

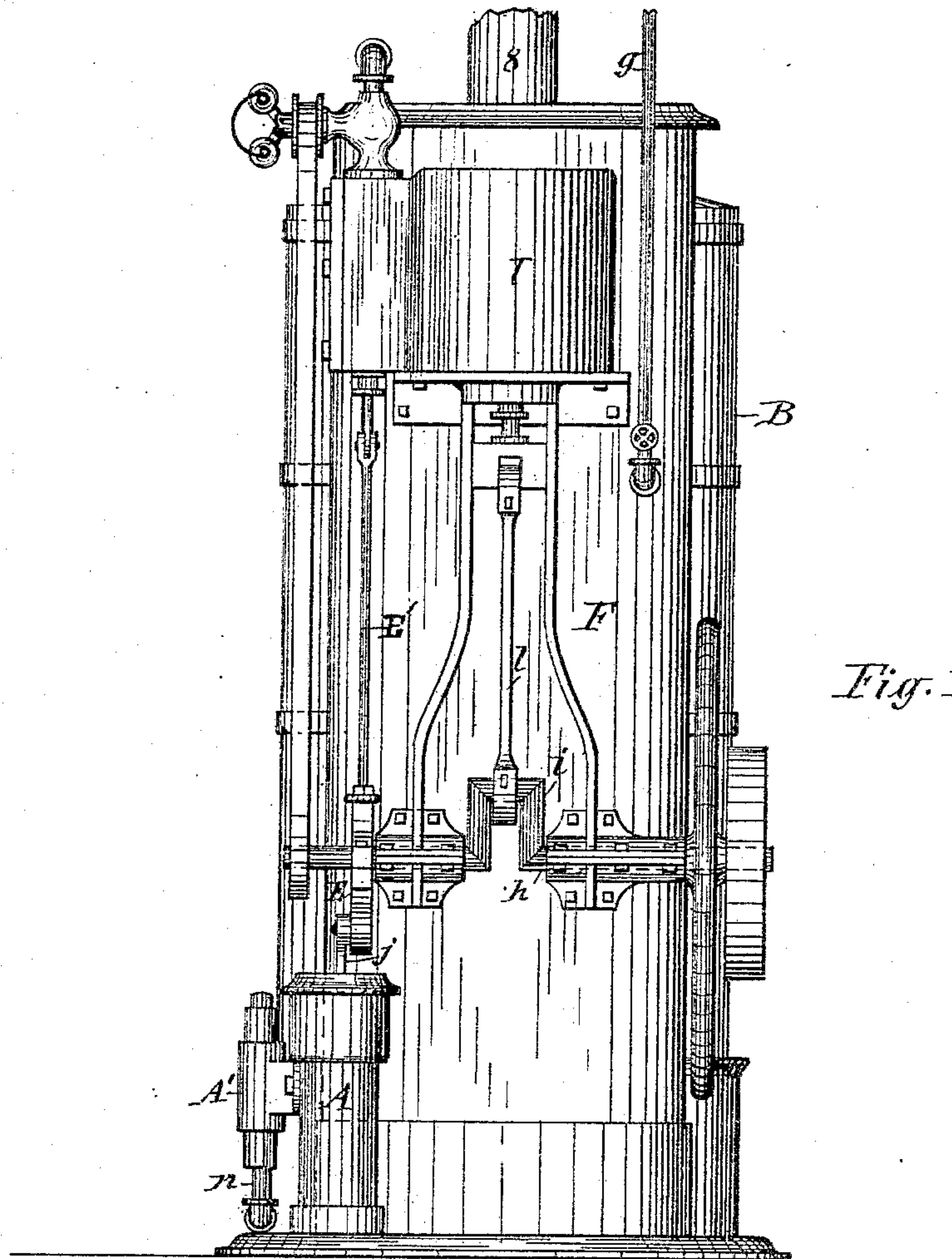
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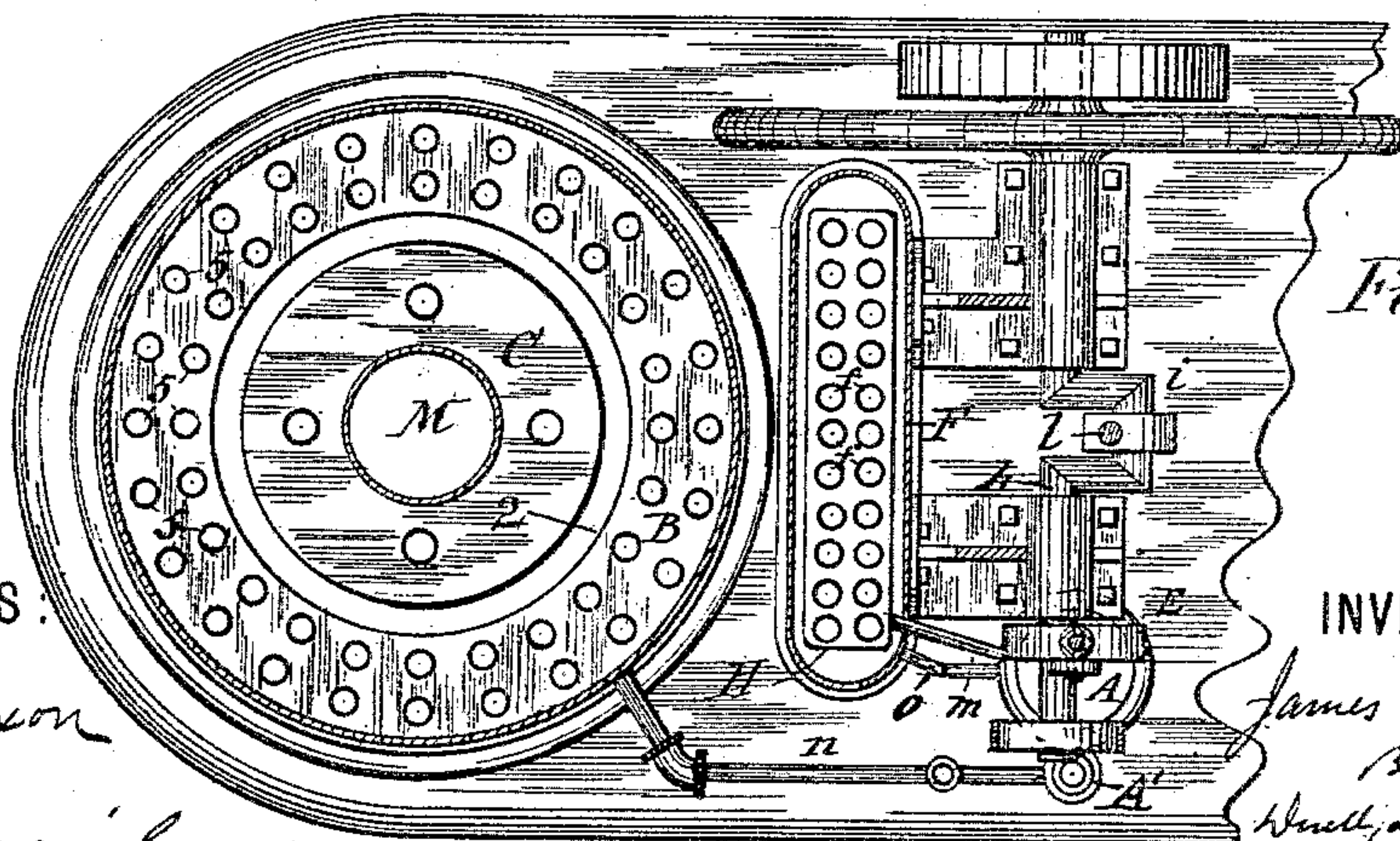
J. A. SHEPARD.  
STEAM ENGINE.

No. 412,047.

Patented Oct. 1, 1889.



*Fig. 1*



*Fig. 3*

WITNESSES:

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(No Model.)

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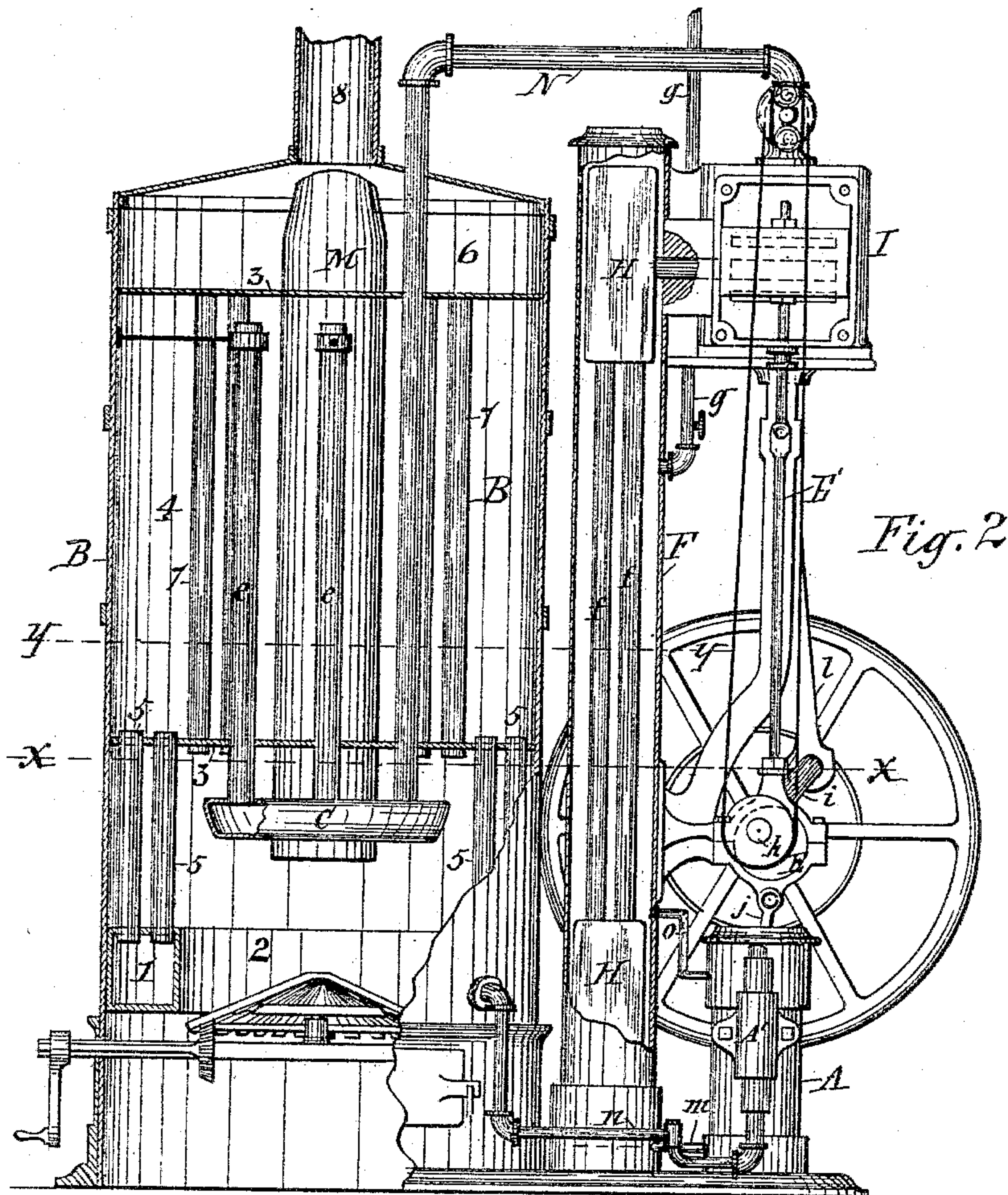


Fig. 2

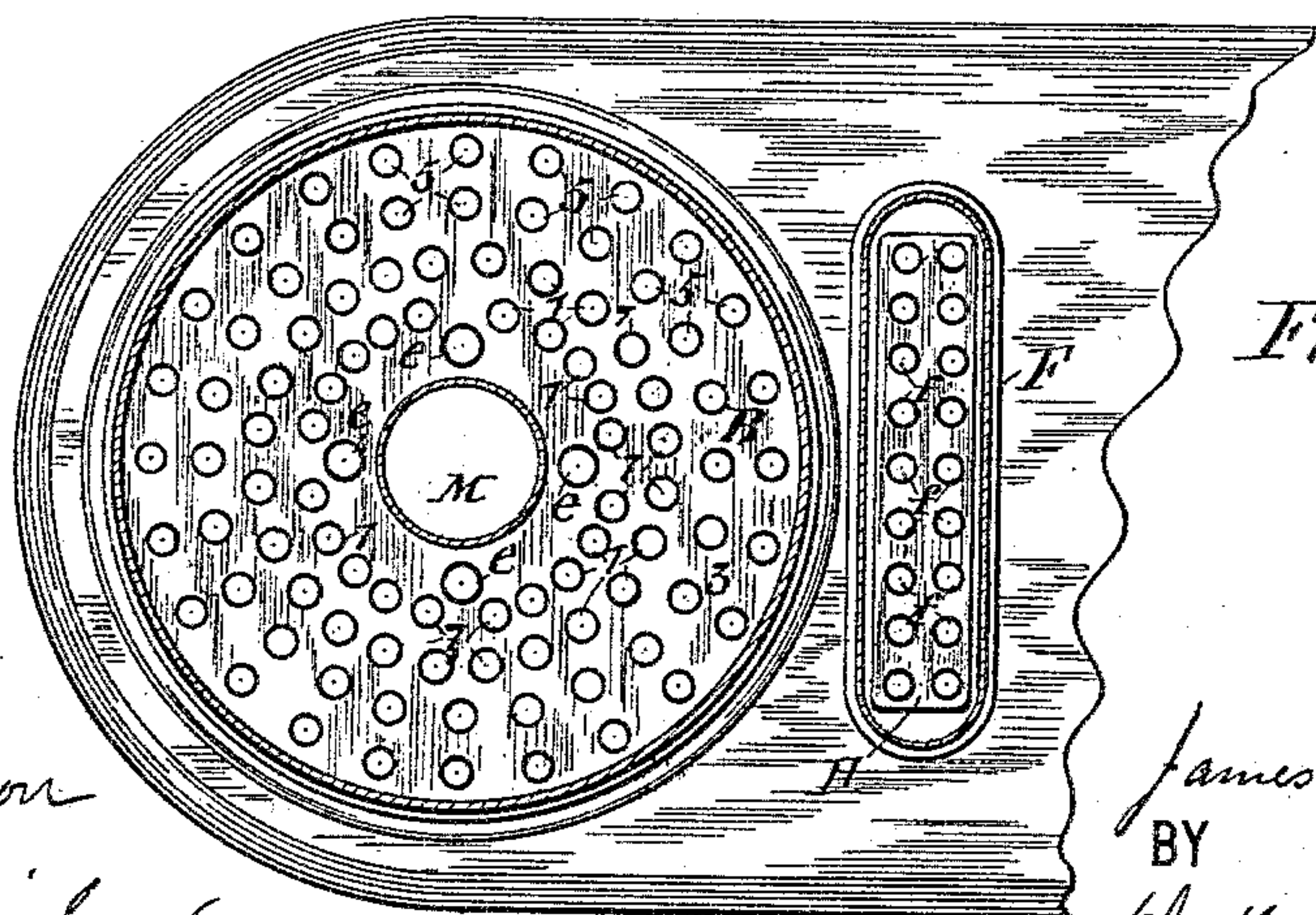


Fig. 4

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(No Model.)

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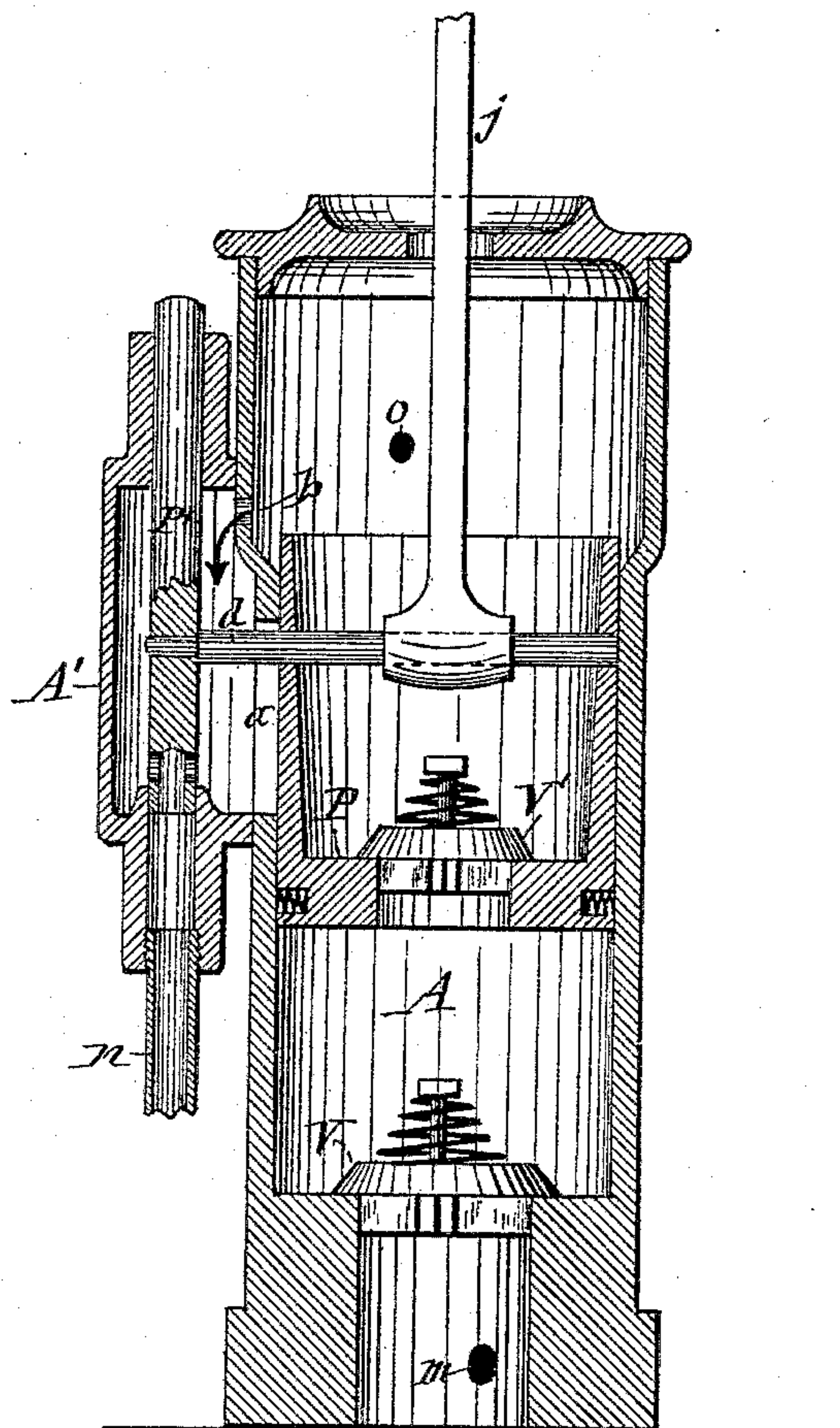


Fig. 5

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# UNITED STATES PATENT OFFICE.

JAMES A. SHEPARD, OF HAVANA, NEW YORK.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 412,047, dated October 1, 1889.

Application filed August 27, 1887. Serial No. 247,998. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES A. SHEPARD, of Havana, in the county of Schuyler, in the State of New York, have invented new and useful Improvements in Steam-Engines, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

The invention relates to steam-engines, and more particularly does it relate to certain improvements in the construction of a combined boiler and superheater for supplying the engine with dry steam at high pressure. The organization of the boiler and superheater is such as to allow the same furnace-fire to be economically employed in heating both the boiler and the superheater connected therewith, this latter being in free communication with the steam-space of the boiler and with the engine, respectively, and compactly arranged within the boiler proper in such relation to the water-space thereof as to guard against the wear and destruction of the superheater by reason of the intense furnace-flame to which it is exposed.

The invention relates, also, to certain improvements in the condensing apparatus of the engine, the condenser being in controllable communication with the air or feed pump, so that the boiler-supply derived from the exhaust-steam may be supplemented at will by commingling therewith the lukewarm water escaping from the jacket of the condenser.

The nature and details of these several improvements will fully appear from the description following, and be thereafter distinctly pointed out by the claims at the conclusion thereof.

In the annexed drawings, Figure 1 is a front elevation of a steam-engine embodying my improvements. Fig. 2 is a vertical transverse section of the same. Figs. 3 and 4 are horizontal transverse sections of the boiler and condenser, respectively, on lines *x x* and *y y* in Fig. 2; and Fig. 5 is an enlarged vertical transverse section of the air-pump connected therewith.

Similar letters of reference indicate the corresponding parts.

B represents the steam-boiler. The said boiler consists of an annular water-chamber 1, constituting the wall of the fire-pot 2, a

cylindrical shell rising from the said water-chamber and having flue-sheets 3 3 extending across its interior, and thereby forming a water and steam compartment 4 above the fire-pot, which compartment communicates with the lower water-chamber 1 by pipes 5 5. Over the top of the compartment 4 is a smoke-box 6, through the center of which and through the compartment 4 is extended the fuel-magazine M. Around the exterior of the magazine are fire-flues 7 7, extending vertically through the compartment 4, and carrying the products of combustion from the fire-pot to the smoke-box 6, from which they escape through the exit-pipe 8.

C denotes a steam-superheater, which is connected with the boiler so as to receive the steam and superheat the same. The said superheater is here represented in the form of an annular chamber C, arranged concentric over the fire-pot 2 and communicating with the steam-space of the boiler by a pipe or pipes *e*. The pipes *e* open near their outer ends into the steam-space of the boiler, and extend thence, as shown, through the water-space of the boiler and flue-sheet 3 to the expansion-chamber or superheater proper C, which latter is separately sustained in the flame-chamber, so as to be freely exposed to the furnace-gases. The pipes *e*, being thus submerged by the water, serve to conduct the heat away from the chamber C, and to impart the same to the water, so that at the outset and before the steam is generated the chamber C, notwithstanding its exposed location, will be relieved from the destructive influence of the furnace-flame. By this expedient the superheater or expansion-chamber while efficiently arranged to insure the preheating of the live steam, as desired, is also protected by reason of the function and location of the pipes *e* from injurious overheating, which otherwise would be apt to occur at the outset and before the steam is generated in volume sufficient to circulate within the expansion-chamber and to keep it comparatively cool.

F represents the condenser, consisting of an upright water-chamber, in opposite ends of which are arranged steam-condensing chambers H H, connected with each other by vertical pipes *f f*, as shown in Fig. 2 of the drawings. Cold water is admitted into the said



water-chamber by a pipe *g*, which leads from a tank or reservoir situated at a proper elevation above the water-line of the boiler. To the upper end of the condenser is secured the steam-cylinder I, the exhaust-port of which communicates with the upper chamber H. A pipe N is extended from the superheater C to the steam-chest of the engine to pass the superheated steam into the cylinder at the end from which the piston is to be driven. The aforesaid cylinder is placed in a vertical position, and beneath it is arranged horizontally the driving-shaft *h*, which is provided with a crank *i*, and receives motion from the piston of the cylinder by the rod *l*, connecting the crank with the piston-rod in the usual manner. The valve of the steam-chest of the engine receives its motion from an eccentric E on the shaft *h* by the eccentric-rod E', connected with the valve-stem in the usual and well-known manner. Under the shaft *h* is the air-pump A, consisting of an upright barrel or case provided at its base with an induction-valve V, above which is the piston P of the form of a hollow cylinder, which is open at the top and provided at its bottom with the lift-valve V', said piston receiving motion from an eccentric—as E, for example—on the driving-shaft *h* by a rod *j*, connecting the same with the piston P. Below the induction-valve V the pump-case A is tapped by a pipe *m*, which is extended to and communicates with the interior of the lower steam-condensing chamber H, so as to pump therefrom the water of condensation and air. The upper part of the aforesaid pump-case is provided in its side with a vertical slot *a* and with a port *b* above said slot. To the exterior of this slotted side of the pump-case A is firmly secured the feed-pump case A', which has an opening in the side adjacent to the case A and coinciding with the slot *a* and port *b*. In vertical guide-channels through the upper and lower ends of the feed-pump case A' slides the supplemental piston P', which is actuated by the piston P of the condenser-pump by means of the pin *d*, which couples the rod *j* to the piston P and projects through the slot *a*, and has its end firmly attached to the supplemental piston P', as shown in Fig. 5 of the drawings. The lower end of the supplemental pump-case A' is provided with a discharge-opening, from which leads a pipe *n* to the water-space of the boiler.

In the operation of the engine the superheated steam introduced in the cylinder of the engine drives before it the piston, while the steam is exhausted from before the piston and passes into the condenser. The pump A, being simultaneously in action, draws the water of condensation and air from the condenser and transfers said water to the supplemental pump A' through the port *b*, as represented

by an arrow in Fig. 5 of the drawings, and is thence forced into the boiler by the said pump.

In order to permit of adding feed-water to the water of condensation in its flow to the boiler when required, I extend a water-supply pipe to either the air or feed pump and from the condenser, so as to conduct said feed-water with the water of condensation to the boiler. This device for supplying the feed-water is represented in the annexed drawings in the form of a pipe *o*, extended from the water-jacket of the condenser to the cylinder of the air-pump A, the pipe being furnished with a suitable stop-cock to regulate the flow of condensing water from the condenser to the pump.

The peculiar construction of air and feed pumps just detailed, wherein the pistons of both pumps are in cross-connection and are operated in common by a single rod, and wherein also both pumps have a common discharge, is not claimed herein; but such construction is hereby reserved to constitute the subject-matter of a separate patent.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

In a steam-engine of the character herein stated, the combination of the following instrumentalities: an upright steam-boiler provided with an annular water-chamber 1, forming the wall of a fire-pot, a cylindrical shell provided with fire-flues extended vertically through a water and steam compartment 4, communicating by means of pipes with said annular water-chamber, a central fuel-supply magazine, a smoke-box, an annular steam-superheater in the fire-chamber provided with vertical pipes rising into the steam-space of compartment 4, a pipe leading from said superheater into one end of a steam-cylinder provided with a reciprocating piston and valve, a vertically-arranged condenser provided with upper and lower chambers H H and pipe-communications, an exhaust-port from the engine-cylinder leading into the upper chamber of said condenser, a cold-water-supply pipe, and a pumping-engine communicating with the condenser and with the annular water-chamber of the boiler, all constructed and adapted for joint operation, substantially as described.

In testimony whereof I have hereunto signed my name, in the presence of two witnesses, at Havana, in the county of Schuyler, in the State of New York, this 1st day of August, 1887.

JAMES A. SHEPARD. [L. S.]

Witnesses:

E. D. VANKUREN,  
H. L. COUCH.