

No. 646,556.

Patented Apr. 3, 1900.

J. & A. NICLAUSSE.
STEAM GENERATOR.

(No Model.)

(Application filed Nov. 15, 1898.)

4 Sheets—Sheet 1.

Fig. 1.

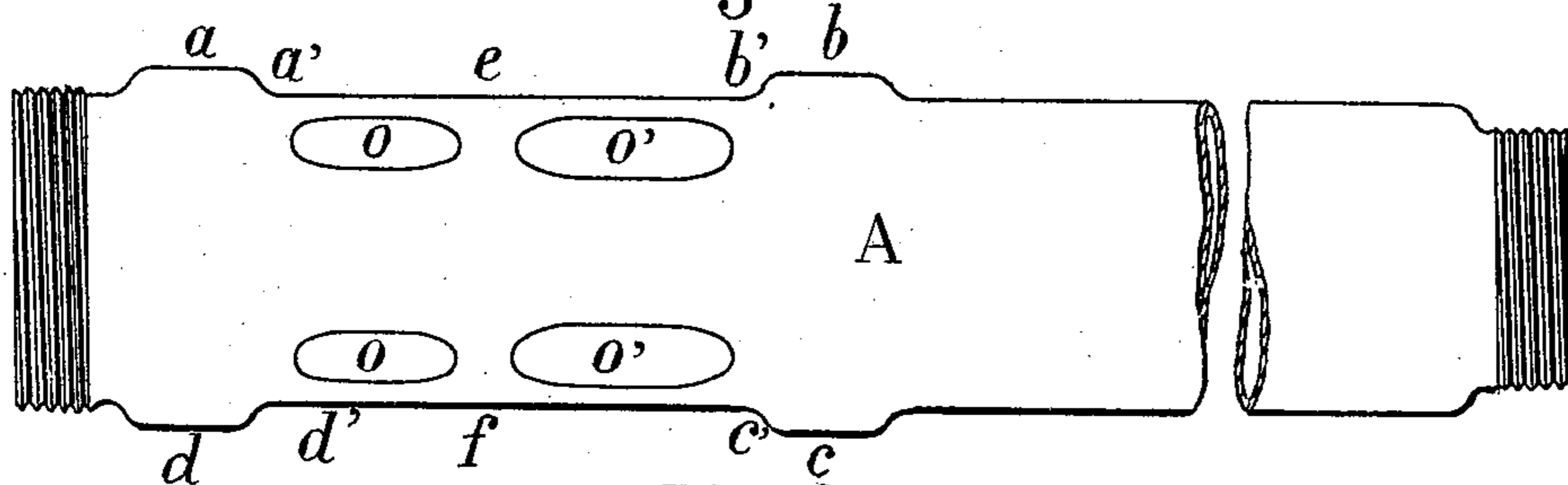


Fig. 2.

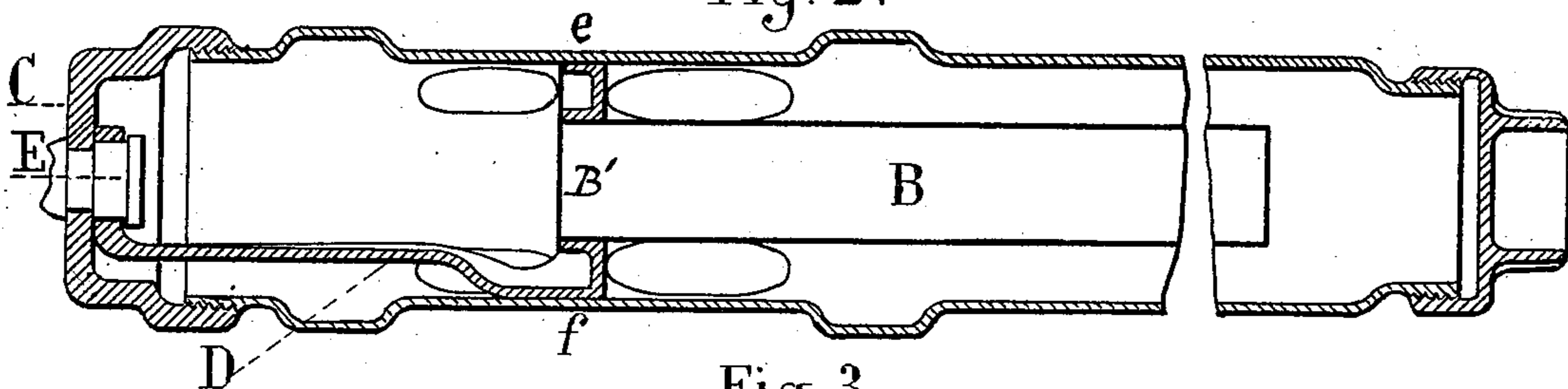


Fig. 3.

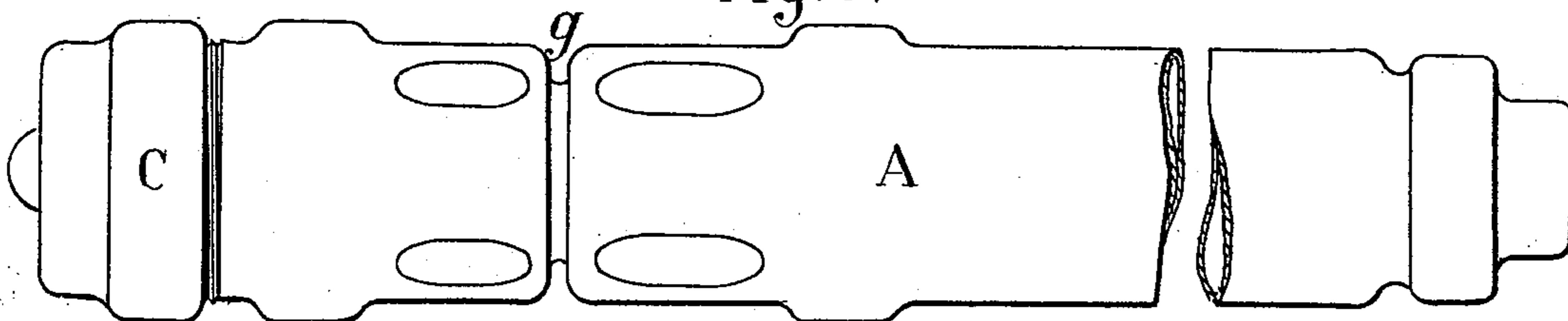
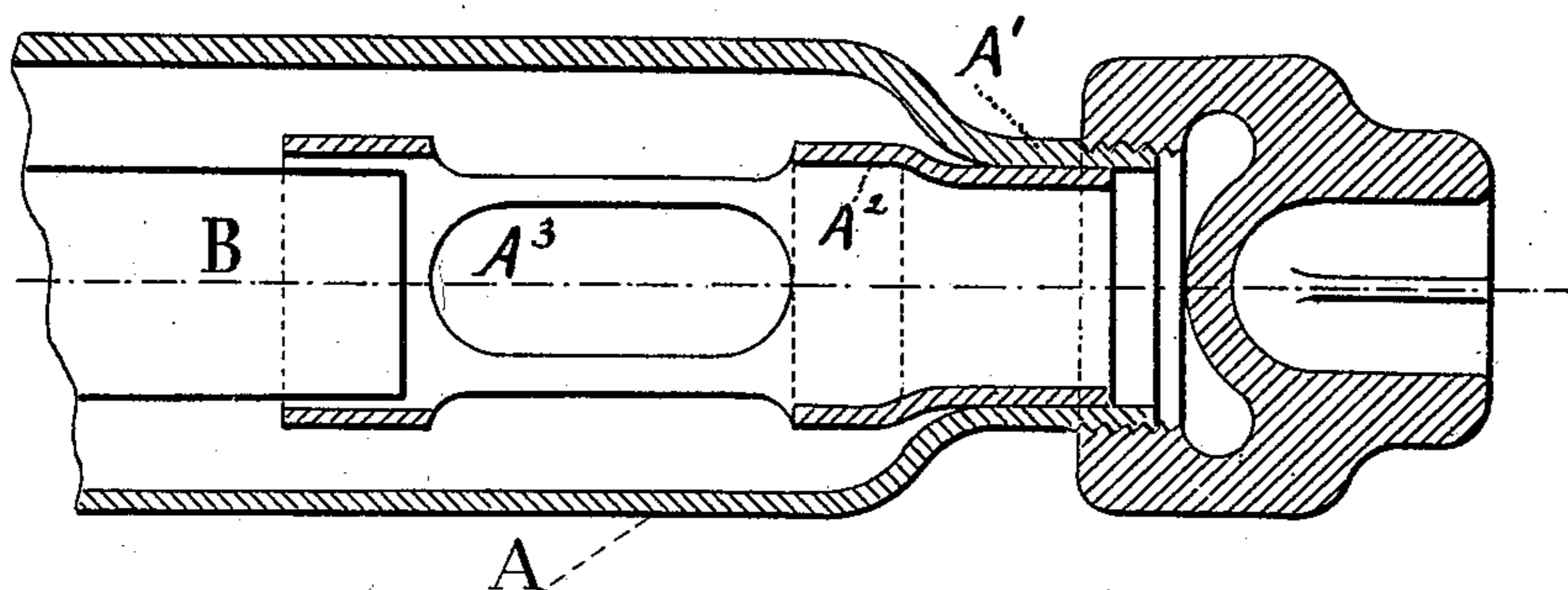


Fig. 4.



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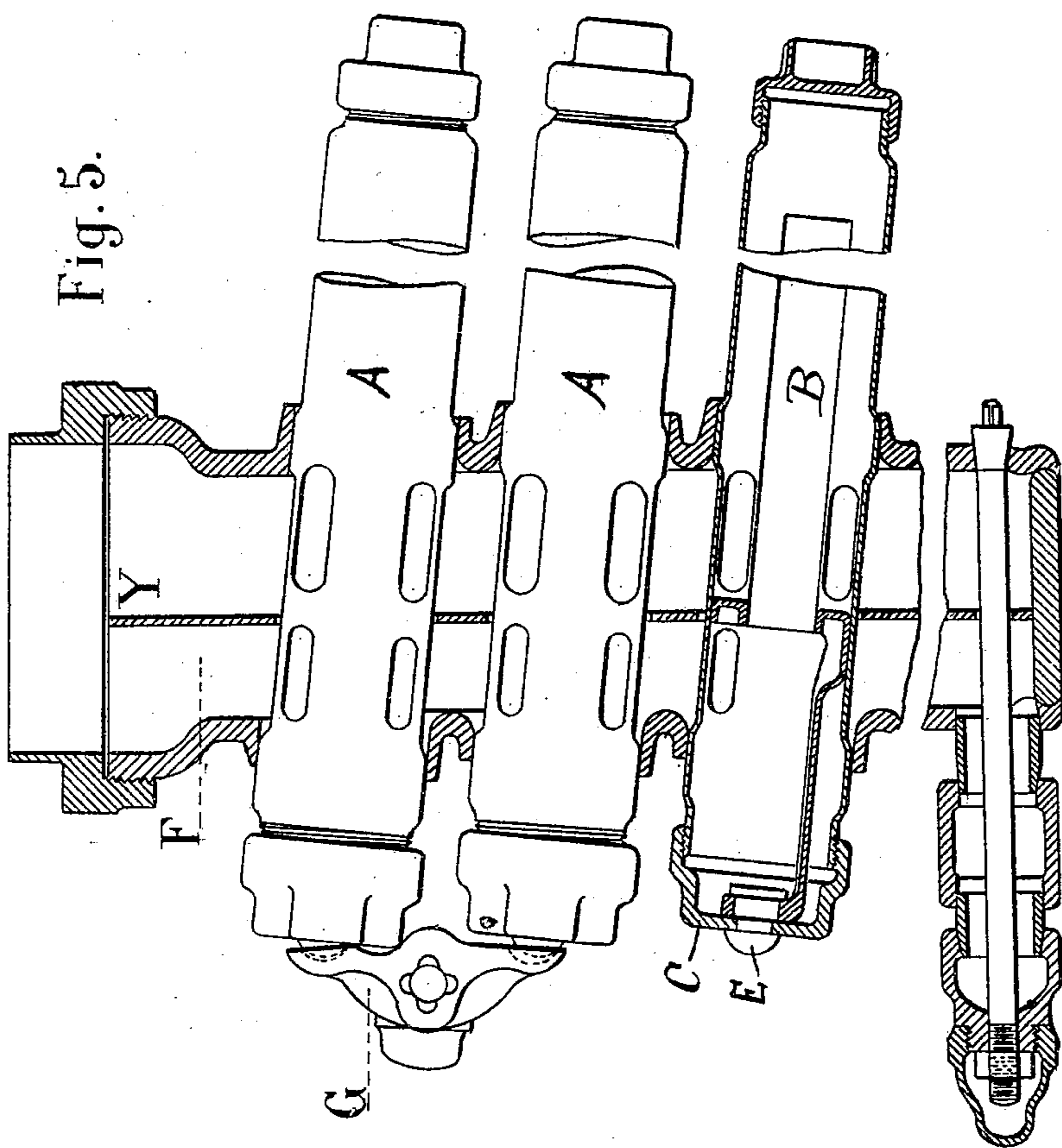
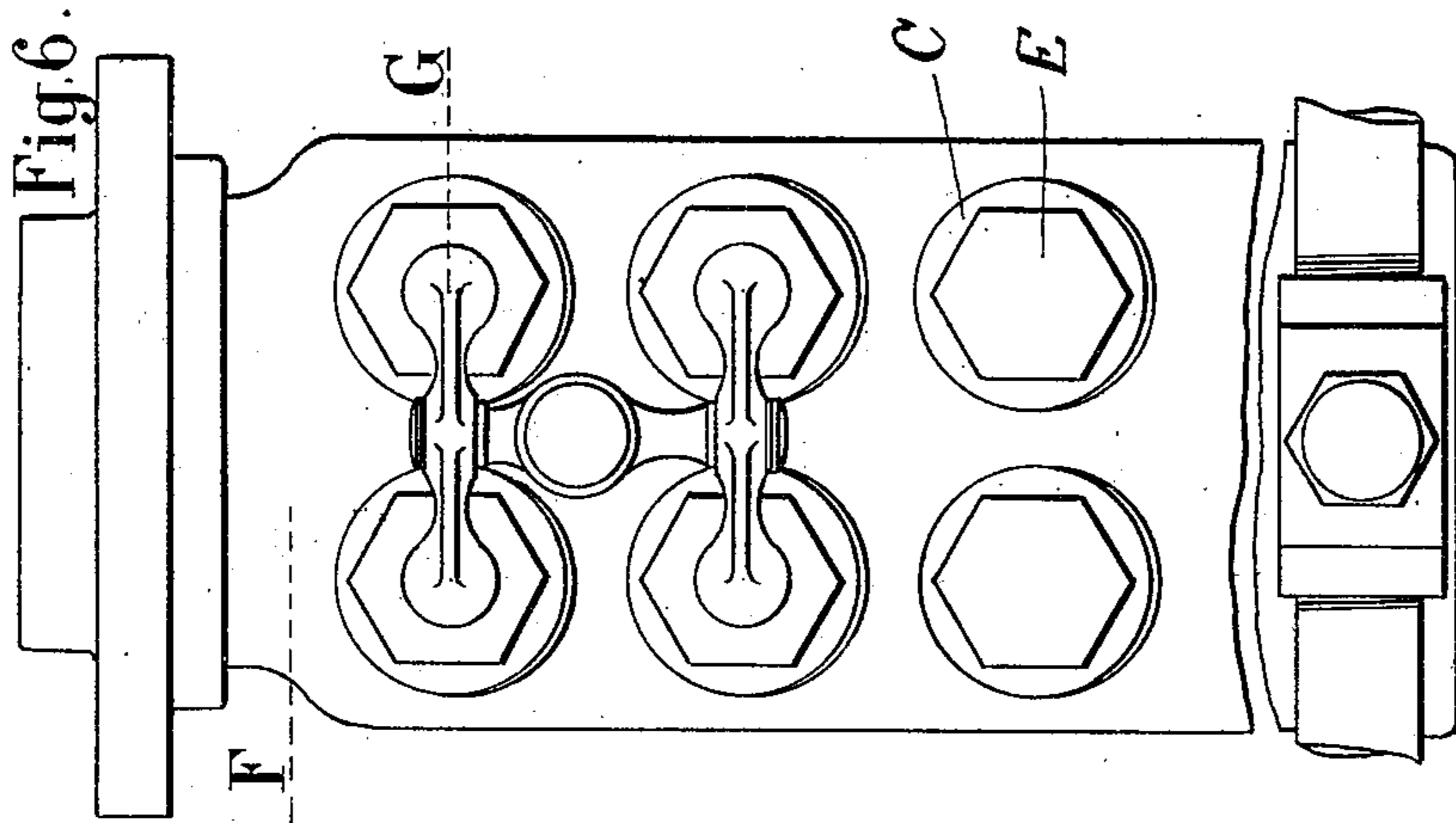
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(Application filed Nov. 15, 1898.)

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4 Sheets—Sheet 2.



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(Application filed Nov. 15, 1898.)

4 Sheets—Sheet 3.

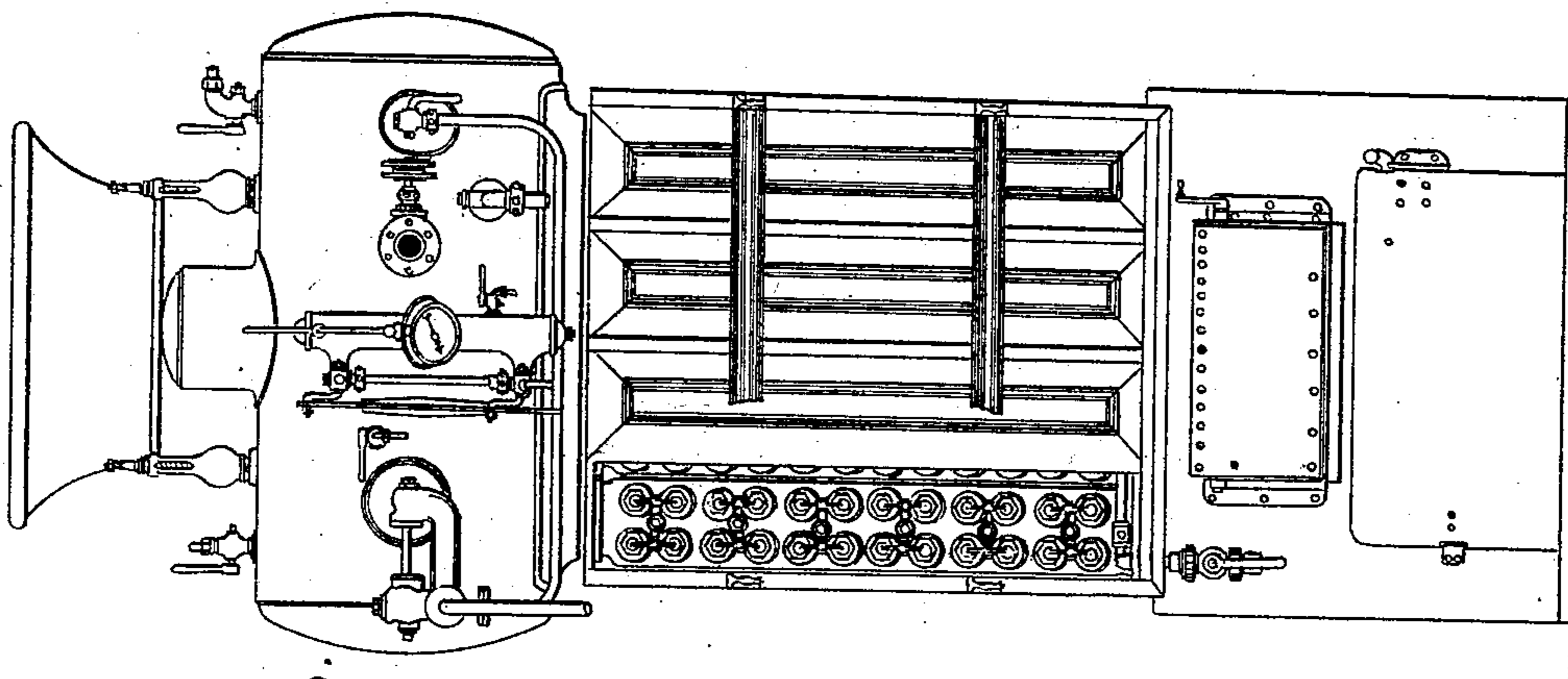


Fig. 8.

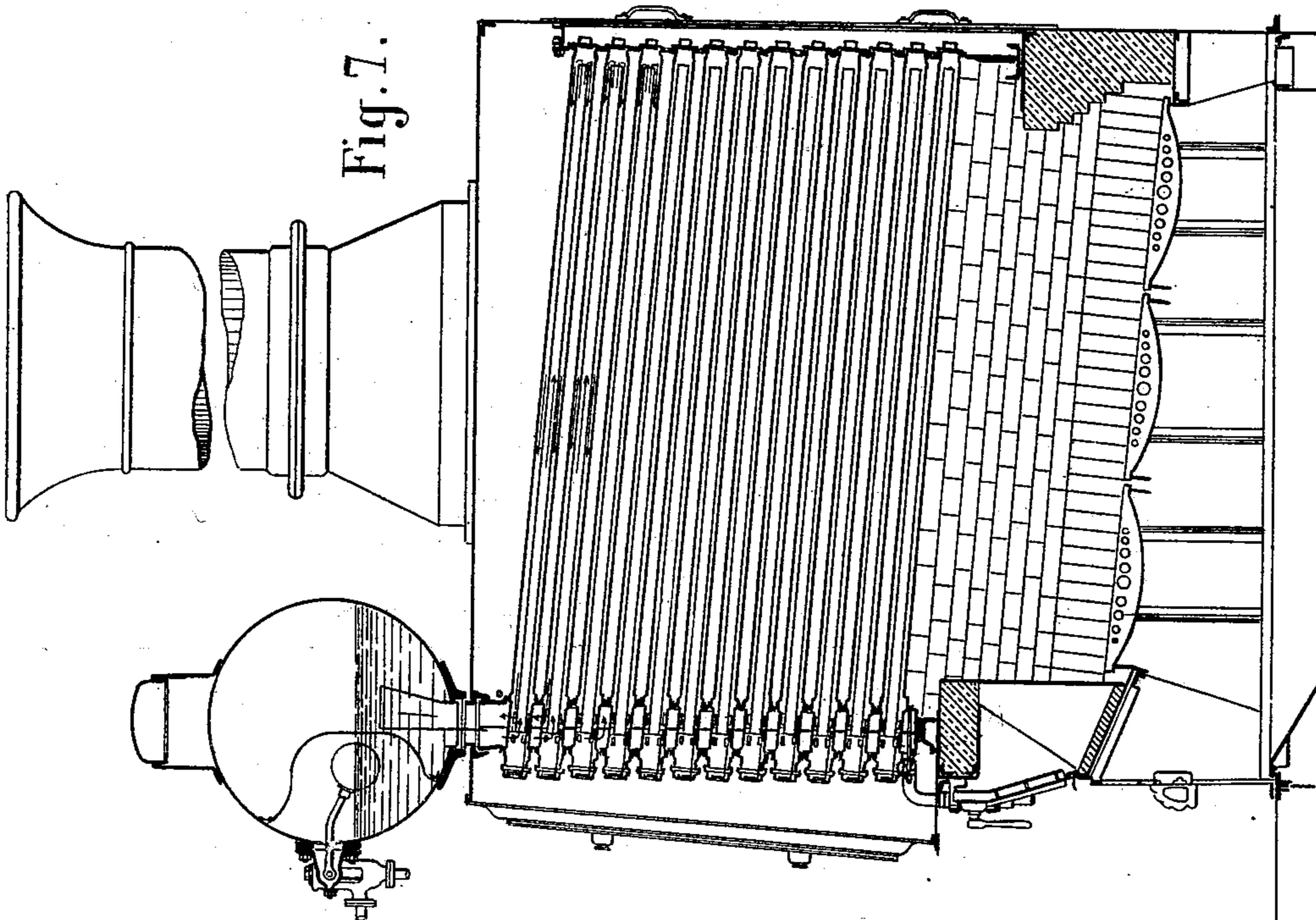


Fig. 7.

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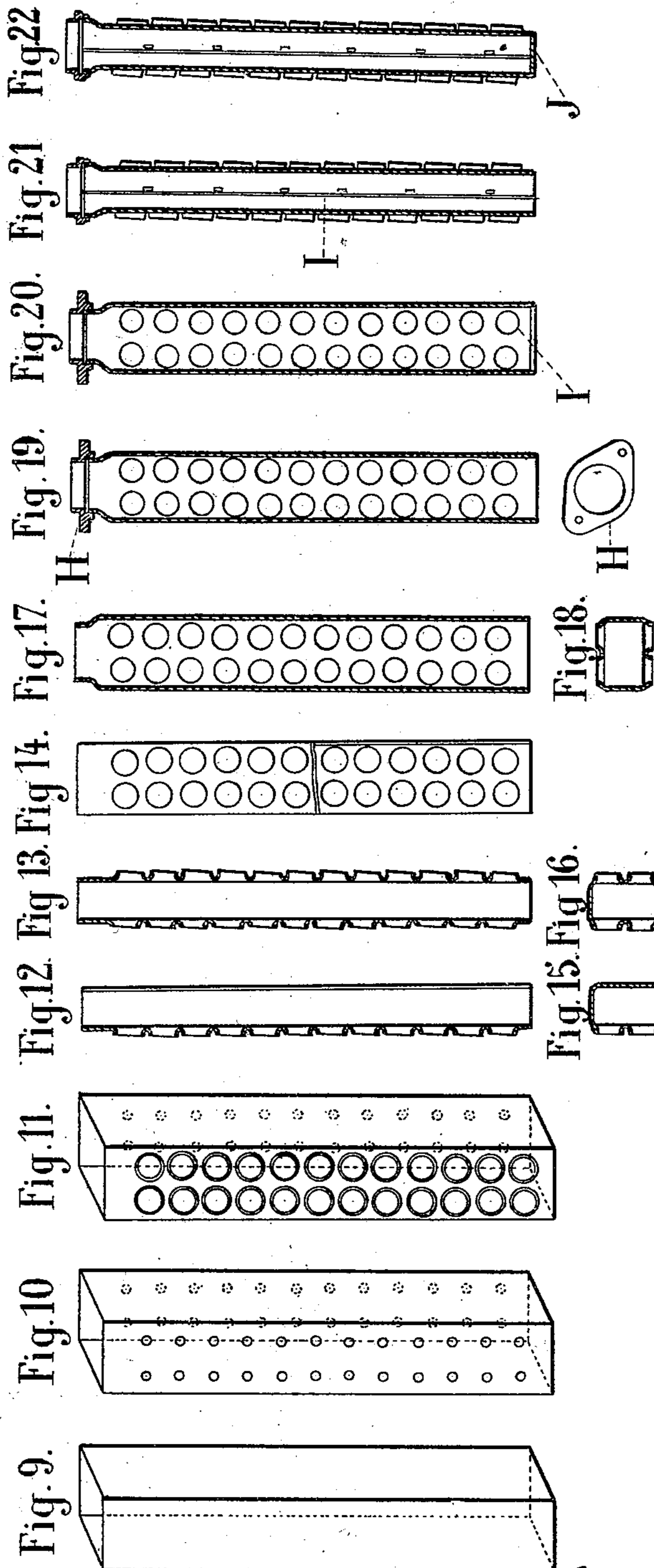
Patented Apr. 3, 1900.

J. & A. NICLAUSSE.
STEAM GENERATOR.

(Application filed Nov. 15, 1898.)

(No Model.)

4 Sheets—Sheet 4.



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UNITED STATES PATENT OFFICE.

JULES NICLAUSSE AND ALBERT NICLAUSSE, OF PARIS, FRANCE.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 646,556, dated April 3, 1900.

Application filed November 15, 1898. Serial No. 696,499. (No model.)

To all whom it may concern:

Be it known that we, JULES NICLAUSSE and ALBERT NICLAUSSE, citizens of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Multitubular Steam-Generators, of which the following is a specification.

Our invention has relation to that type or class of multitubular steam-generators where-
in the steam-producing tubes or vaporizers are connected to a collector or header in such a manner that feed-water is supplied to the tubes and the generated steam is liberated therefrom, and in such connection our invention more particularly relates to an improvement in the construction and arrangement of the tubes and headers described and claimed in Letters Patent previously granted to us, No. 460,254, of September 29, 1891, and No. 550,350, of November 26, 1895, whereby the tubes may be readily inserted or removed either singly or collectively from the headers, and when inserted the tubes form tight joints with said headers.

Our invention consists, essentially, of a steam-producing tube having its wall expanded at two points to form annular conical extensions or deformations in combination with a header having two conical openings in its front and rear walls into which, respectively, the deformations of the tube are adapted to enter and form tight joints, the distance between the openings being slightly less than the distance between the two deformations of the tube.

The nature and scope of our invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a side elevational view of one of the steam-producing tubes removed from the header. Fig. 2 is a central longitudinal view of Fig. 1. Fig. 3 is a side elevational view of a modified form of the tube illustrated in Figs. 1 and 2. Fig. 4 is a longitudinal sectional view of the rear end of a tube, showing a modified form of connecting the inner circulating-pipe to the outer vaporizing-pipe of the tube. Fig. 5 is a side elevational view, partly in section, illustrating the tubes held in position in the header and making tight

joints therewith. Fig. 6 is an end elevational view of Fig. 5. Figs. 7 and 8 are respectively longitudinal sectional and end elevational views of a steam-generator containing our improved tubes and header; and Figs. 9 to 22, inclusive, are detail views illustrating the preferred manner of constructing the header.

Referring to the drawings, A represents the steam-producing tube, having inlet-openings *o o* for the water which enters the inner circulating-pipe B and outlet-openings *o' o'* for the escape of steam generated within the tube A. The wall of the tube A is expanded, as at *a d* and *b c*, to form annular conical flanges, extensions, or deformations. These deformations are thus formed without the addition of extraneous material and without weakening of the wall of the tube A. The inlets and outlets *o o* and *o' o'* are formed in that part *e f* of the tube A which is between the two conical deformations *a d* and *b c*. By expanding the wall of the tube A to form these deformations, which are rounded, as at *a', d', b', and c'*, and by separating the two deformations by an unexpanded portion *e f* of the tube the elasticity of the tube between the deformations is not impaired.

The front portion of the boiler-tube A is preferably closed by a threaded conical cap C or in any suitable manner. Upon the interior of these caps are fixed the circulation-tubes B by means of one or more tongues D, which are fixed to the caps by means of the pieces E, which form pivots to allow the cap to be unscrewed to permit the tubes B to be withdrawn with the caps from the interior of tubes A for the purpose of cleaning or repairs and without turning the tubes B. In certain forms of the invention the tube B is formed as with a head B', (shown in Fig. 2,) the head B' serving as a partition to prevent direct communication between the openings *o o* and the space in tubes A outside of tube B, or, as shown in Fig. 3, the tube A may be contracted into a neck *g* for the same purpose. The rear end of tube B in certain instances may be supported by the tube A, as illustrated in Fig. 4, by means of a contraction or neck A', formed at the rear end of tube A and into which an extension or tubular piece A², having the outlet-openings A³, is fitted to maintain the rear end of tube B in concentric relationship with tube A.

Referring now to Figs. 5, 6, 7, and 8, the header or collector F is fixed beneath a water and steam reservoir of any well-known type. The header or collector F is formed, preferably, in the following manner: A rectangular extra-soft jointless steel tube of the form shown in Fig. 9 is first pierced with holes on opposite sides, as illustrated in Fig. 10, which holes coincide with the center of the steam-producing tubes A. These holes on one face are deformed or expanded at a single operation by means of dies, punches, or hydraulic or other presses. (See Figs. 12 and 15.) The same operation is then performed upon the other face and results in the tube illustrated in Figs. 13, 14, 16, and 18, Fig. 14 being partly in face and partly in section to show the interior of the tube as well as its face. The dies or other mechanism are so arranged as to form conical openings which coincide with the corresponding conical extensions or deformations *a d* and *b c* of the tube A. The portion of the tube which is to form the head or upper portion is then forged, so as to form a cylindrical neck, the successive operations being illustrated in Fig. 17. Upon the neck thus formed is secured, Fig. 19, an oval flange H, by means of which the header or collector F may be united to the water and steam reservoir. Within the tube is next introduced the partition I, having openings coincident with the openings in the sides of the header-tube, and this partition is secured to the unperforated sides of the header-tube. (See Figs. 20 and 21.) Lastly, the bottom of the header-tube is closed, usually by welding a piece J thereto, as illustrated in Fig. 22.

The necessary elasticity of the joints in the header is preferably obtained by varying the angle of the conical expansions *a d* and *b c* or of the corresponding conical openings in the header into which the deformations *a d* and *b c* are to fit. Thus, as illustrated in the drawings, the front deformation *a d* is very slightly conical and is nearly straight or cylindrical, while the other deformation *b c* is more conical. The conical opening in the front wall of the header F corresponds in configuration to the deformation *a d* and is of a diameter to permit of the easy entrance or withdrawal of the rear deformation *b c*. The conical opening in the rear wall of the header F corresponds in shape to the rear deforma-

tion *b c* of the tube, and the distance between the two conical openings in the header is longer than the distance between the conical deformations of the tube. Hence when the tube is inserted in place in the header the rear deformation will bear first in the conical opening in the rear wall of the header, and as it is pushed farther inward the front deformation will fit into the front conical opening in the header. When the rear deformation binds tightly, then the joint will be formed.

Having thus described the nature and objects of our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a multitubular steam-generator, a boiler or steam-producer tube having its wall expanded at two portions on the head of the tube to form annular conical deformations on the external surface of the tube, in combination with a header having two conical openings each respectively in the front and rear walls and into which the conical deformations of the tube are adapted to enter and to form tight joints, the distance between the openings in the header being longer than the distance between the conical deformations on the tube, substantially as and for the purposes described.

2. In a multitubular steam-generator, a boiler-tube having its wall expanded at two points on the head of the tube to form conical deformations on the external surface of said tube, the front deformation being slightly less conical than the rear deformation, in combination with a header having its front and rear walls provided with two conical openings corresponding respectively with the conical deformations on the tube, the opening in the front wall being of larger diameter than the diameter of the rear conical deformation of the tube and the distance between the two openings being longer than the distance between the two deformations on the tube, substantially as and for the purposes described.

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

JULES NICLAUSSE.
ALBERT NICLAUSSE.

Witnesses:

J. ALLISON BOWEN,
GEO. E. LIGHT.