

(No Model.)

L. SERPOLLET.
STEAM GENERATOR.

No. 379,421.

Patented Mar. 13, 1888.

Fig. 1.

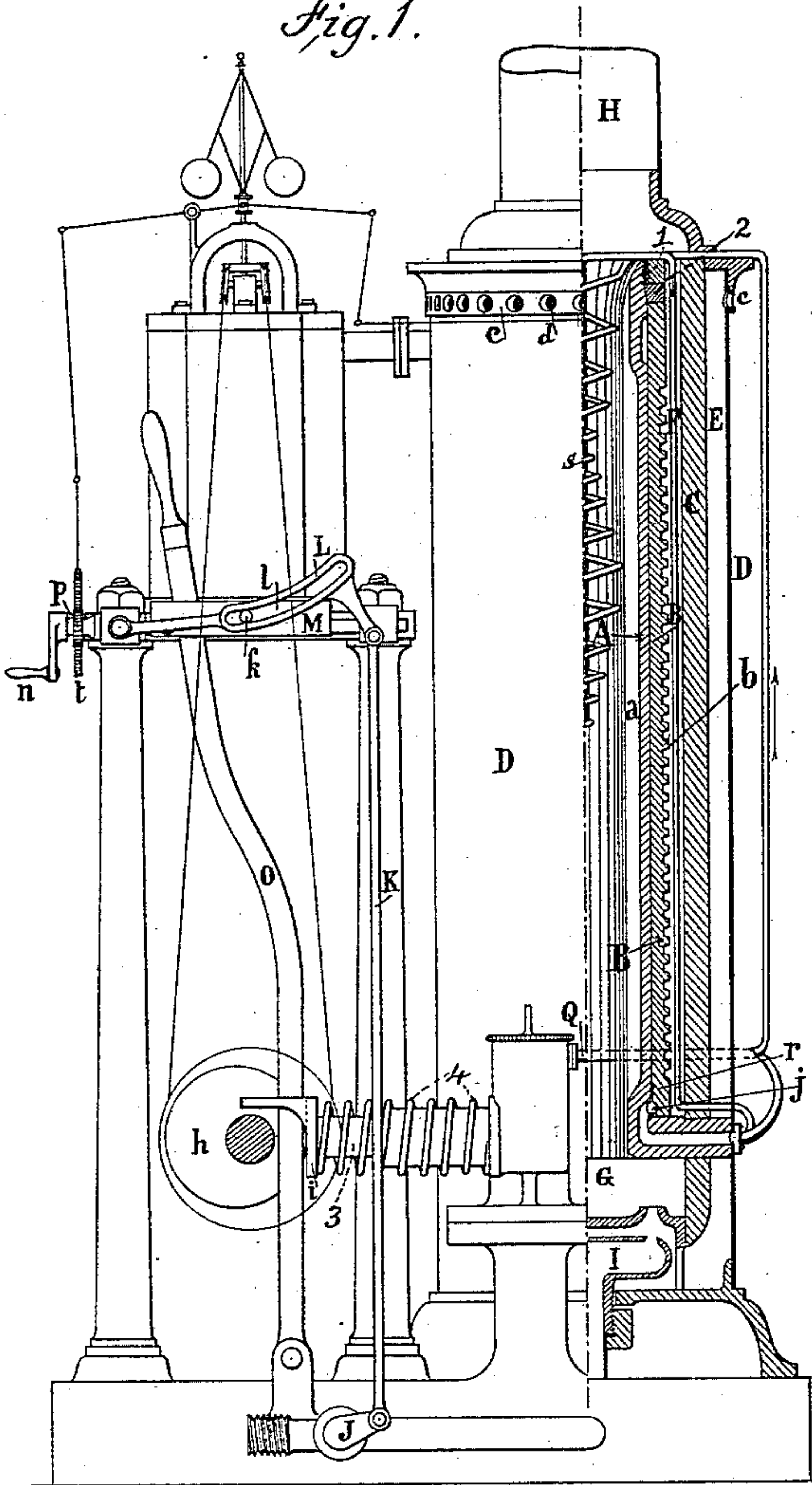


Fig. 3.

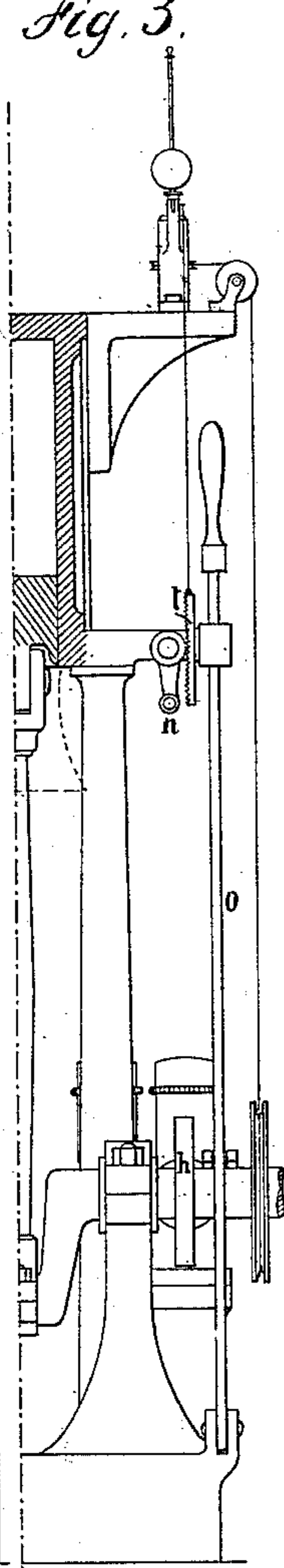


Fig. 4.

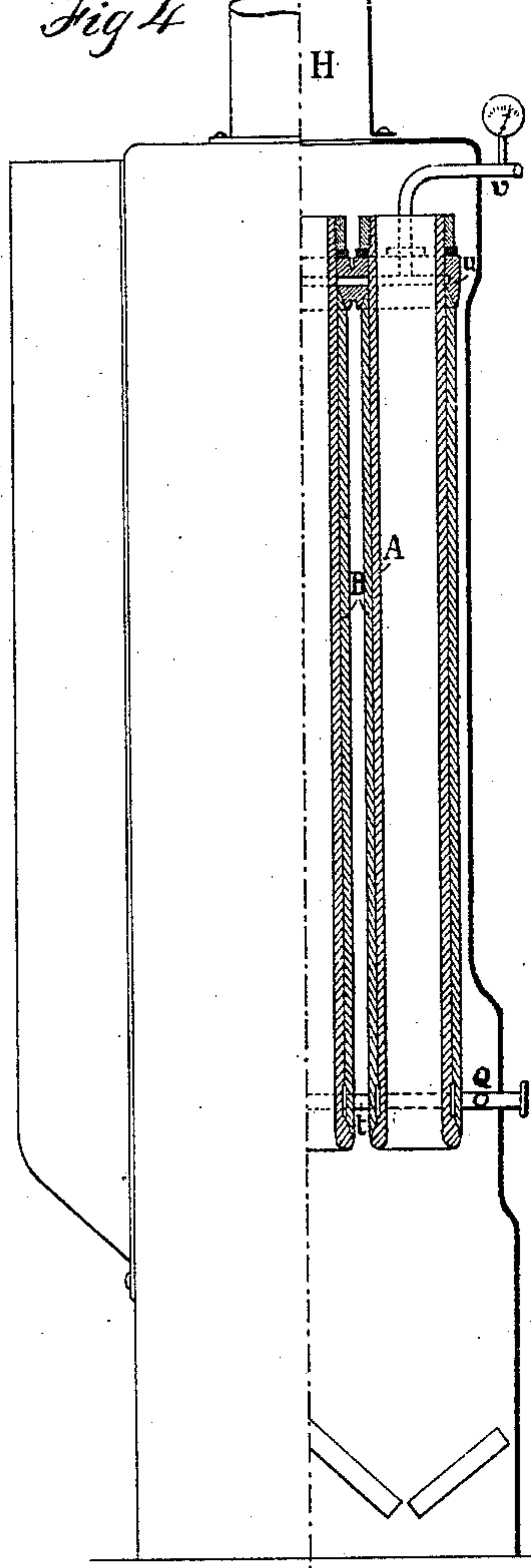


Fig. 2.

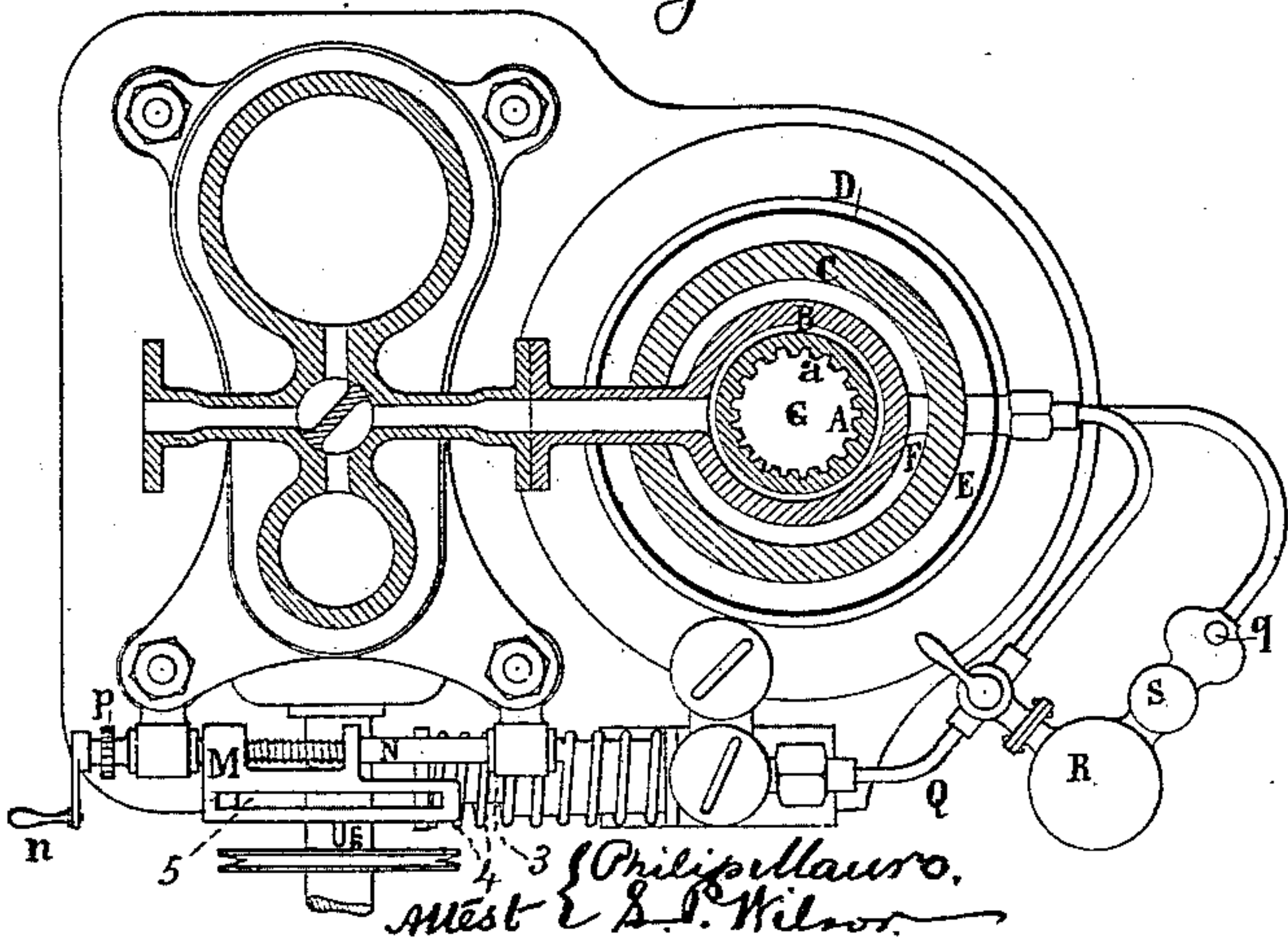
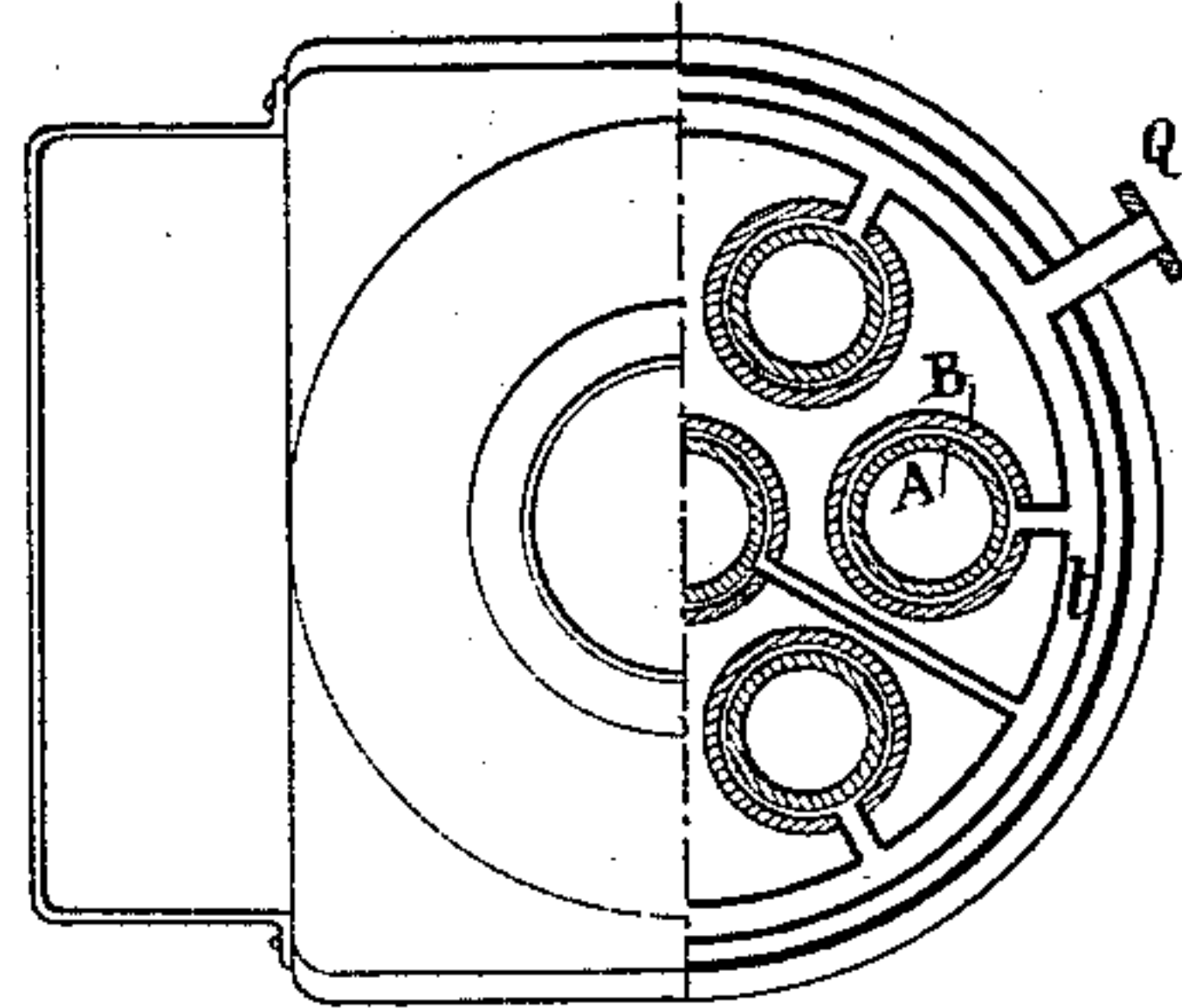


Fig. 5.



Léon Serpollet by
A. Pollok
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UNITED STATES PATENT OFFICE.

LÉON SERPOLLET, OF PARIS, FRANCE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 379,421, dated March 13, 1888.

Application filed November 29, 1887. Serial No. 256,418. (No model.)

To all whom it may concern:

Be it known that I, LÉON SERPOLLET, of Paris, in the Republic of France, have invented a new and useful Improvement in Steam-Generators, which is fully set forth in the following specification.

This invention relates to apparatus for producing the instantaneous vaporization of water, and the application of the steam thus obtained to engines or motors, even the smallest.

It comprises a special steam generator or vaporizer having a single vaporizing element or a group of such elements, and also certain combinations of parts for regulating the supply of water to and the heating of the generator.

In the accompanying drawings, which form part of this specification, Figure 1 is a view, partly in front elevation and partly in central vertical section, of a small steam-engine of the Wolf-Pilore type, combined with a simple generator and regulating apparatus constructed in accordance with the invention. Fig. 2 is a view of the same in horizontal section, looking down; Fig. 3, a partial view of the same, partly in edge elevation or profile and partly in vertical section; Fig. 4, a view, partly in elevation, of a compound generator constructed in accordance with the invention—that is to say, a generator with a group of communicating steam-generating elements; and Fig. 5, a view, partly in plan and partly in horizontal section, of the said compound generator.

The heating of the generator may be effected with solid fuel, a fire chamber for which is indicated in Fig. 4, or by means of fluid fuel—such as a liquid or gaseous hydrocarbon—the use of which is provided for in the apparatus of Figs. 1, 2, and 3. The heating by means of a hydrocarbon is the easier to regulate.

Each steam-generating element is composed of a metal tube, A, and a second tube, B, placed as a sleeve around said tube A, leaving between them a capillary space whose capillary action is greater at the bottom than at the top. The tubes are pressed together by means of a nut, 1, under which is placed a washer, 2. Each tube is provided on the outside surface (the adjacent surfaces between which the capillary space is formed being considered the inside)

with ribs or projections—such as the longitudinal ribs *a* or the horizontal ribs *b*—in order to increase the heating-surface. The inside surface, near the point of injection, is finely striated by grooves made in a lathe by means of emery-paper or a soft file and crossing each other in such manner as to offer to the liquid a multitude of microscopic divisional canals. Higher up, where the steam can be considered as well formed, the space which separates the two surfaces increases slightly, without, however, ceasing to be capillary.

Around the tubes there is a tubular envelope, C, preferably of refractory material, and outside of this a metal envelope, D, pierced at its upper part with a number of holes, *d*, to admit air for supplying the fire into the space between the envelopes C D, so that in passing down through the said space the air takes up a part of the radiant heat. The holes *d* can be obstructed in whole or in part, so as to cut off or to regulate the admission of air, by means of the slide-ring *c*, provided with similar holes and turned by hand or by a connection with the governor.

The hot gases of combustion rise through the space F, around the steam-generating tube B and the passage G, through the tube A, and pass off by the chimney H. When the gases are formed by a Bunsen burner, I, the supply thereto is regulated by a stop-cock, J, which is adjusted by hand or automatically by means of a governor. The adjustment is effected through the connecting-rod K and lever L, which is oscillated by means of a pin, *k*, projecting from the movable piece M into the slot *l* in said lever. The piece M is engaged by a screw-threaded rod, N, and is moved in the direction to depress or to raise said lever by turning said rod in one direction or the other. The rod N can be turned by hand by means of the crank-wheel *n*, or automatically by the governor raising or depressing a rack-bar, *t*, which engages the pinion *p*, fast in said rod N.

A lever, O, serves to put the apparatus into or out of operation by its action upon the plunger 3 of the feed-pump, which supplies the generator with water to be vaporized. This plunger is pushed in by the eccentric *h* acting against the shoe *i* on the plunger, and

is returned by the spring 4. By moving the lever O to the right the return of the plunger, is permitted, and consequently the feed by the pump is arrested. By properly placing the lever O the outward motion of the plunger, and consequently its stroke, can be limited and the supply of water regulated. The lever O passes through the slot 5 in the piece M, and normally bears against the surface at the left end of said slot, so that it partakes of the motion of the piece M, and the feed of water is regulated at the same time as the supply of fuel and to a corresponding extent; but said lever O is independently movable, for the purpose of stopping the feed whenever desired.

The water is forced from the pump through the pipe Q, either directly or after passing through the coil s into the annular throat j, formed at the bottom of the steam-generating element, and thence it enters the capillary space between the tubes A B by little furrows r, which taper to points in a little distance.

In order not to have to stop the generation of steam in case the pump should be stopped for a moment, the compressed-air regulator R, with a discharge valve, S, is placed between the pump (which then sends the feed-water into it) and the steam-generator A B or the coil s. In that case the governor is made to control the balanced distributor g, as well as the stop-cock J and the ring e.

The coil s, forming a continuation of the outlet-pipe Q from the pump, is placed in the upper part of a generator and can be prolonged into the smoke-box. It has for its object to prevent the hot gases from escaping at too high a temperature, and, preliminarily, to heat under pressure the feed-water which is about to be instantaneously vaporized. This coil or heater may be a simple or a double cylinder or a spiral pipe.

When the generator, in consequence of the amount of power to be developed, is composed of a number of connected elements, as shown in Figs. 4 and 5, the injection is made by a circular conduit, t, having a branch for each element, and the plate u, which joins together the different elements at the top, is provided with passages through which the elements communicate with one another, and the steam is conducted to the pipe v, (provided with a manometer,) leading to the slide-valve, which distributes the steam, and permitting the de-

tention of the steam and avoiding the influence of objectionable anterior spaces.

The improved double-tube steam-generators have the advantages of lightness, strength, and small size, as well as a large heating-surface, which vaporizes the water instantaneously as it is injected, and by permitting a uniform heating, are free from the dangers of irregular expansion. They can be easily taken apart, inspected, and put together, and are always perfectly tight. These advantages result from the circular form of the steam-generating element, the construction of the two tubes, and their relative arrangement.

I claim as my invention—

1. The vaporizing or steam-generating element formed by the exteriorly-ribbed tubes, placed one around the other and pressed together by a nut acting on a washer, so as to form close joints, and provided with inlet and outlet passages, said element being adapted for multiplication, substantially as described.

2. The combination, with the stop-cock for regulating the supply of fuel and the pump-plunger, of the mechanism composed of the threaded rod, the piece moved thereby, and the two levers moved by said piece, one connected with the said stop-cock and the other limiting the stroke of the said plunger, substantially as described.

3. The combination, with the steam-generator, of the means—namely, the perforated slide-ring—for varying the amount of air admitted to the combustion-chamber, the means—namely, the stop-cock—for varying the supply of fuel, and the means—namely, the lever—forming a stop to a spring-retracted plunger for varying the supply of water to be vaporized, the three means being connected so as to be simultaneously regulated, substantially as described.

4. The combination, with the steam generator or vaporizer and the pump, of the compressed-air regulator and its distributor interposed between the said pump and the said generator, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

LÉON SERPOLLET.

Witnesses:

G. DUPONT,
V. BEDAUH.