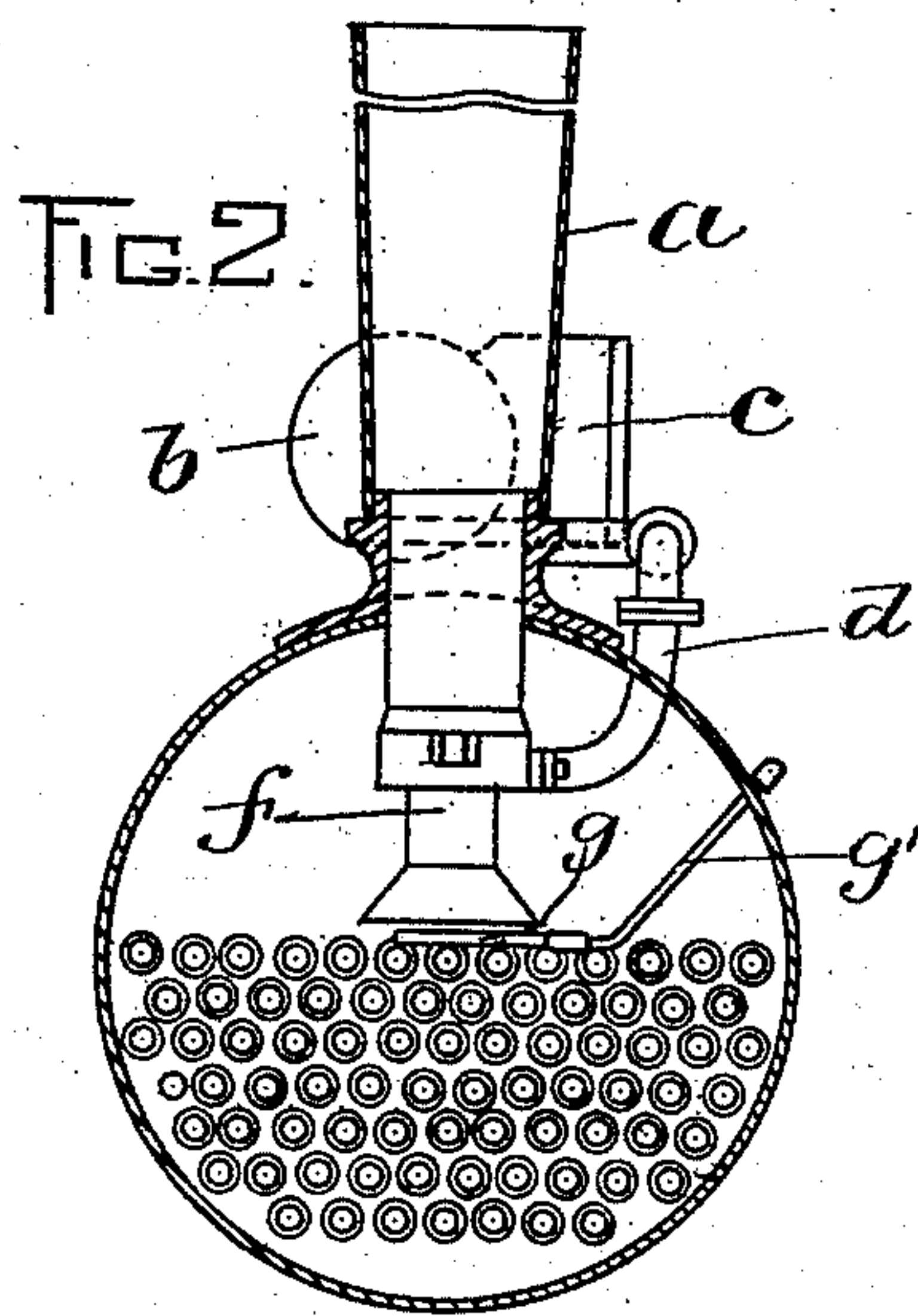
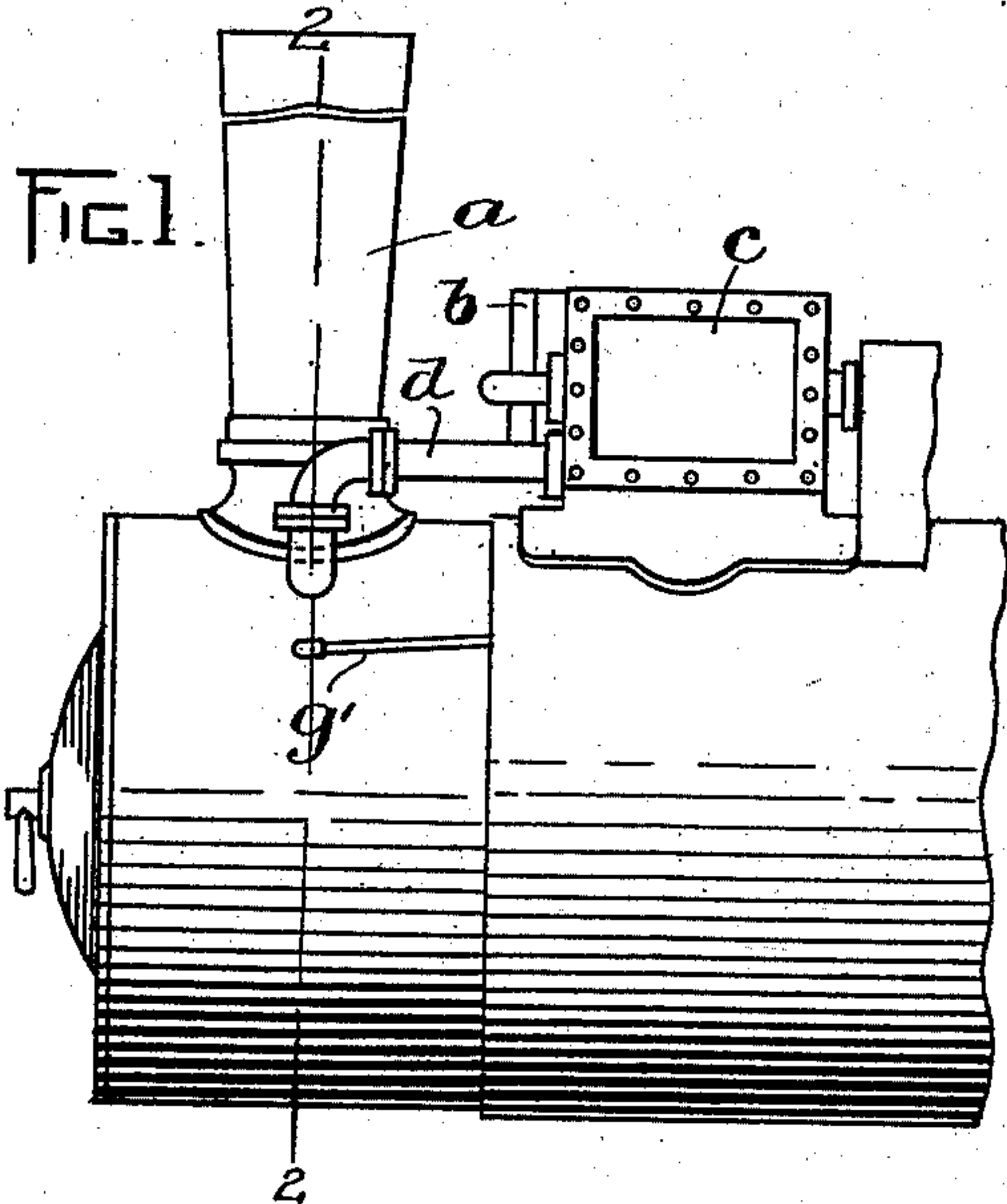
No. 705,713.

Patented July 29, 1902.

J. Y. SMITH.
EXHAUST APPARATUS.
(Application filed Mar. 7, 1902.)

(No Model.)

2 Sheets—Sheet I.



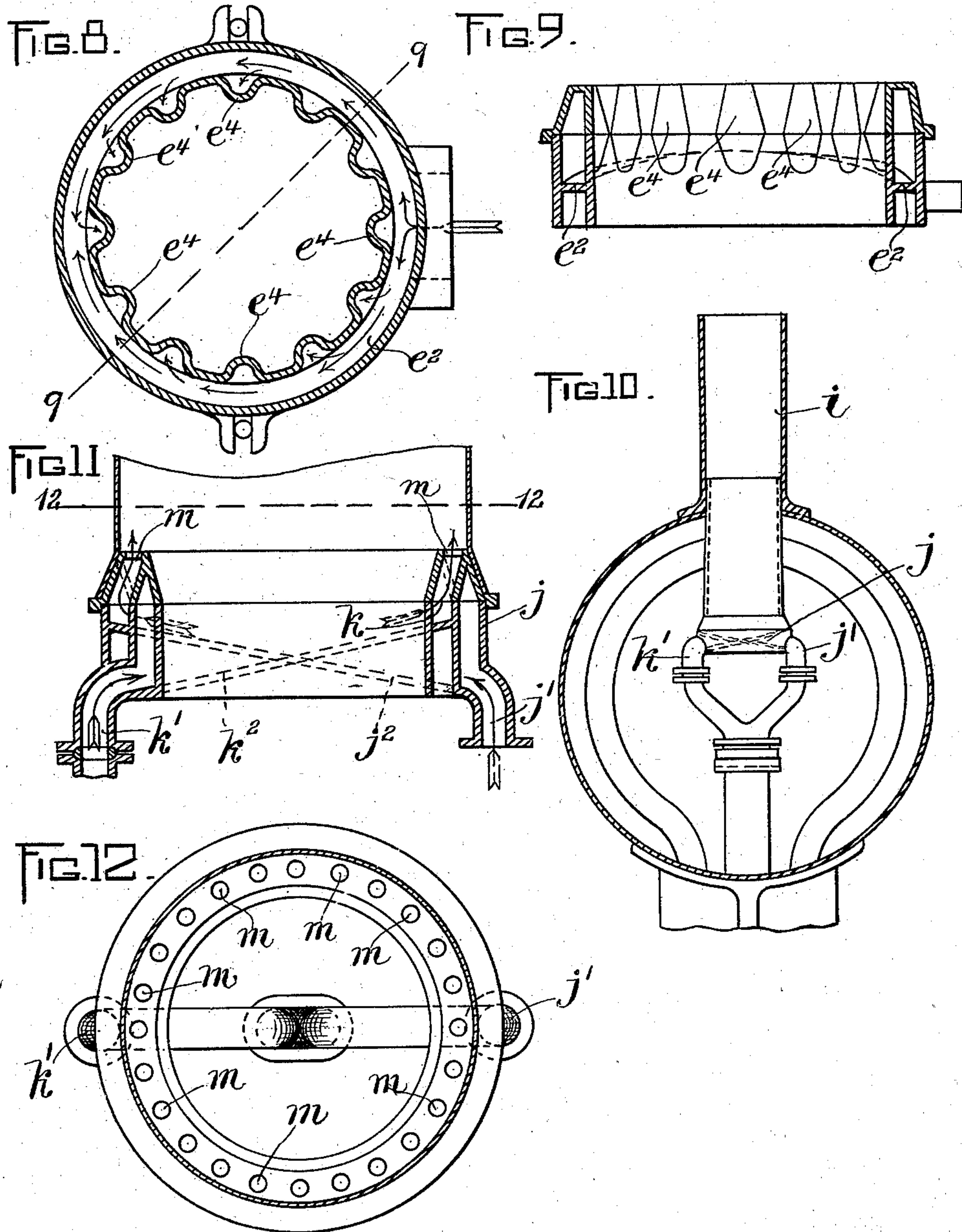
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2 Sheets—Sheet 2.



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UNITED STATES PATENT OFFICE.

JOHN Y. SMITH, OF DOYLESTOWN, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO WILLIAM R. DEWEY, TRUSTEE, OF NEWTON, MASSACHUSETTS.

EXHAUST APPARATUS.

SPECIFICATION forming part of Letters Patent No. 705,713, dated July 29, 1902.

Application filed March 7, 1902. Serial No. 97,049. (No model.)

To all whom it may concern:

Be it known that I, JOHN Y. SMITH, of Doylestown, in the county of Bucks and State of Pennsylvania, have invented certain new and useful Improvements in Exhaust Apparatus, of which the following is a specification.

This invention relates principally to exhaust apparatus for consuming smoke and sparks from boiler-furnaces, and may be used in connection with the furnaces of either locomotives or other movable engines or with the furnaces of stationary engines.

The invention consists in the several improvements hereinafter described and claimed, whereby a practically continuous upward or outward draft may be maintained in a furnace of the character above specified, thus preventing back pressure or any considerable cessation of draft and facilitating combustion to such an extent as to practically consume the smoke and sparks, besides accomplishing other desirable results, all as hereinafter described.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a side elevation of a portion of a road-engine provided with an exhaust apparatus embodying my invention. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents an enlargement of a portion of Fig. 2, showing the exhaust-nozzle in section. Fig. 4 represents a detached sectional view of the exhaust-nozzle. Fig. 5 represents a top plan view of the same. Fig. 6 represents a top plan view of the live-steam nozzle shown in edge view in Fig. 3. Fig. 7 represents a section on line 7 7 of Fig. 6. Fig. 8 represents a section on line 8 8 of Fig. 4. Fig. 9 represents a section on line 9 9 of Fig. 8. Fig. 10 represents a vertical transverse section through the smoke-chamber of a locomotive-engine provided with an exhaust apparatus embodying my invention. Fig. 11 represents a sectional view of the exhaust-nozzle shown in Fig. 10. Fig. 12 represents a section on line 12 12 of Fig. 11 and a plan view of the parts below said line.

The same reference characters indicate the same parts in all the figures.

Referring to Figs. 1 to 9, inclusive, *a* represents the smoke-stack of a single-cylinder engine, which, as shown in Figs. 1 and 2, is of the type used for impelling traction or road engines for any purposes, *b* being the cylinder, *c* the steam-chest, and *d* the exhaust-pipe, extending from the steam-chest into the smoke-chamber below the stack.

In carrying out my invention I provide an annular exhaust-nozzle *e*, which receives steam from the pipe *d*, said nozzle being located in the base of the stack and arranged in a substantially horizontal plane, its formation being such that it delivers a circular series of steam-jets upwardly into the stack and in close proximity to the wall of the stack, so that the steam-jets surround a central passage for smoke and products of combustion from the furnace. The top or upper end of the nozzle is substantially horizontal and is provided with a series of outlets *e'*, arranged in a circular series in close proximity to the internal surface of the stack. The bottom *e²* of the nozzle is inclined from one side to the opposite side of the nozzle, as indicated by dotted lines in Figs. 3 and 4, so that the height of the nozzle or the distance between its bottom and its top varies, the height being greatest at one side and smallest at the opposite side. At the side of the nozzle having the greatest height is a steam-inlet *e³*, connected with the exhaust-pipe *d*, so that the exhaust-steam enters the nozzle at its highest or deepest portion. The reduction in the height or depth of the nozzle from the side having the inlet *e³* to the opposite side causes a practically equal distribution of the steam-pressure throughout the entire circle of the nozzle, so that the steam issues from all the outlets *e'* at practically the same pressure. The equalization of the pressure is facilitated by the horizontal arrangement of the inlet *e³*, which causes the steam to enter in a horizontal or approximately horizontal direction.

f represents a supplemental or petticoat pipe, which is surrounded by the nozzle *e* and extends a short distance below and a short distance above the same, as shown in Fig. 3. Between the pipe *f* and the interior of the nozzle are a series of vertical passages *g²*,

which communicate at their lower ends with the smoke-chamber and at their upper ends with the stack. The intermittent discharges of exhaust-steam from the nozzle *e* induce upward currents of air from the smoke-chamber through the passages *g*², these currents continuing after the supply of exhaust-steam is cut off and practically until the next admission of exhaust-steam, so that the outlets *e'* of the nozzle and the pipe *f* conjointly furnish a continuous upward draft in the stack, preventing back pressure or the downward movement of relatively cold air through the stack. By thus maintaining a continuous draft I am enabled to much more completely consume the smoke, cinders, sparks, &c., than heretofore. The passages *g*² are preferably formed by inwardly-projecting protuberances *e*⁴, formed on the inner wall of the nozzle *e*, said protuberances bearing on the external surface of the supplemental pipe *f*, as shown in Figs. 3 and 5.

The steam-jets and induced jets or currents form a practically circular series, passing upwardly along the inner wall of the stack and surrounding the central portion of the stack, through which the products of combustion pass, the said products being thus exposed to contact with an annular enveloping stream of steam and hot air, which facilitates the combustion of any unconsumed products that may pass above the nozzle.

g represents a live-steam nozzle which is connected by a pipe *g'* with the steam-space of the boiler and is arranged to deliver jets of steam under boiler-pressure upwardly into the supplemental pipe *f*, said nozzle being of annular form, so that it does not interfere materially with the upward movement of the products of combustion into said pipe *f*. The pipe *g'* is to be closed while the engine is in operation and exhaust-steam is being supplied through the pipe *d*. When the engine is not in operation, the pipe *g'* may be opened, the live steam supplied by it creating a continuous upward draft in the stack and producing the same effect as the upward draft caused by the exhaust-nozzle *e*.

My invention, so far as the varying height or depth of the annular exhaust-nozzle is concerned, is not limited to the construction shown in Figs. 1 to 9, inclusive. In Figs. 10 and 11 I show an adaptation of the said nozzle to a locomotive-engine. *i* represents the stack of the engine, and *j* *k* represent two concentric annular exhaust-nozzles, one located within the other, the two nozzles being located at the base of the stack. The outer nozzle *j* receives exhaust-steam from one of the cylinders of the engine through an inlet *j'*, while the inner nozzle *k* receives exhaust-steam from the opposite cylinder through an inlet *k'*. The nozzle *j* has an inclined bottom *j*², while the nozzle *k* has an oppositely-in-

clined bottom *k*². The outlets *m* at the upper ends of the nozzles are arranged in a circular series. The steam is admitted alternately into the nozzles *j* and *k* and maintains a practically continuous draft through the stack.

I claim—

1. An apparatus of the character specified, comprising a stack or conduit, and an annular exhaust-nozzle within the conduit, said nozzle having in its upper side a series of outlets arranged to deliver a series of jets surrounding the central portion of the conduit, and an exhaust-pipe entering one side of said nozzle and arranged to deliver steam horizontally thereto, the bottom of the nozzle being inclined relatively to the top, whereby the pressure of the steam at the several outlets is substantially equalized.

2. An apparatus of the character specified, comprising a stack or conduit, an annular exhaust-nozzle in said conduit having in its upper side a series of outlets arranged to deliver a series of jets surrounding the central portion of the stack, an exhaust-pipe communicating with the nozzle, a supplemental conduit surrounded by said nozzle, and a series of passages between the nozzle and supplemental conduit, whereby a series of induced jets of air from the smoke-chamber may be admitted to the stack.

3. An apparatus of the character specified, comprising a stack or conduit, an annular exhaust-nozzle in said conduit having in its upper side a series of outlets arranged to deliver a series of jets surrounding the central portion of the stack, and a series of protuberances on its inner side, an exhaust-pipe communicating with the nozzle, and a supplemental conduit surrounded by the nozzle, said pipe and the protuberances on the nozzle forming a series of passages for the delivery of induced jets of air to the stack.

4. An apparatus of the character specified, comprising a stack or conduit, an annular exhaust-nozzle in said conduit having in its upper side a series of outlets arranged to deliver a series of jets surrounding the central portion of the stack, an exhaust-pipe communicating with the nozzle, a supplemental conduit surrounded by said nozzle, a series of passages between the nozzle and supplemental conduit, whereby a series of induced jets of air from the smoke-chamber may be admitted to the stack, and a nozzle connected with a constant source of steam-supply and adapted to direct steam under boiler-pressure upwardly through the supplemental pipe into the stack.

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

JOHN Y. SMITH.

Witnesses:

HORACE BROWN,
A. D. HARRISON.