(No Model.) 4 Sheets—Sheet 1.

G. C. BLACKMORE.

STEAM OR HOT WATER HEATING BOILER.

No. 484,083. Patented Oct. 11, 1892.

Fig. 1.

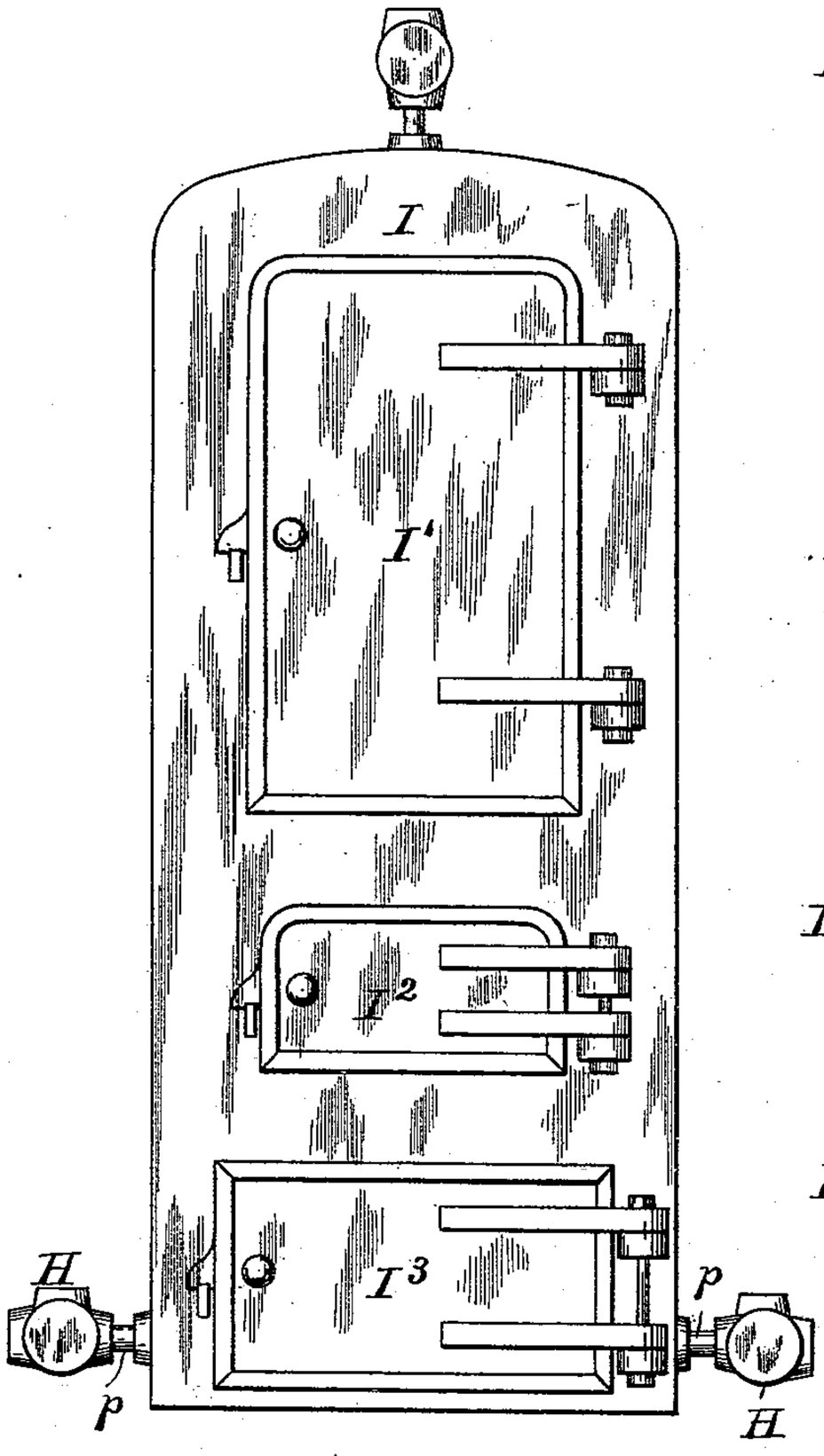
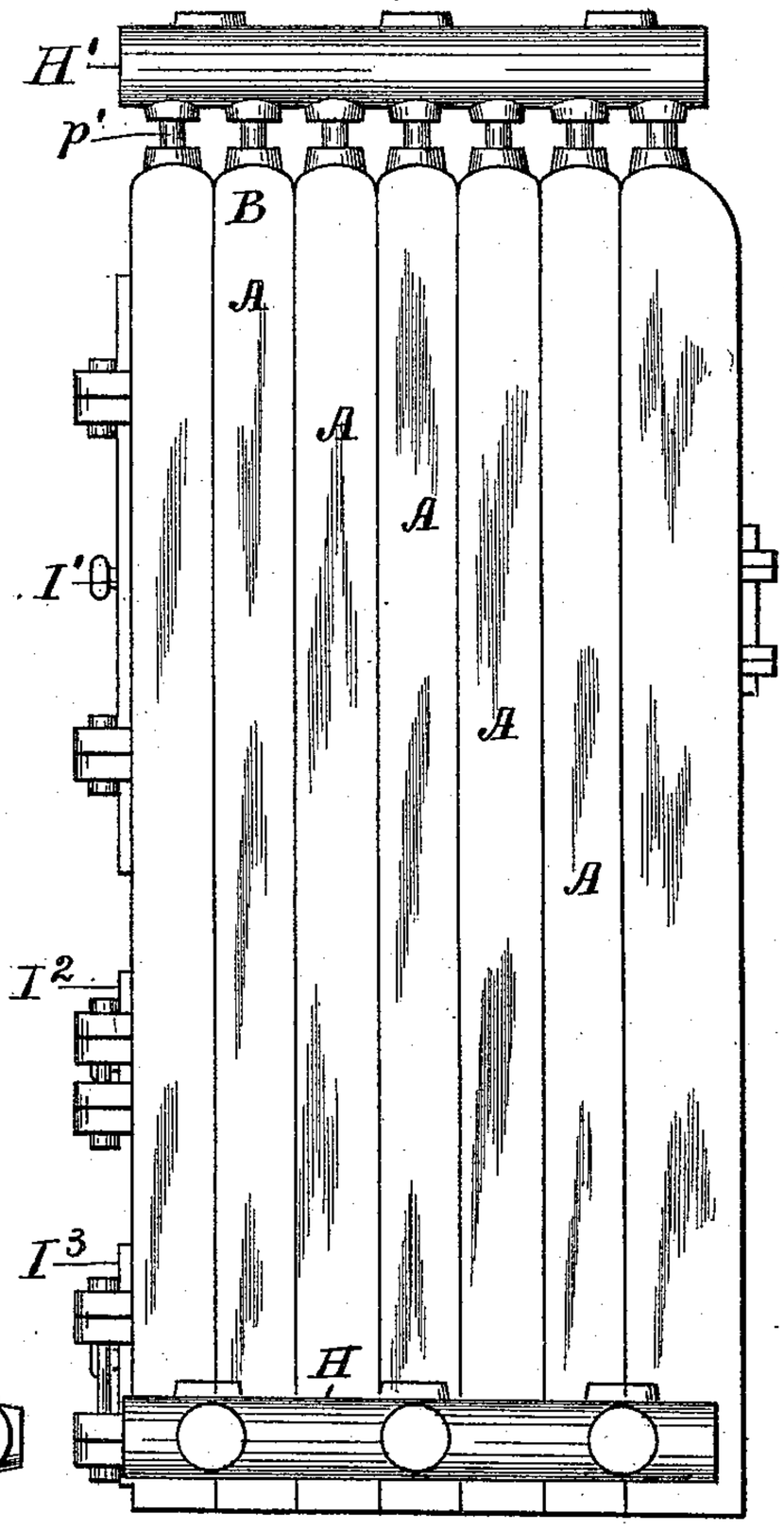


Fig. 2.



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STEAM OR HOT WATER HEATING BOILER.

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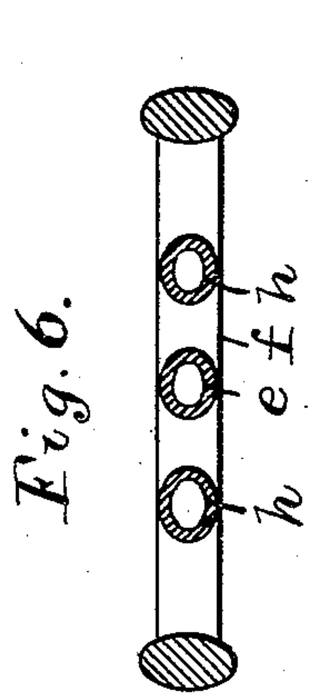

Fig. 6.

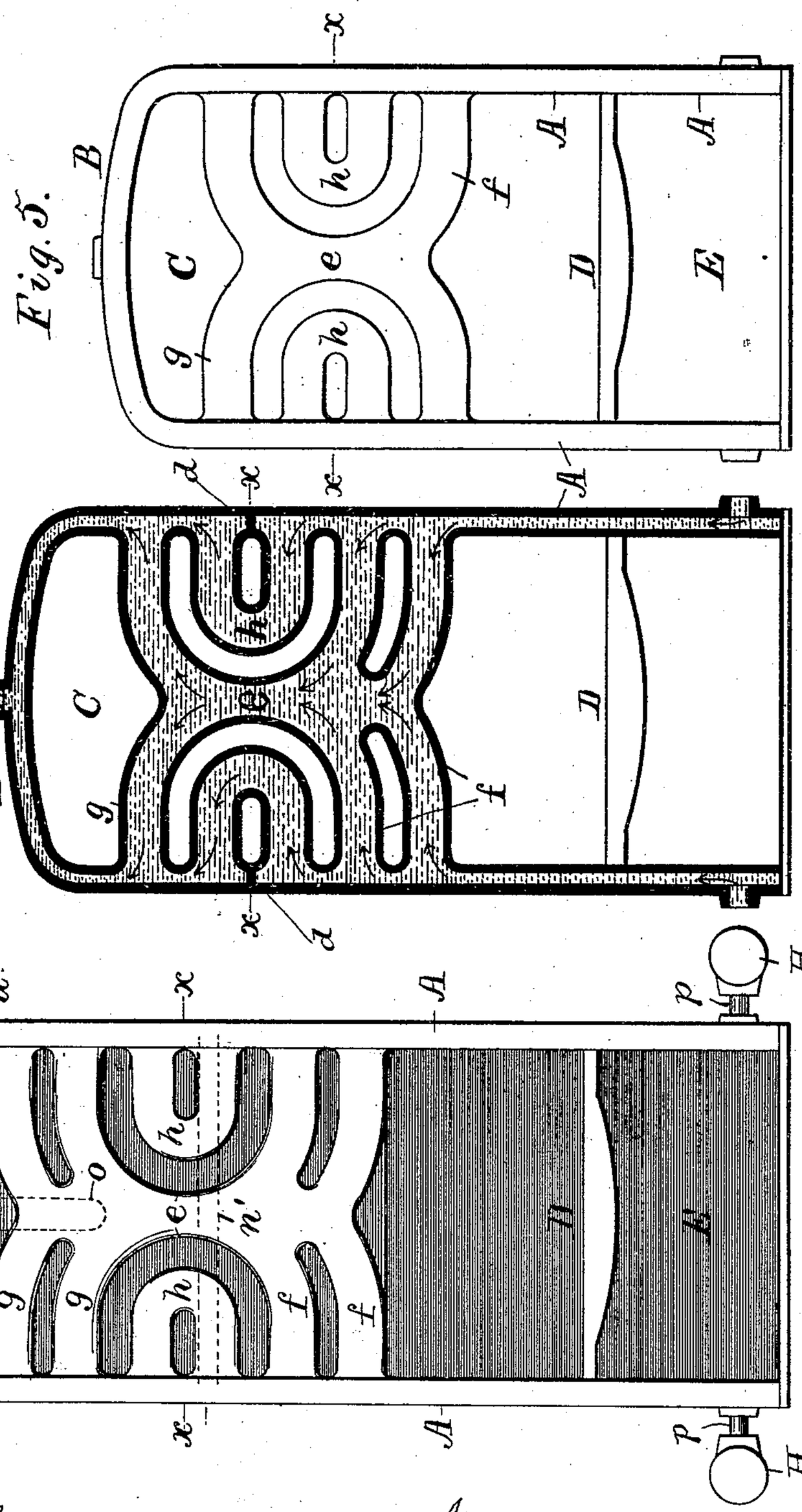

Fig. 5.

Fig. 4.

Fig. 3.

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Fig. 7.

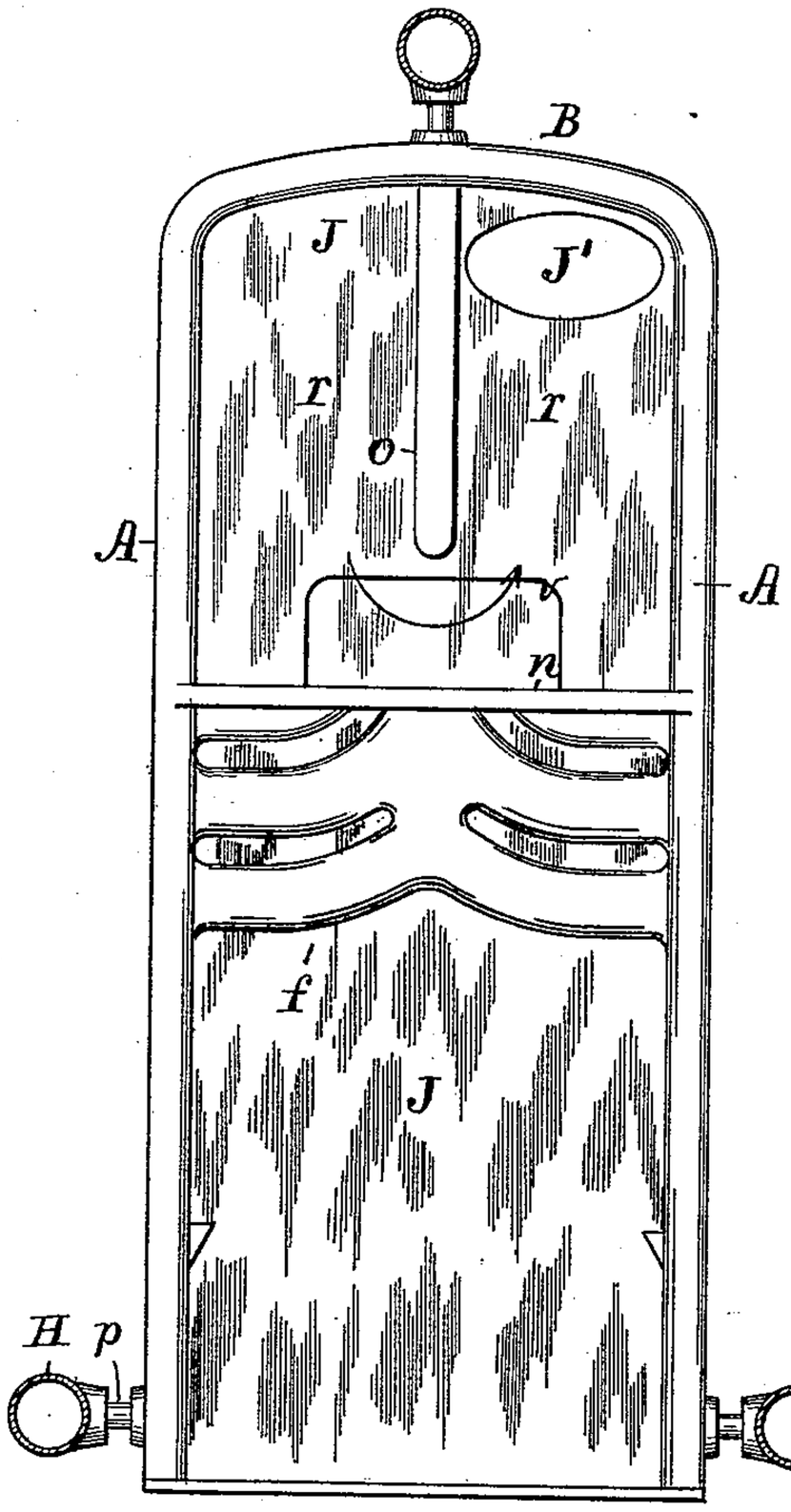
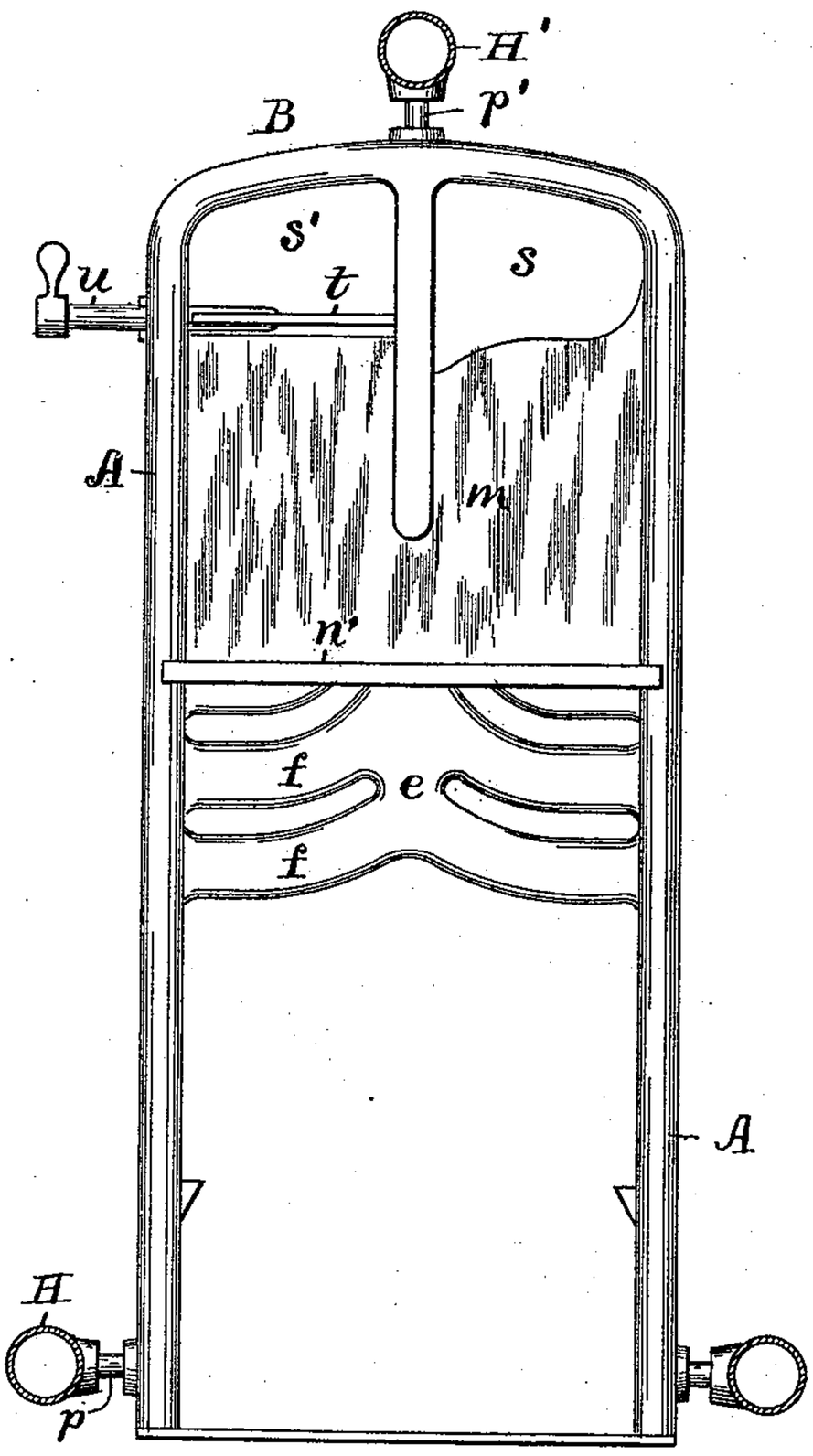


Fig. 8.



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(No Model.) 4 Sheets—Sheet 4.

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STEAM OR HOT WATER HEATING BOILER.

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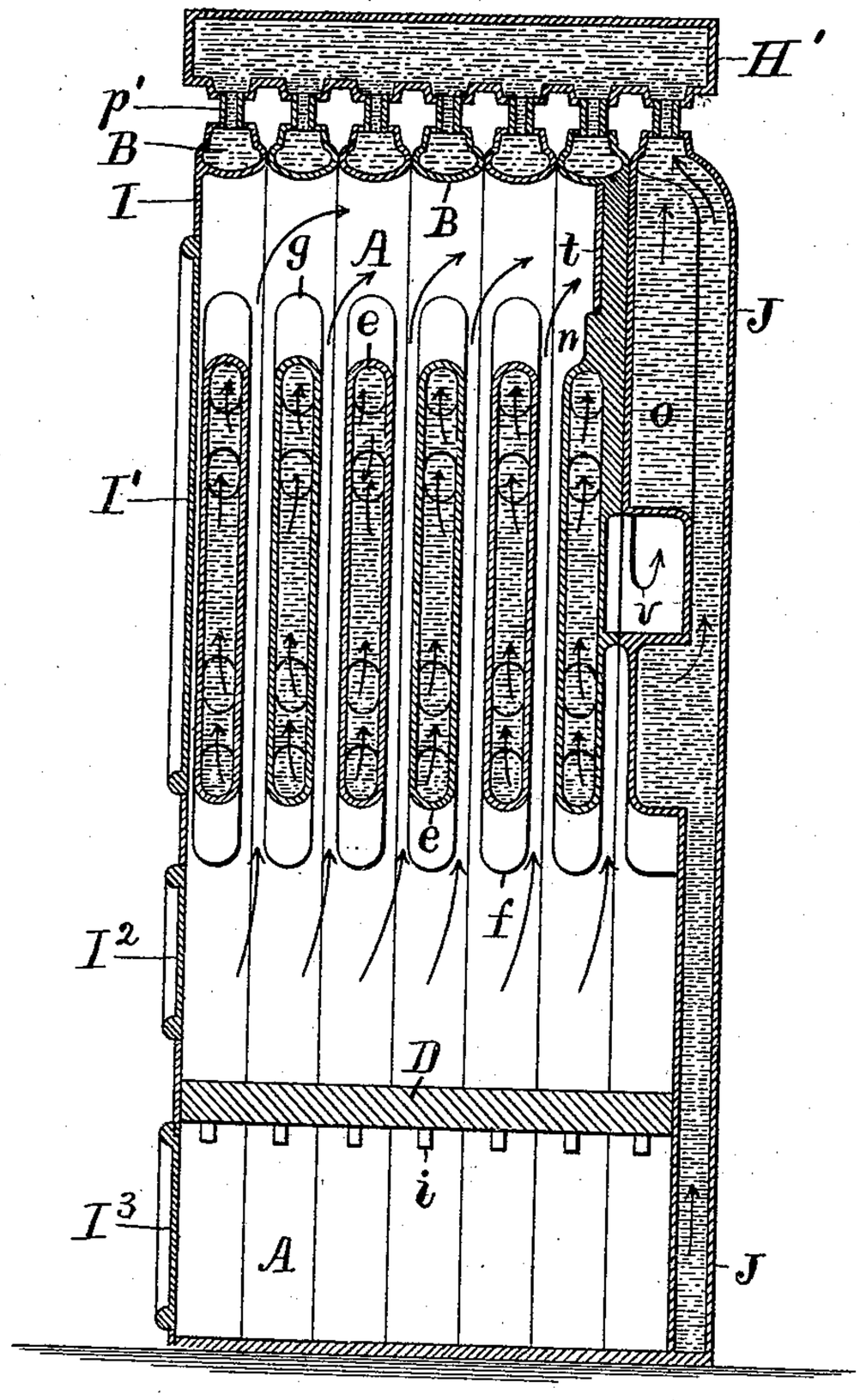
Fig. 9.



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UNITED STATES PATENT OFFICE.

GEORGE C. BLACKMORE, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE BLACKMORE HEATING COMPANY, OF SAME PLACE.

STEAM OR HOT-WATER HEATING BOILER.

SPECIFICATION forming part of Letters Patent No. 484,083, dated October 11, 1892.

Application filed February 12, 1892. Serial No. 421,259. (No model.)

To all whom it may concern:

Be it known that I, GEORGE C. BLACKMORE, a citizen of the United States, residing at Newark, Essex county, New Jersey, have invented certain new and useful Improvements in Steam or Hot-Water Heating Boilers, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a boiler made in upright detachable sections; and its object is to furnish a construction by means of which the circulation of the water may be rendered more positive and may be deflected over the hottest part of the fire, and the construction also secures a combustible chamber in the upper part of the fire and a downward-draft flue at the rear of the boiler. This construction operates to generate a high temperature in the top of the boiler, from which the steam or water is drawn off, and also operates to secure the abstraction of the heat from the gases in the highest possible degree.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 is a front elevation, and Fig. 2 a side elevation, of the entire boiler. Fig. 3 is an elevation of the boiler with the front section removed, the pattern shown being adapted for a boiler of the largest type. Fig. 4 is a section for a somewhat-smaller boiler, and Fig. 5 a section for a still smaller pattern. Fig. 6 represents a cross-section taken on line *x x* in Figs. 3, 4, and 5. Fig. 7 shows the inside of the rear section, and Fig. 8 the rear side of the adjacent section. Fig. 9 is a central vertical longitudinal section.

Each section of the boiler, as shown in Figs. 3, 4, and 5, consists in side columns A, united by a hollow arch or tube B at the top and connected by other transverse tubes at such a distance below the top as to form a combustion-chamber C.

The fluid is fed into the boiler by pipes *p* at the bottoms of the columns A and is discharged by pipes *p'* at the top of the arch B. Each of the sections is formed in one piece of iron by casting, as such material is commonly used in low-pressure heating-boilers. Any desired number of the sections may be secured together by means of headers H H', which are connected with the pipes *p* and *p'*.

The joints between the sections are closed by suitable cement to retain the gases. The front and rear of the sections are closed by plates I and J, the former being provided with cleaning-door I', fuel-door I^2, and ash-door I^3. The rear plate J is provided with a nozzle J' to receive a smoke-pipe. A partition *d* is inserted in each of the side columns A at a suitable point to wholly intercept the flow of the fluid, and the transverse tubular connections are joined to the side columns above and below the partitions, and also to a central column *e*.

The lower transverse connections *f* are sloped upwardly in the same degree from the side columns A to the center column *e*, while the upper connections *g* are sloped upwardly from the center column to the side columns. With such a design the fluid which is obstructed by the partitions *d* is deflected into the lower tube *f* and central column *e*. After rising in this column the fluid is again deflected through the upper tubes *g* into the side column and thence to the arch B, from whence it escapes by the pipe *p'*. Between the transverse connecting-pipes *f* and *g* a loop *h* is formed, with its ends connected to the column A at opposite sides of the partition *d*, the water entering the lower end of such loop and returning to the column A by the upper end of the loop, as with the tubes *f* and *g*.

Lugs *i* are shown upon the inner sides of the columns A to support a grate D at a suitable distance below the transverse connections *f*, and the side columns are preferably extended below the grate a suitable distance to form an ash-box E beneath the grate, when the sections are set upon a foundation. The space between the grate and the connections *f* serves as a fire-box or furnace, the lateral walls of which are formed wholly by the column A.

The transverse connections are, as shown in Fig. 9, made of lesser thickness laterally than the side columns A, so that vertical passages *l* are formed between the transverse

connections, through which the gases rise from the fire-box to the combustion-chamber C.

The spaces *w* between the several transverse tubes and loops *f*, *g*, and *h* in each section form gas-passages in which the flames circulate, and thus heat the contents of all the tubes in the desired manner. Such gas-passages are unobstructed from the front of the boiler to the section next the rear, where the passages above the tubes *f* are closed by a partition *m*.

The plate J is cast hollow in one piece with the columns A and arch B, the upper transverse connections being omitted from this section to form a return-flue, as shown in Figs. 7 and 9. The return-flue is closed at the bottom by a transverse rib *n*, which makes contact with a corresponding rib *n'* at the bottom of the partition *m*. The space above the ribs *n n'* in both the sections is divided vertically for a great part of its depth by a rib *o*, extended downward from the arch B.

The combustion-chamber C connects by separate openings (lettered *s s'* in Fig. 7) with the spaces *r* and *r'*, which form ascending and descending flues at opposite sides of the rib *o*, and outlet-nozzle J' is connected with the space *r'*.

A damper *t*, with spindle *u* projected outside of the section, is applied to the opening *s'* and when open permits a direct draft from the furnace to the nozzle J'. When closed, the gases then escape from the combustion-chamber only through the opening *s*, and pass thence downward through the space *r* beneath the lower end of the rib *o* and thence through the space *r'* to the outlet-nozzle, as indicated by the arrows *v* in Figs. 8 and 9. The rib *o* is preferably made hollow and connected internally with the water box or plate J, which brings the gases into contact with water-heating surfaces throughout its entire passage to the nozzle J'.

The operation of the apparatus is as follows: The flames from the fire-box rise between the transverse connections in each section through smoke-passage *l* into the combustion-chamber C, circulating more or less in the spaces *w* at the same time, so as to heat the contents of the tubes *f*, *g*, and *h*. When kindling the fire, the damper *t* is opened, as shown in Fig. 8, and the gases pass directly from the combustion-chamber to the outlet-nozzle J'; but at other times the damper would be closed and the gases forced to pass through the return-flue in the spaces *r r'*, which retains them in the combustion-chamber sufficiently to permit a complete combustion of all the gaseous elements, which results in a high temperature for the arches B or upper portions of the boiler-sections. The damper *t* thus furnishes a means of providing either a direct or indirect draft, as may be required by the necessities of the fire. The construction may be used for heating by either water or steam, and the fluid, whether steam or water, being drawn from the tops of the sections, is thus delivered at a higher temperature than in a boiler having the greatest heat confined entirely to the fire-box. In most sectional cast-iron boilers the vertical flues are made zigzag or tortuous to prevent the flames from passing upward freely to the top of the boiler, and no provision is made for a large combustion-chamber beneath the upper water arch or dome. In the present construction the vertical passages *l* are not interrupted in any manner; but the gases are permitted to rise freely into the combustion-chamber, so that they may generate a high temperature therein, and thus deliver the fluid from the boiler as hot as possible. By making the rear plate J of hollow structure, as shown in Fig. 9, and locating the water-rib *o* within the return-flue the heat is thoroughly obstructed from the gases before its discharge to the smoke-outlet. The water when the boiler is in operation enters the extreme lower ends of the columns A, where no heat is applied to the metal, and the return fluid is therefore prevented from chilling a highly-heated surface, and thus inducing an injurious contraction or effect upon the structure. The fluid then rises in the side columns to the partition *d*, which diverts the entire current inward over the hottest part of the fire-box. From this location the central column *e* furnishes a direct channel for the upward passage of the water, which passes thence through the tubes *g* into the side columns and arch B, where the water is still further heated by the combustion in the chamber C. It is understood that a boiler of any capacity may be formed of such sections by using a suitable number of the same, and a boiler of such construction may thus be readily extended after it has been in use.

To form a section of smaller capacity than that shown in Fig. 3, the transverse connections may be diminished in number, as shown in Figs. 4 and 5, the boiler-section in Fig. 4 having only one of the upper tubes *g* and two of the lower tubes *f*, while the boiler-section in Fig. 5 has only one each of the tubes *f* and *g*. In these two boiler-sections the combustion-chamber, the fire-box, and the ash-box are diminished correspondingly in height to form with a series of such sections a boiler of smaller dimensions and capacity than that shown in Fig. 3.

It is obvious that the combustion-chamber C, arranged in the upper part of the boiler beneath the water-arch B, may be used with transverse connections of different character than those described herein, and the combustion-chamber is therefore claimed in such relation.

The precise form of the water-arch B is immaterial, as its function is to deliver the water from the tops of the columns A to the outlet-pipes *p'*; but it obviously offers less re-

sistance to the movement of the water when curved or arched, as shown in the drawings.

Having thus set forth the nature of the invention, what is claimed is—

1. A section for a vertical sectional boiler, consisting in side columns A, united at the top by arch B and having the partitions *d* formed therein and having transverse tubes connected with the columns A above and below the partition *d* and united in a central column *e*, as set forth.

2. A section for a vertical sectional boiler, consisting in the columns A, connected by arch B and provided with the loops *h*, and the tubes *f* and *g*, united in the column *e* and having the partition *d* inserted in the columns A between the ends of the loop, with the water-inlets *p* and the outlet *p'*, arranged substantially as set forth.

3. In a vertical sectional boiler, the combination, with a series of vertical cast-iron sections consisting each in side columns A, united at the top by arch B and having the partition *d* formed therein and having the transverse tubes connected with the columns A above and below the partition *d* and united in a central column *e*, of the water-plate J, applied at one end of the series, and the front plate I, provided with the door I', opening into the combustion-chamber, being applied at the opposite side of the series, as and for the purpose set forth.

4. In a vertical sectional boiler, the combination, with a series of vertical cast-iron sections provided with a combustion-chamber in the top of the boiler beneath a water-arch, of the partition *m* and the ribs *n* and *o*, arranged at one end of the boiler, as set forth, to form a return-flue, and the smoke-outlet J', and the damper *t*, arranged opposite the same to furnish a direct or indirect draft, substantially as herein set forth.

5. A cast-iron sectional boiler formed with a series of vertical sections having a combustion-chamber in the top beneath a water-arch and provided at one end with the water-plate J, having the smoke-outlet J', and the hollow rib *o*, projected into a return-flue, and the vertical section adjacent to the water-plate, being provided with a partition *m*, and the damper *t*, arranged and operated substantially as herein set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GEORGE C. BLACKMORE.

Witnesses:
THOMAS S. CRANE,
E. L. WYMAN.