

No. 709,371.

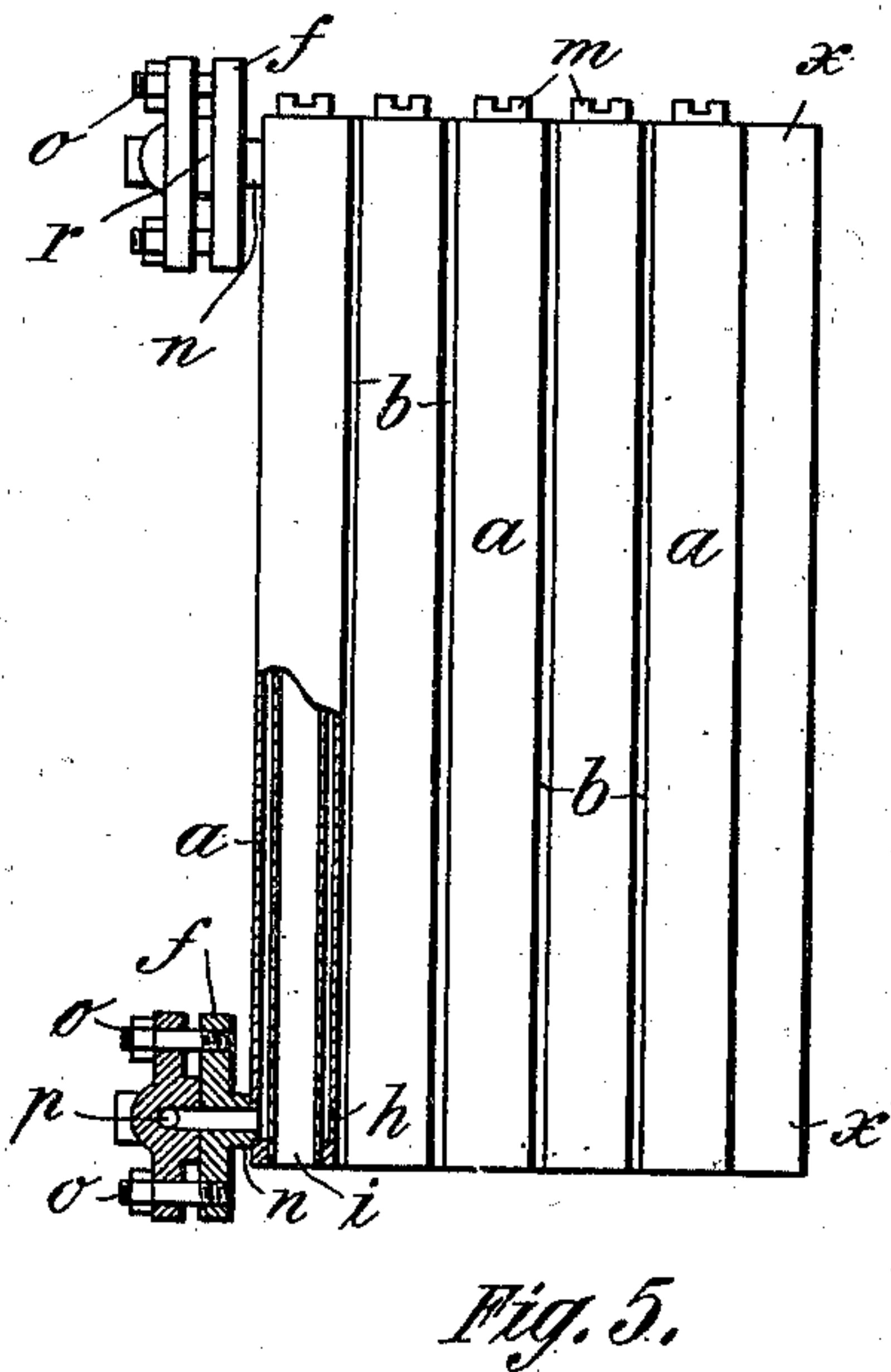
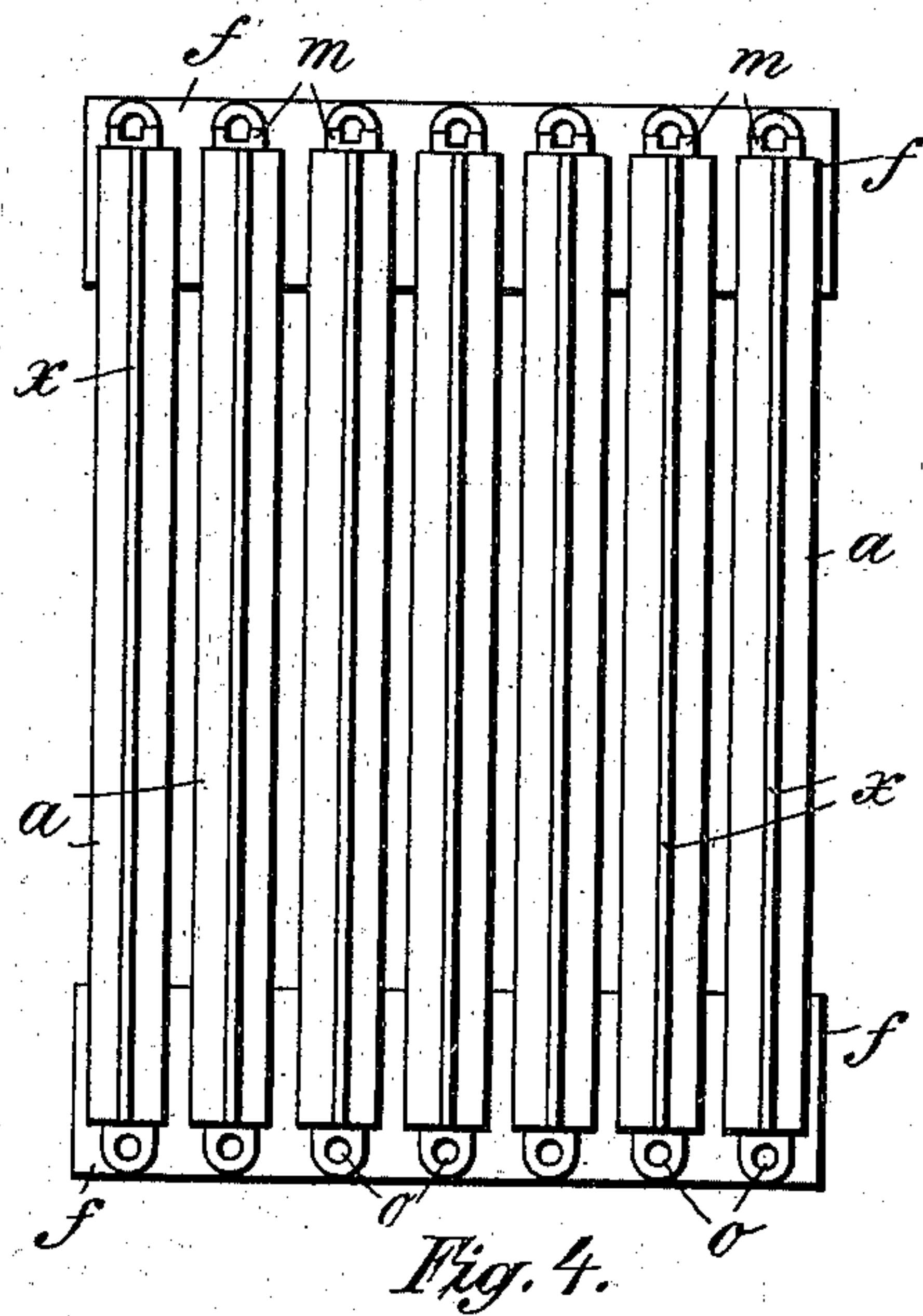
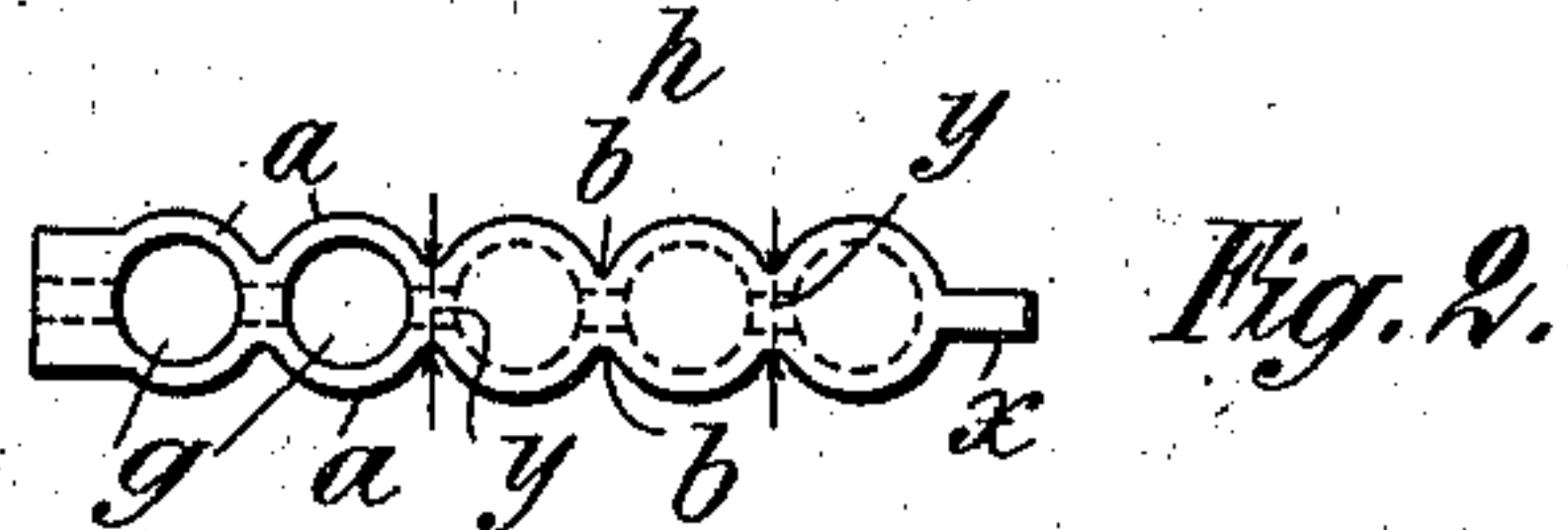
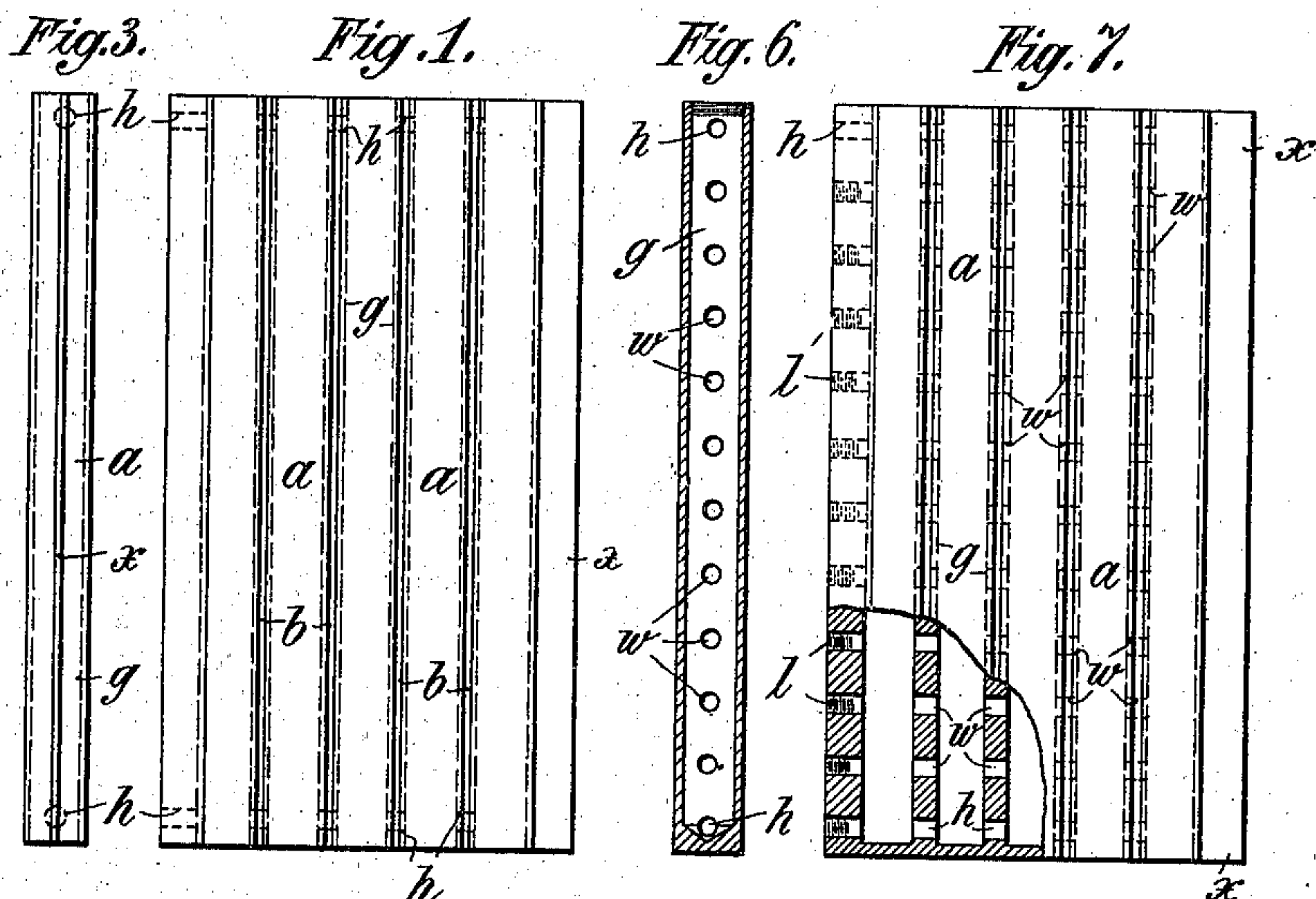
Patented Sept. 16, 1902.

P. STOLTZ.
STEAM GENERATOR.

(Application filed Oct. 28, 1901.)

(No Model.)

2 Sheets—Sheet 1.



WITNESSES
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No. 709,371.

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2 Sheets—Sheet 2

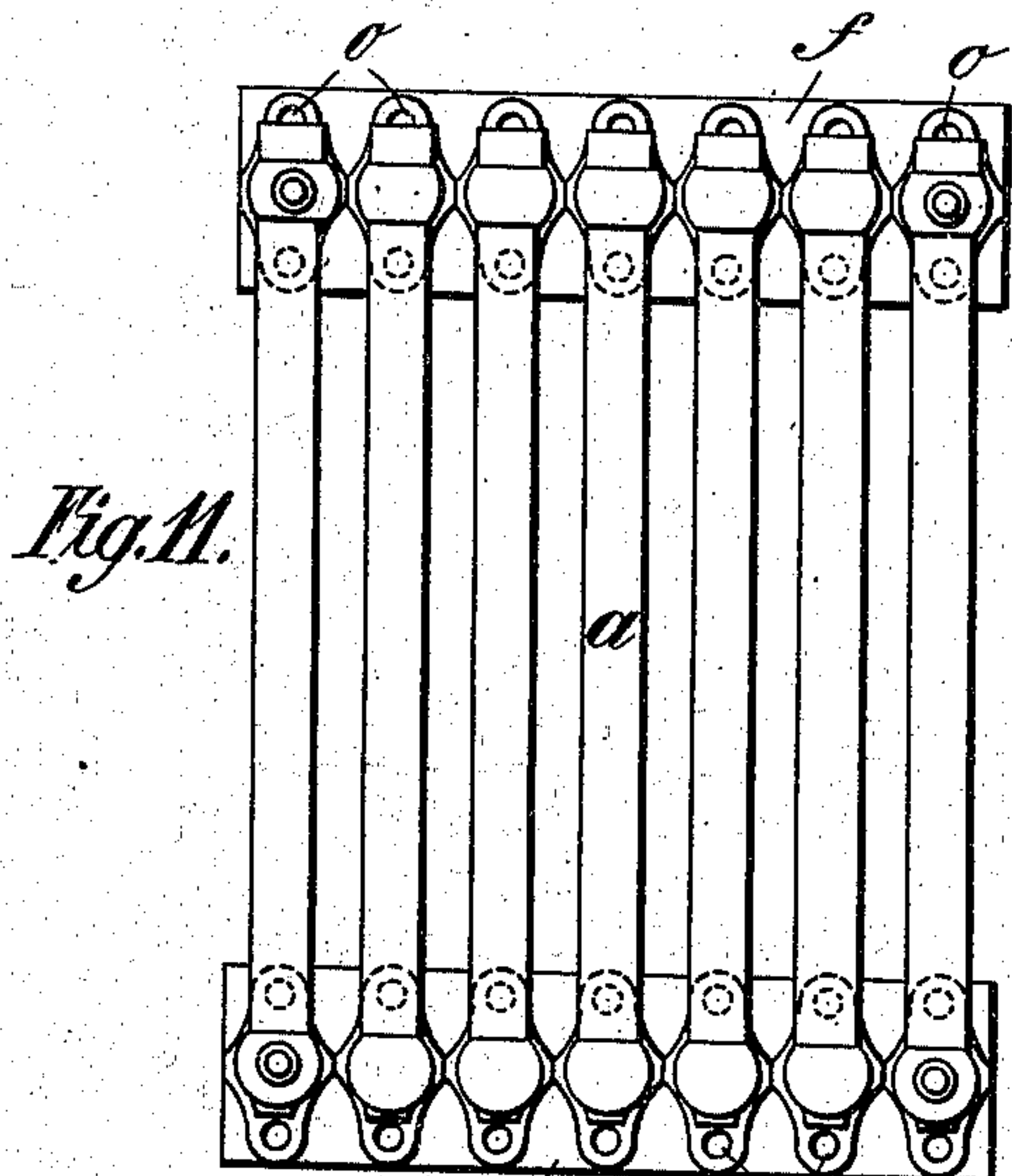


Fig. 11.

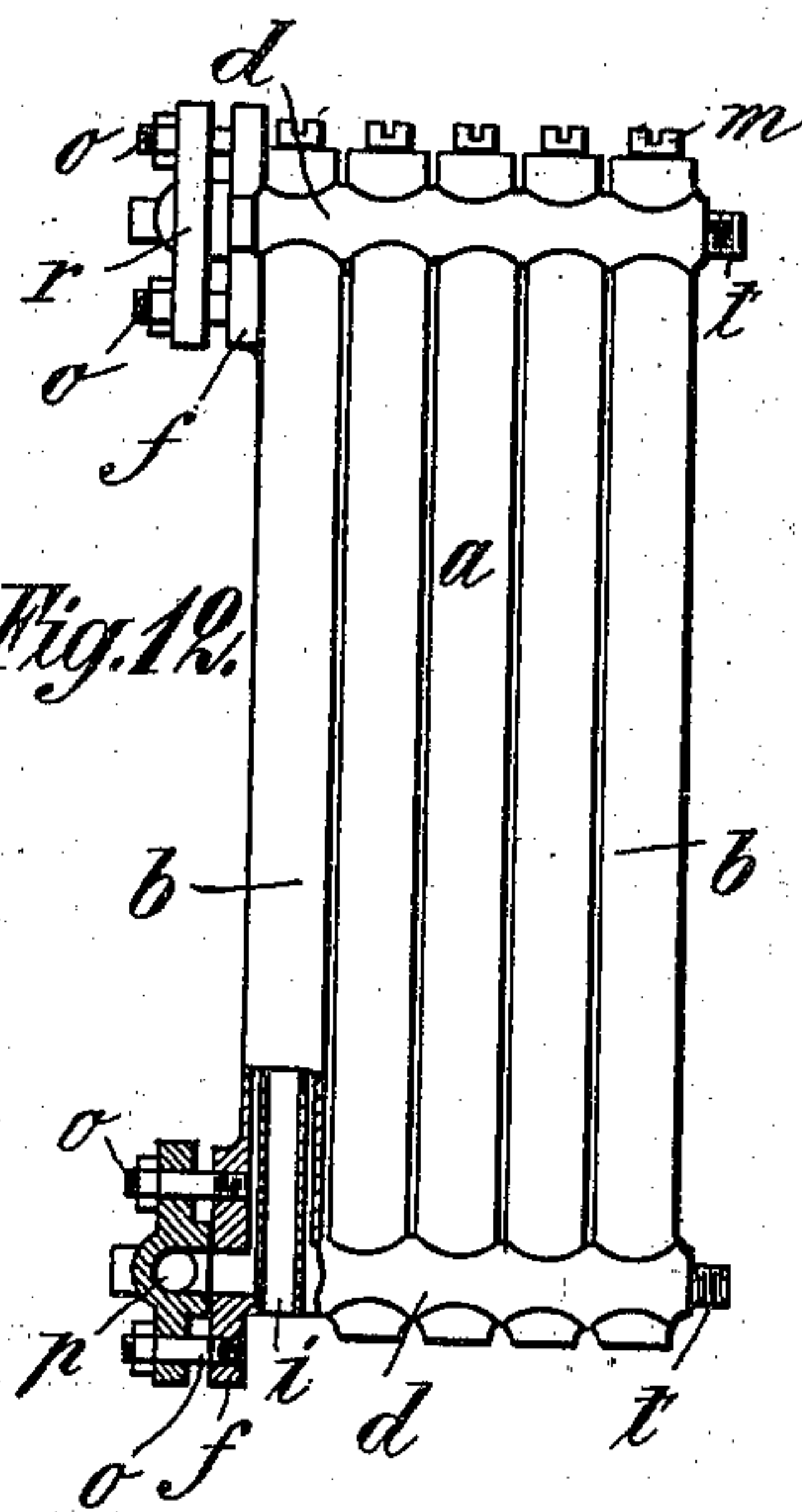


Fig. 12.

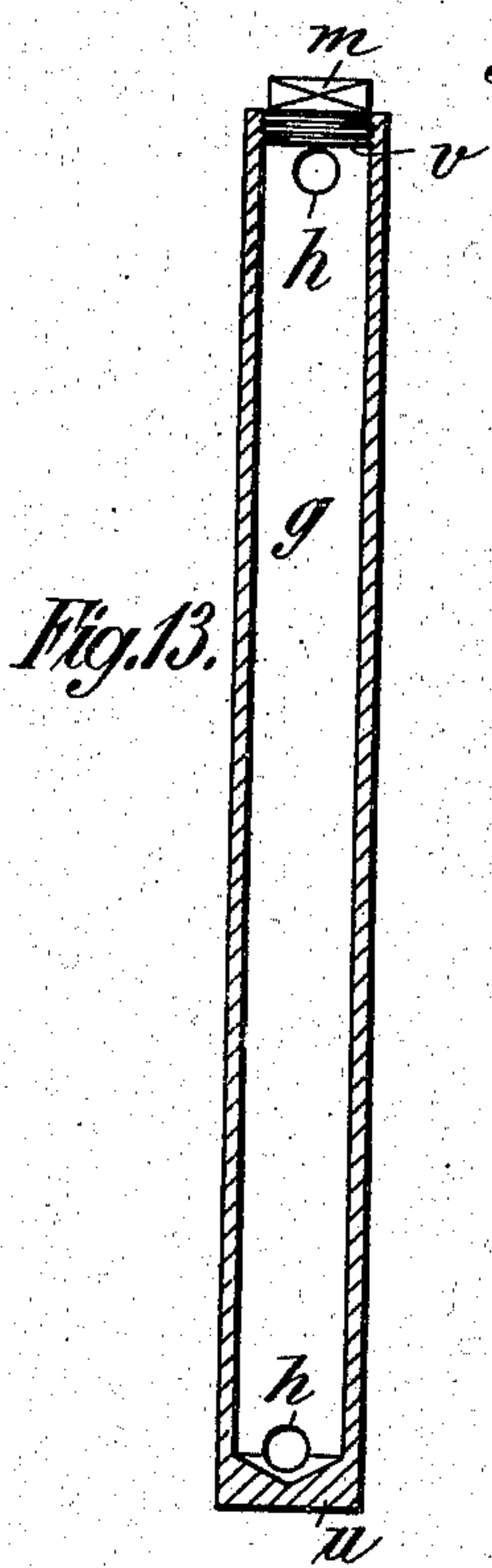


Fig. 13.

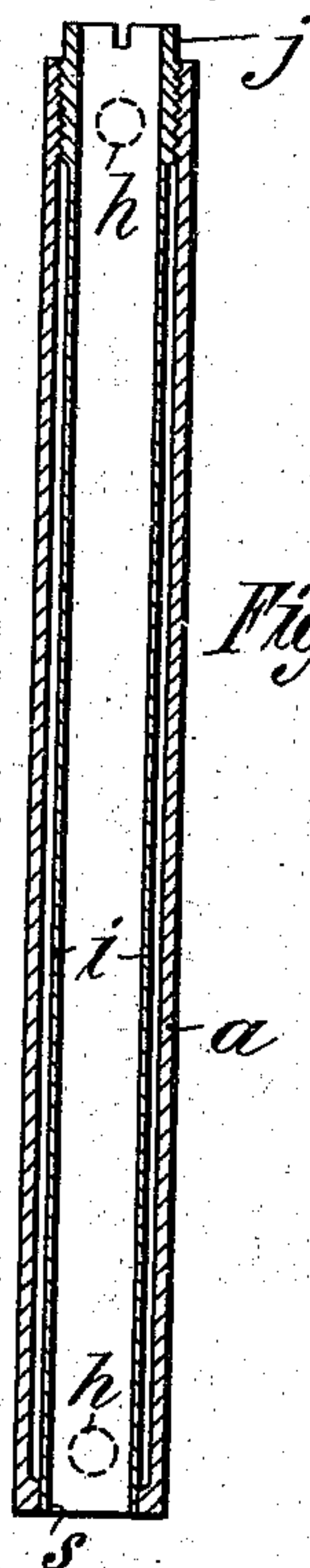


Fig. 14.

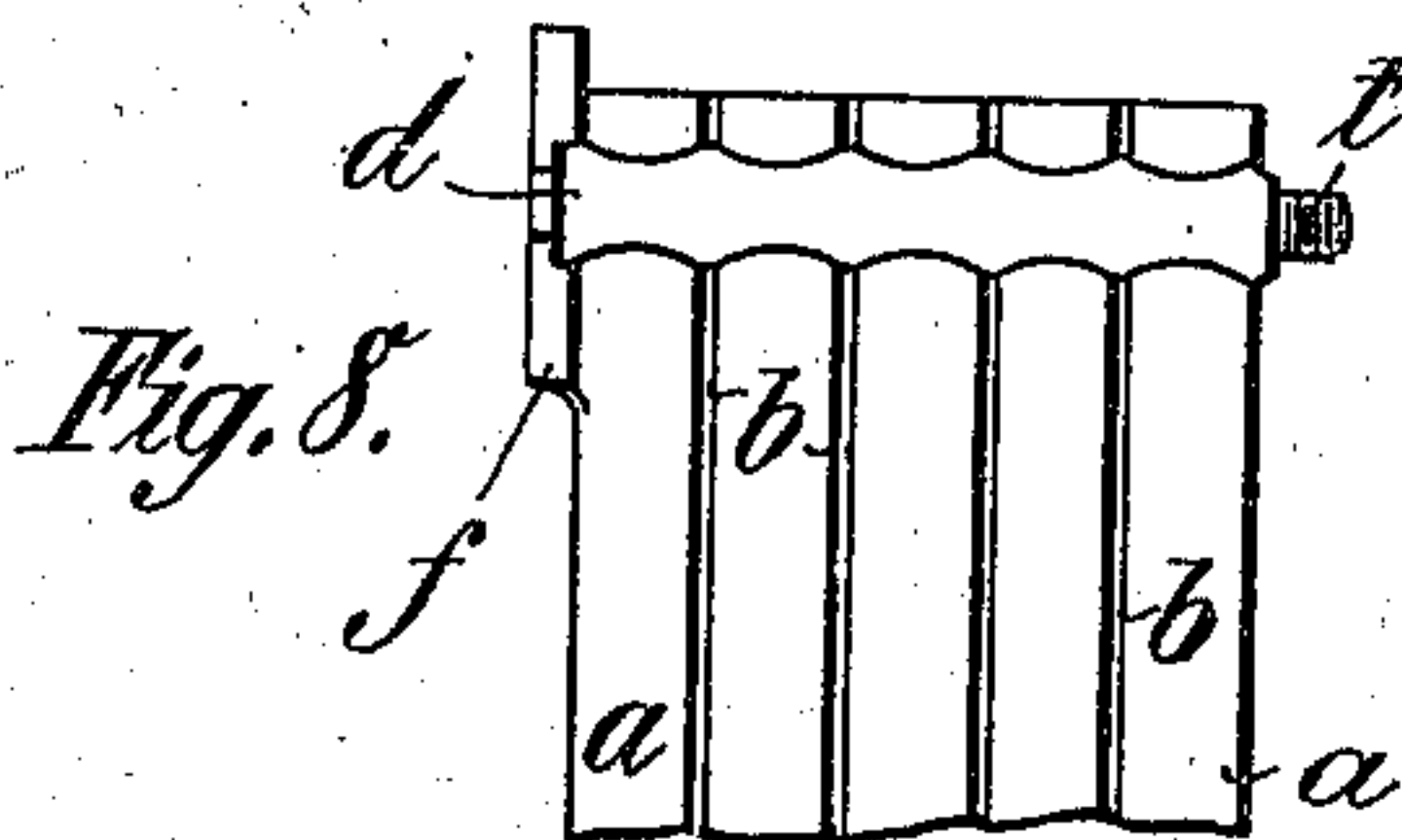


Fig. 8.

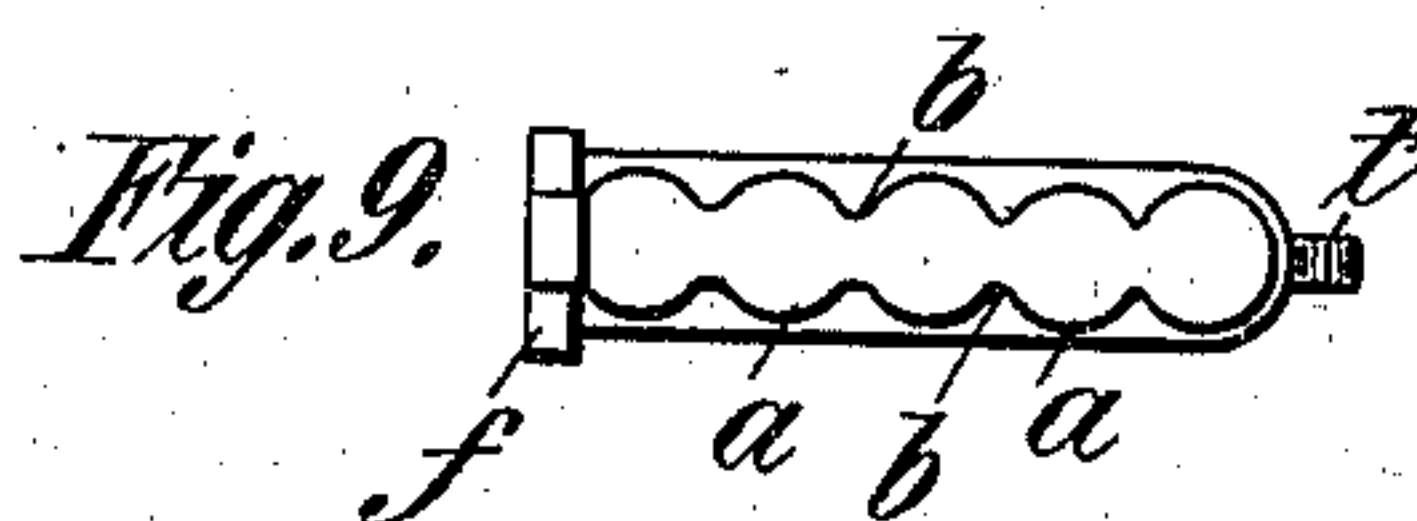


Fig. 9.

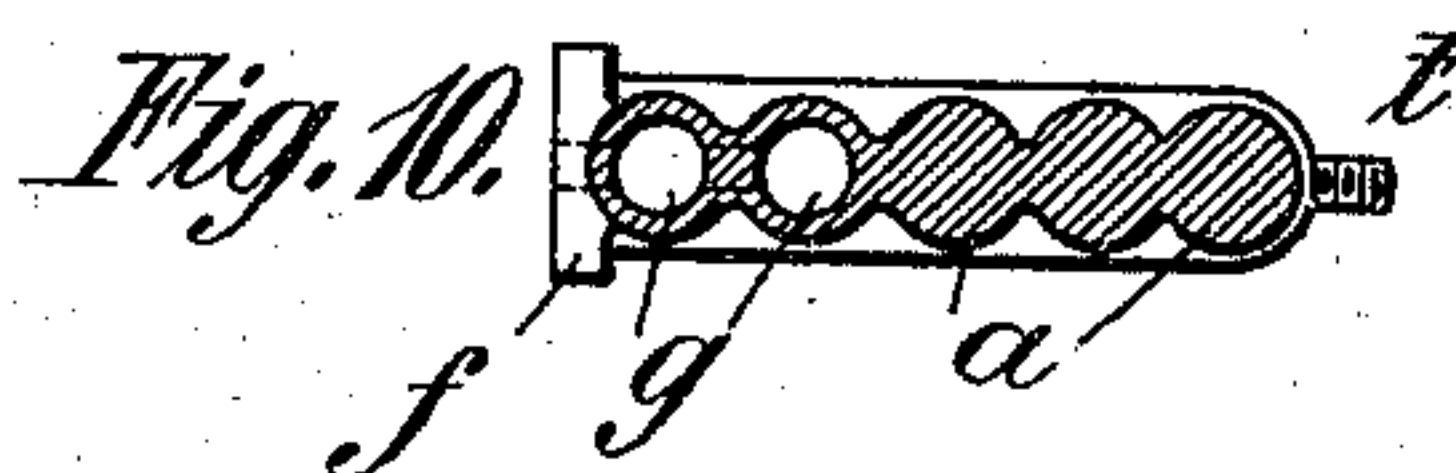


Fig. 10.

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UNITED STATES PATENT OFFICE.

PETER STOLTZ, OF BERLIN, GERMANY.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 709,371, dated September 16, 1902.

Application filed October 26, 1901. Serial No. 80,086. (No model.)

To all whom it may concern:

Be it known that I, PETER STOLTZ, engineer, a subject of the Emperor of Germany, residing at 138 Friedrichstrasse, Berlin, in the
5 Empire of Germany, have invented certain new and useful Improvements Relating to Steam-Generators, of which the following is a specification.

This invention relates to steam-generators
10 having several groups of tubes connected together, whereby the adjacently-disposed longitudinal tubes and the cross-passages for connecting the ends of the latter with each other in each group of tubes form an undi-
15 vided structure. These groups of tube elements may be produced by casting, rolling, forging, or in any other convenient manner, first the external form of the groups of tubes, and then by boring out the longitudinal chan-
20 nels or passages for forming the vaporizing-spaces, and, finally, the cross-passages which connect the said longitudinal channels. In constructing a steam-generator in accordance with this invention several such elements of
25 groups of tubes are disposed side by side and connected with one another. Heretofore in constructing steam-generators of this class the tube ends have been secured in cham-
30 bers; but with this method of construction, however, it is necessary to stiffen the said chambers by stay-bars or stay-bolts, so as to avoid excessive stress on the connecting-joints of the tubes.

In my improved steam-generator the walls
35 of the longitudinal tubes and of the transverse passages which connect said longitudinal tubes in each group with each other form a solid whole, thereby avoiding the use of the above-mentioned stay-bars, while at the
40 same time obviating the disadvantages due to the fixing of the longitudinal tubes in the chambers. By avoiding said fixing of the longitudinal tubes they can be placed close together, and thus provide a large heating-
45 surface within a small space and increase the proportion of the heating area to the volume or the space occupied by the boiler. The tubes may be disposed so close together as to have combined walls at the adjacent parts,
50 thereby preventing distortion of the tubes and rendering the whole boiler compact and light, while, furthermore, the resistance of the

tube groups is increased and greater rigidity imparted to the generator. The separate groups of tubes can readily be changed, 55 and cleaning of the same is greatly facilitated. If the first formation of the group of tubes is effected by external mechanical operation—for instance, by rolling, pressing, forging, &c.—the quality of the material is 60 improved by the compression, thereby increasing the resistance and safety of working of the generator. This type of steam-generator is suitable for very high steam-pres-
65 sures and in particular for motor-vehicles and motor-boats.

In order that my invention may be readily understood and carried into practice, I will now proceed to describe the same fully with reference to the accompanying drawings, in 70 which—

Figure 1 shows a front elevation of a group of tubes embodying this invention and preferably made by rolling. Fig. 2 is a plan of the same with partly-bored channels. Fig. 3 75 is an edge view. Figs. 4 and 5 show a front and side elevation, respectively, of a steam-generator, partly in section, which is composed of groups of tubes as shown in Figs. 1 to 3. Figs. 6 and 7 show a longitudinal sec- 80 tion and a side elevation, respectively, partly in section. Figs. 8 to 10 show a modification, in which Fig. 8 shows the upper portion of a group of tubes in side elevation, Fig. 9 shows a plan, and Fig. 10 a cross-section with partly- 85 bored channels. Figs. 11 and 12 show a front elevation and a side elevation, partly in section, of a steam-generator composed of groups of tubes as shown in Figs. 8 to 10. Figs. 13 and 14 show several forms of construction of 90 the evaporating-chambers.

Figs. 1 to 3 show the manner of construct-
ing or forming a group of tubes of a single rolled piece. The shape of the rolled piece is shown in Fig. 2, and it is only necessary to 95 cut the desired length from the piece from the rolling-mill, Fig. 1. This part thus has already the required finished external form, in which the longitudinal tubes *a* stand out as ribs. The tubes *a* are connected at their 100 adjacent longitudinal parts by narrow webs *b*. After the production of the rolled piece, Fig. 1, the successive longitudinal channels *g*, Fig. 2, are made by boring. The tubes

thus formed are thus connected together at the upper and lower ends by cross-passages, formed by boring at h through all the webs b , as indicated by dotted lines in Fig. 1. To enable these cross-passages to be made, it is necessary to have the webs b between the adjacent tubes at y , Fig. 2, sufficiently thick. The longitudinal rib x may be utilized for fixing several such tube-group elements manufactured in the manner hereinbefore described in a frame. In this tube-group element the tubes a must be closed at the open end, and this may be effected, as shown in Fig. 13, by not boring the hole g right through the tubes a , but leaving them closed at u , so that no separate means for closing is required at such end. The opening v at the other end of the tube may then be closed by a screw-stopper m or in any other convenient means.

If it is desired to obtain a more favorable heating effect by providing annular water and steam chambers, this may be carried out as shown in Fig. 14. In this case the tube a is bored out for its entire length, and into the tube a is then inserted a second tube i at s and j , so as to form a water and steam space of annular section. The manner of fixing the tube i may be such as to enable it to be readily removed for the purpose of cleaning the interior of the steam-generator. For this purpose the tube i in this arrangement is provided with screw-threads at one end j and is screwed into the screw-threaded mouth of the tube a .

The other end may be secured in the tube a by wedging, burring, or other suitable manner. In the arrangement shown in Fig. 14 the vaporizing-chamber of annular section is thus formed between the tubes i and a . The spaces thus formed communicate with each other through the passages h . Owing to the fact that the tubes i and the tubes a are not secured to separate communication-chambers, all the tubes of each group may be disposed close together, with their axes as shown in Fig. 2. By having the tubes a so close together, with a single or common wall between them, a greater stiffness of all the tubes a , combined with greater strength, is obtained, while, further, the largest possible internal space for the steam-generator is provided in proportion to the entire space occupied by the said generator. Moreover, by the manner of securing the inner tubes i , as shown in Fig. 14, the joints thereof are not subjected to pull or pressure, while the rolled or forged shaped part, which contains the tubes g h , forms a single structure which receives all the stresses of pull and pressure from the generation of the steam without communicating said stress to the joints. For this reason the longitudinal stays required for ordinary steam-generators composed of tube groups and which are placed lengthwise to the tubes a can be dispensed with. In consequence of the increased resistance of the tube element formed by mechanical operation it will be possible to

reduce the wall thicknesses without weakening the safety factor of working, and thus the efficiency of the boiler is raised. All these conditions cooperate to produce advantageous proportions between internal space, external space, water volume, and weight.

The elements of tube groups thus manufactured are mounted together to form a steam-generator as follows: In the arrangements shown in Figs. 4 and 5 in the ends of the cross-passages h h , which are provided with suitable flanges f , are screwed hollow tubular ends n , secured by screw-bolts o with the lower water-channel p or upper steam-channel r . The tube-group elements thus connected one with another may in motor-cars, for example, be engaged and fixed in a frame.

In order to enable steam-generators constructed according to my improved arrangement to have a minimum of weight and also an effective connection between the various tubes, the tube groups may be further bored with cross-channels w , as shown in Figs. 6 and 7, and the outer holes may afterward be closed by screw-plugs l or the like. By this arrangement of cross-passages w the weight of the steam-generator is reduced, while at the same time the water circulation is greatly increased.

The tube element shown in Figs. 8 to 10 may be produced by forging or stamping in dies. In this form of construction there are provided special enlargements d d for the passages forming the cross-channels h h . The tubes may be completely separate or they may be connected by their adjacent parts. They may, as previously described, be connected together by small longitudinal webs b . The stamped or forged section may advantageously be formed at the same time with the flanges f at the ends of the enlargements d and with the screw-threaded connections t at the other ends for mounting the steam-generator together.

Figs. 11 and 12 show a steam-generator composed of such tube-group elements, whereby the flanges f are connected by means of bolts o with the lower water-channel p and the upper steam-channel r , respectively.

The details may be variously modified, and the cross-section of the various tube elements may also be altered. The tubes a may externally be formed with prismatical walls or with ribs, and the arrangement for connecting the several tube elements with each other may be executed in various manners. It is always essential that each tube group or their longitudinal and cross passages should form a complete structure, whereby the tube groups first receive their external form by any appropriate means, while both the tubes, as also the channels connecting the same, are produced by boring.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. A steam-generator, comprising vaporiz-

ing-chambers, each consisting of a single plate of metal provided with oppositely-disposed pairs of convex ribs extending from edge to edge of said plate, and with longitudinal passages concentric with said convex ribs and extending centrally through said plate substantially from edge to edge thereof, and also provided with short passages connecting said longitudinal passages.

10 2. A steam-generator, comprising vaporizing-chambers, each consisting of a single plate of metal provided with oppositely-disposed pairs of convex ribs extending longitudinally from edge to edge of said plate, and
15 with longitudinal cylindrical passages concentric with said convex ribs, said plate being further provided with means for allowing intercommunication between said longitudinal passages at points adjacent to the ends
20 thereof.

3. A steam-generator, comprising vaporizing-chambers each consisting of a single plate of metal provided with oppositely-disposed pairs of convex ribs integrally connected together, and also provided with longitudinal passages disposed closely together, said longitudinal passages being connected

together by short passages extending directly through the substance of the plate, whereby the tendency toward leakage is greatly lessened and a structure of great strength is produced. 30

4. A steam-generator, comprising vaporizing-chambers each consisting of a plate of metal provided with longitudinal passages extending throughout the substance of said plate substantially from edge to edge thereof, and a plurality of hollow tubes disposed within said longitudinal passages and fitted steam-tight into the respective ends thereof, said hollow tubes at points intermediate of said ends being concentrically spaced within said passages, thereby forming steam-spaces each of a general tubular form, said plate being further provided with means for maintaining communication between said steam-spaces. 40 45

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 12th day of October, 1901.

PETER STOLTZ.

Witnesses:

WOLDEMAR HAUPT,
HENRY HASPER.