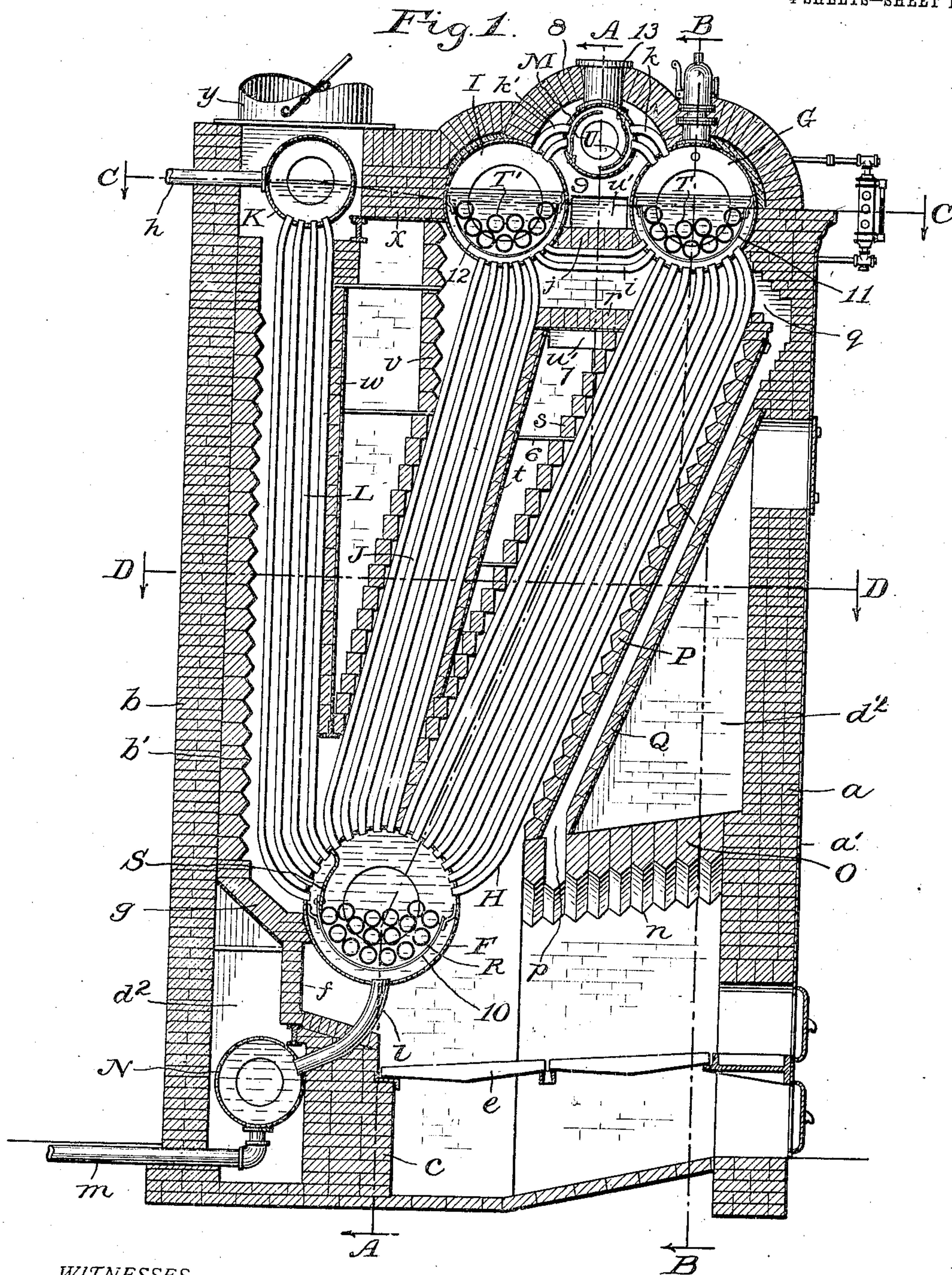


No. 822,718.

PATENTED JUNE 5, 1906.

I. H. BOYER.
STEAM PRODUCER.
APPLICATION FILED FEB. 10, 1906.

4 SHEETS—SHEET 1.



WITNESSES:

Dow W. Vorhies.
Stella Snider.

INVENTOR:

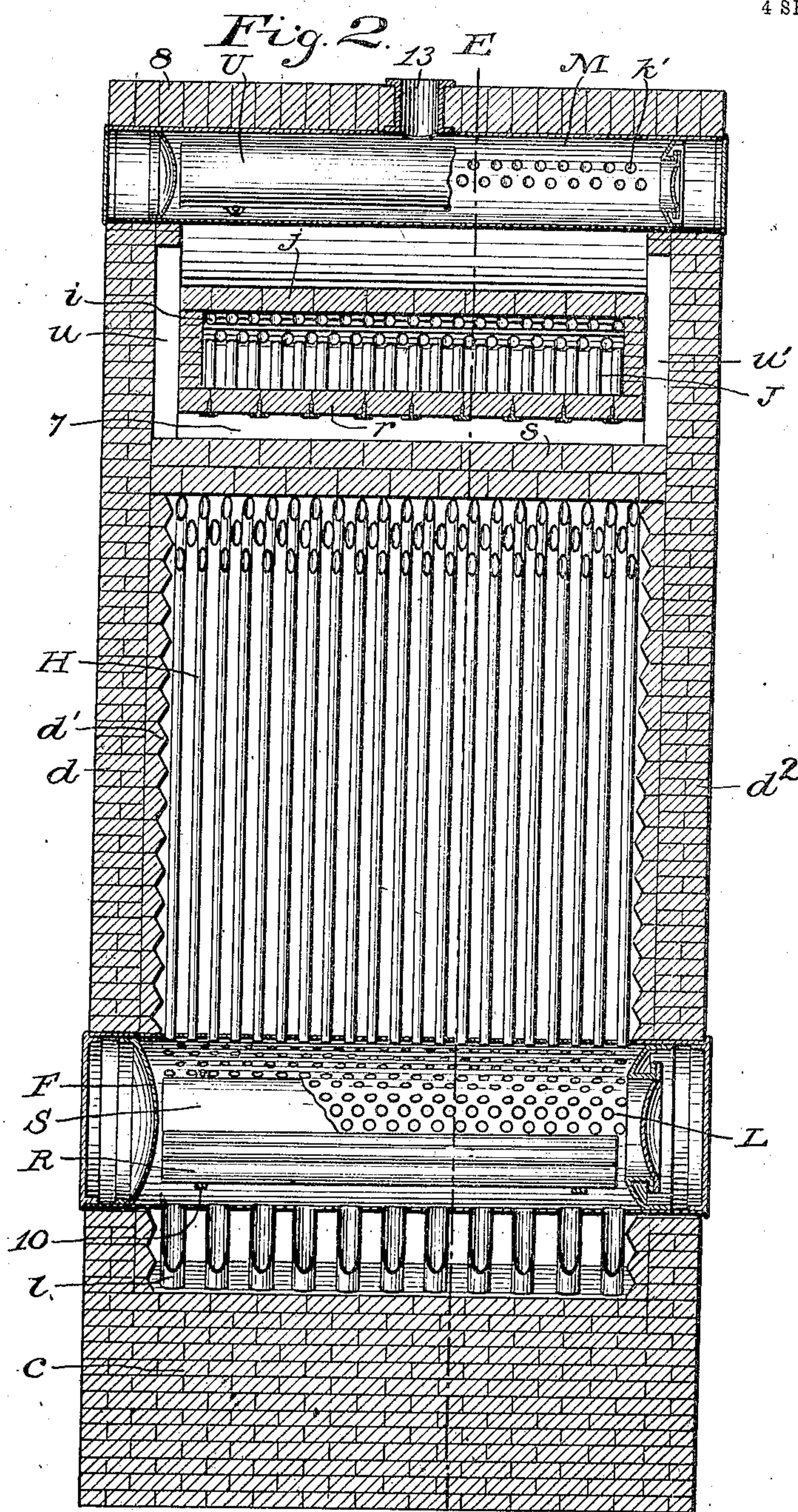
Isaac H. Boyer
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No. 822,718.

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APPLICATION FILED FEB. 10, 1906.

4 SHEETS—SHEET 2.



WITNESSES:

E

INVENTOR:

Dor W. Voorhis.
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No. 822,718.

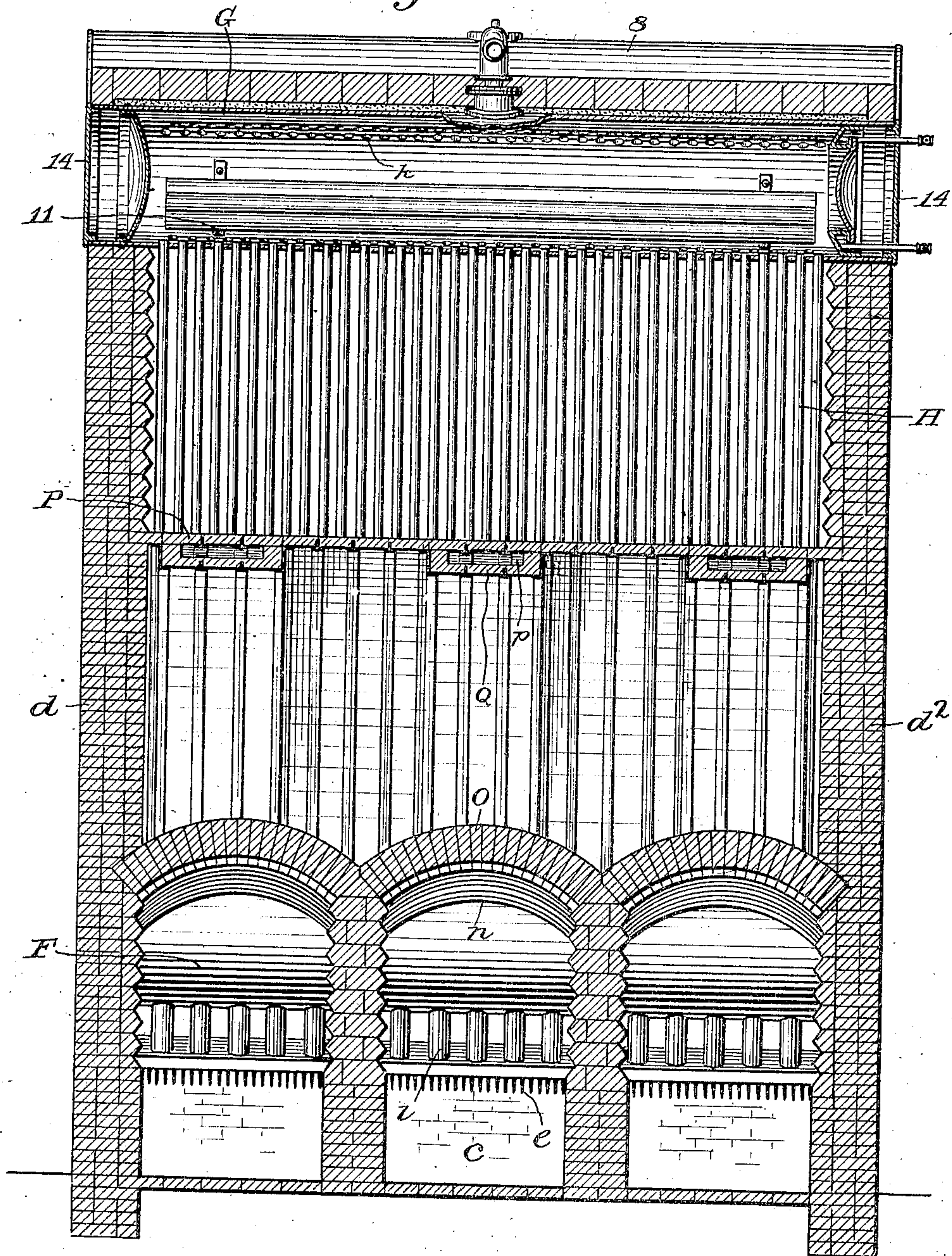
PATENTED JUNE 5, 1906.

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STEAM PRODUCER.

APPLICATION FILED FEB. 10, 1906.

Fig. 3.

4 SHEETS—SHEET 3.



WITNESSES:

Row W. Vorhies.
Stella Snider.

INVENTOR:

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APPLICATION FILED FEB 10, 1906.

4 SHEETS—SHEET 4.

Fig. 5.

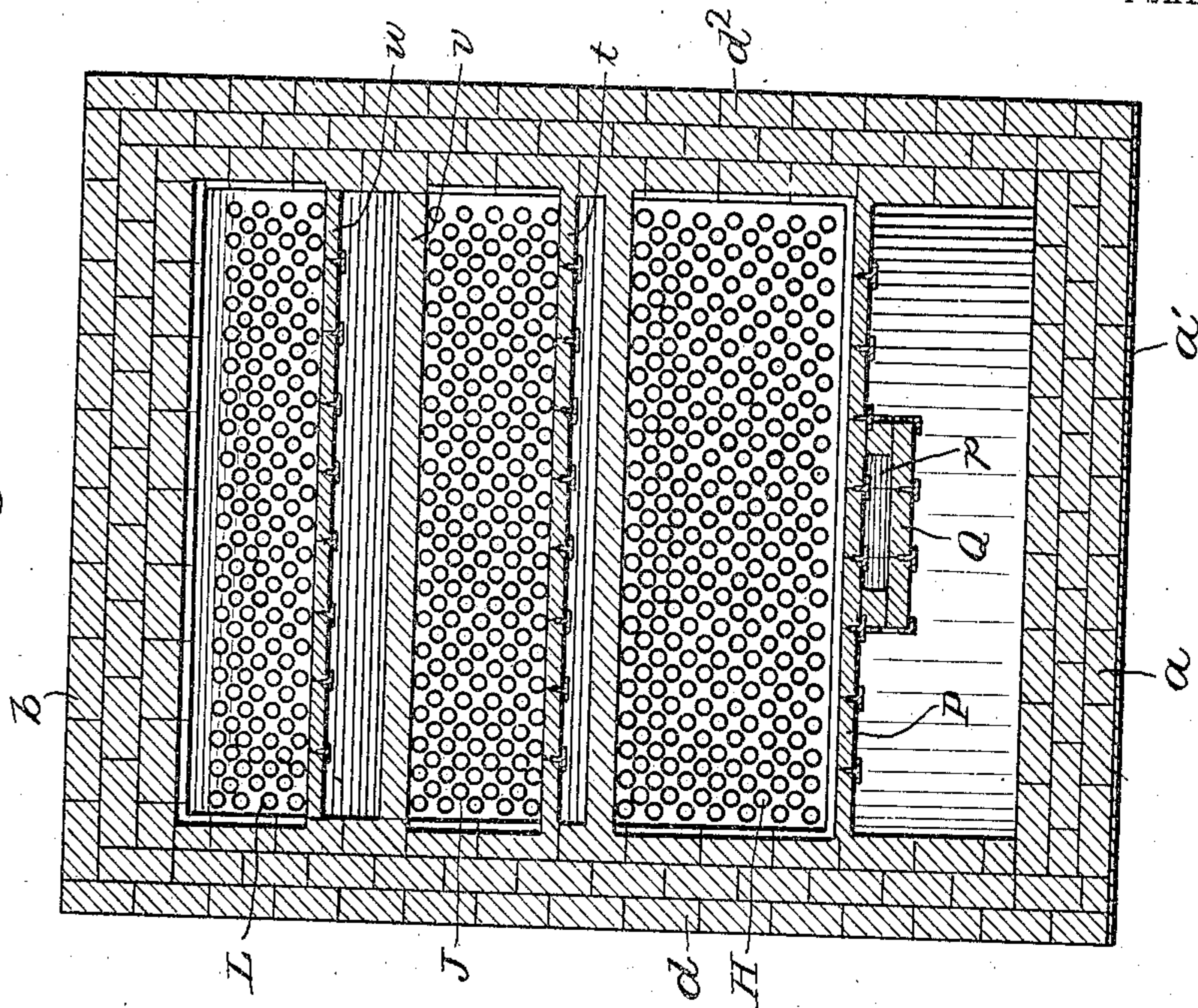
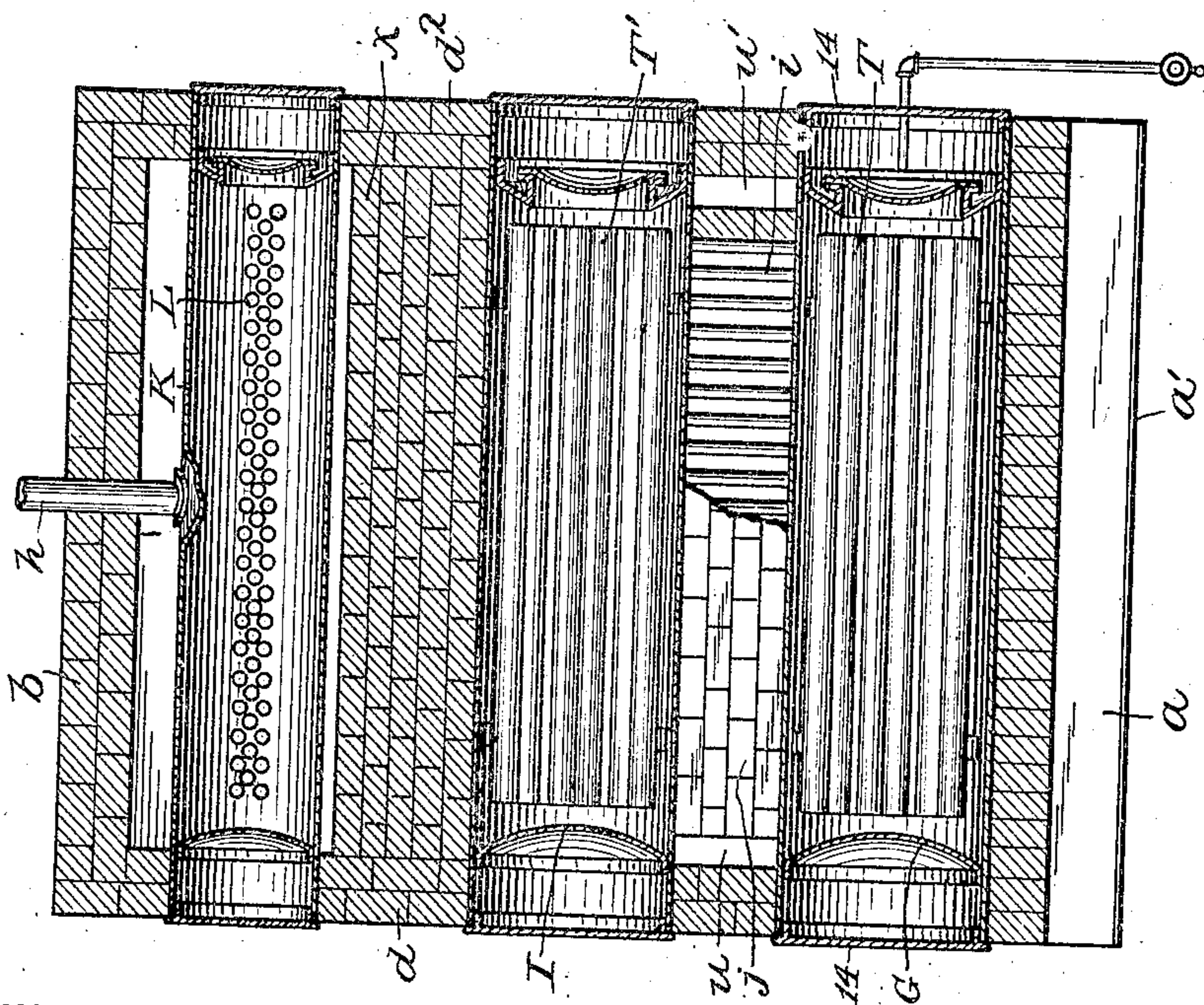


Fig. 4



WITNESSES:

Row W. Vorhies.
Stella Snider.

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UNITED STATES PATENT OFFICE.

ISAAC H. BOYER, OF MUNCIE, INDIANA.

STEAM-PRODUCER.

No. 822,718.

Specification of Letters Patent.

Patented June 5, 1906.

Application filed February 10, 1906. Serial No. 300,473.

To all whom it may concern:

Be it known that I, ISAAC H. BOYER, a citizen of the United States, residing at Muncie, in the county of Delaware and State of Indiana, have invented new and useful improvements in Steam-Producers; and I do declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to apparatus for converting water into steam by the consumption of coal or other fuel, the invention having reference particularly to the furnace and the draft-passages therefor and to the vessels for holding the water and the steam.

Objects of the invention are, first, to improve the construction generally of upright water-tube types of steam-producers with respect to the distribution and application of the heat; second, to provide improved apparatus for heating the water; third, to provide improved evaporators for converting the water into steam, and, fourth, to provide means for separating mud or other foreign matter from the water.

The above-mentioned and minor objects are attained in the present invention, which consists of a steam-producer having evaporators and also a water-drum provided with water-dividers, the water-drum being provided also with a water-deflector and a mud-drum; and the invention consists, further, in the novel parts and the combinations and arrangements of parts, as hereinafter particularly described and claimed.

Referring to the drawings, Figure 1 is a vertical longitudinal sectional view of the improved steam-producer, taken at a suitable plane, as on or near the line E E in Fig. 2; Fig. 2, a transverse vertical sectional view on the plane of the line A A in Fig. 1; Fig. 3, a transverse vertical sectional view on the plane of the line B B in Fig. 1, but represented as being wider than the structure shown in Fig. 2; Fig. 4, a horizontal sectional view on the plane of the line C C in Fig. 1, and Fig. 5 a horizontal sectional view on the plane of the line D D in Fig. 1.

Similar reference characters in the drawings designate corresponding elements or features throughout the various figures thereof.

In construction the steam-producer comprises a front wall *a*, having an iron front *a'*

with suitable furnace and ash-pit doors; a rear wall *b*, lined with bricks having projections *b'*, adapted to become heated rapidly and to radiate the heat; a furnace-wall *c*; side walls *d* and *d'*, lined with bricks having projections *d'*, the side walls being any suitable distance apart to conform to the capacity of the apparatus; grates *e* in the furnace, formed by the walls and extending from the front wall to the furnace-wall *c* near the top thereof. A wall *f* is built upon the rear part of the wall *c*, and a sloping wall *g* extends from the wall *f* to the rear wall *b*.

A water-drum *F* is supported horizontally by the side walls somewhat above the wall *c* and against the front of the top of the wall *f*. A drum *G*, comprising the principal part of an evaporator, is supported by the upper portions of the side walls *d* and *d'* against the upper portion of the front wall *a*, and a series of water-tubes *H* are connected to both of the drums *F* and *G*. A drum *I*, comprising the principal part of another evaporator, is supported by the side walls at a suitable distance behind the drum *G* in the same horizontal plane therewith, and a series of water-tubes *J* are connected to the drums *F* and *I*.

A water-drum *K* is supported by the side walls near the rear wall *b* and has an inlet-pipe *k* connected thereto, and a series of water-tubes *L* are connected to the drums *F* and *K*, extending close to the projections *b'* of the rear wall *b* and above the wall *g*. A series of evaporator-tubes *i* are connected to the lower portions of the drums *G* and *I*, and a roof *j* is placed upon the tubes, extending between the side walls and also between the drums *G* and *I*. A steam-drum *M* is mounted on the side walls near the tops thereof in a plane between the drums *G* and *I* and above the water-level thereof, there being a series of ducts *k*, connecting the drums *G* and *M*, and a series of ducts *k'*, connecting the drums *I* and *M*, so that steam may pass from the evaporator-drums into the steam-drum.

A mud-drum *N* is supported by the side walls *d* and *d'* between the walls *b* and *c* and is connected by a series of ducts *l* with the water-drum *F*, the ducts extending through the wall *c*, so that all deposits from the water in the water-drum may pass to the mud-drum, which is provided with a blow-off pipe *m*.

An arch *O*, having projections *n*, is arranged in the furnace and extends from the front wall *a* toward the water-drum *F* nearly

to the series of tubes H. An inclined wall P extends from the end of the arch near the series of tubes to the front wall near to the drum G, a main heat-passage being behind the wall P between the tubes. A trough Q is built against the front of the wall P, so as to form an auxiliary heat-passage *p*, that is extended through the top of the arch O and also into the upper portion of the front wall *a* with a terminal *q* communicating with the main heat-passage beneath the drum G. The heat-passage *p* may, however, be arranged separately from the wall P, if desired. The wall P extends from one side wall to the other. Any suitable number of arches O may be provided, and likewise any desired number of auxiliary heat-passages *p* may be provided, as appears in Fig. 3.

A horizontal partition *r* is arranged below the roof *j*, so as to form a heat-passage from beneath the drum G to the drum I. A wall *s* extends from the drum F to the partition *r*, and a wall *t* extends from the drum F to the partition *r* with a dead space 7 between the walls *s* and *t*, there being braces 6 for the walls *s* and *t*. Side passages *u* and *u'* are formed in the side walls *d* and *d'*, connecting the dead space 7 with the space above the roof *j*, so that the hot air from the dead space may be conducted to the steam-drum M for drying the steam therein, there being an arch 8 on the drums G and I, extending over the drum M, forming the roof of an air-chamber 9, in which the drum M is arranged. The drums G and I are suitably covered. A wall *v* is built at the rear of the tubes J, completing, with the wall *t*, a draft-passage from the drum I to the drum F, the passage extending under the wall *v*, which is joined by a wall *w*, that is built against the tubes L, the walls *w* and *b* forming a draft-passage to the upper portion of the structure where a horizontal roof *x* is placed upon the walls *v* and *w* and against the rear part of the drum I. A chimney connection *y* is placed upon the roof *x* and the rear wall *b* above a smoke-box in which the drum K is arranged.

It will be seen from the foregoing that a heat-passage extends from the end of the arch O between the tubes H to the drum G and thence to the drum I, thence to the drum F, and thence to the drum K. The heat rising between the tubes H will become somewhat absorbed by the water in the tubes in rising to the drum G; but the gases will be reheated by direct furnace heat rising through the passage *p* under the drum G, so that the greater amount of steam will be produced in the drum G, and the augmented heat will be applied also to some extent to the drum I.

The water-drum F is provided with a water-divider to prevent agitation of the whole body of water in the drum and to provide that a shallow body of the water only shall be exposed to the heat on the lower part

of the shell of the drum in order that the water may be heated rapidly to a high degree before entering the tubes that extend to the evaporators. The water-divider comprises stirrups 10, supported in the drum, and a series of tubes R, piled upon the stirrups, the tubes having open ends. A deflecting-plate S is supported in the drum F, opposite to the ends of the tubes L, to deflect the incoming water under the tubes R, so that the water will pass principally through a shallow channel under the tubes R, although there will be slow circulation among the tubes.

The evaporators include water-dividers comprising, respectively, a plurality of tubes T, arranged on stirrups 11 in the drum G, and a plurality of tubes T', arranged on stirrups 12 in the drum I. The divider-tubes are supported a short distance above the bottoms of the drums, so that a shallow body of water only in each drum is acted upon by the heat at one time, therefore insuring rapid conversion of the water into steam and with the minimum consumption of fuel.

The steam-drum M has deflectors U therein and also an outlet-pipe connection 13, and all of the drums have their heads fixed within the ends of their shells, the ends of the shells being provided with caps 14 to exclude cold air from the heads of the drums. If desired, the water-dividers in the various drums may be formed differently in detail from the construction described.

In practical use the feed-water will enter the drum K and pass to the drum F, the water that may carry matter in suspension gravitating to the mud-drum N. From the drum F the water will rise into the evaporator-drums G and I, there to be converted into steam, which will pass to the steam-drum M and therein be dried. Other results of operation will be fully understood from the foregoing description in connection with the details of construction of the apparatus.

Having thus described the invention, what is claimed as new is—

1. A steam-producer including inclosing walls forming a furnace, a water-drum in the furnace, an evaporator in the upper portions of the walls, a main heat-passage extending from the furnace to the evaporator, a series of water-tubes in the main heat-passage connected to the water-drum and also to the evaporator, and an auxiliary heat-passage extending from the furnace to the upper end of the main heat-passage and connected therewith.

2. A steam-producer including inclosing walls forming a furnace, a water-drum in the furnace, an evaporator in the upper portions of the walls, a main heat-passage extending from the furnace to the evaporator, a series of water-tubes in the main heat-passage connected to the water-drum and also to the

evaporator, an arch in the furnace and having a heat-passage in the top thereof, and an auxiliary heat-passage extending from the heat-passage of the arch to the upper end of the main heat-passage and connected therewith adjacently to the evaporator.

3. A steam-producer including inclosing walls forming a furnace, a main heat-passage and an auxiliary heat-passage extending from the furnace and joined together near the tops of the walls, a water-drum in the furnace, an evaporator above the top of the main heat-passage, a series of water-tubes connected to the water-drum and also to the evaporator, a mud-drum in planes below and rearward of the water-drum, and a series of ducts connected to the water-drum and also to the mud-drum, the mud-drum having a blow-off pipe.

4. A steam-producer including inclosing walls forming a furnace with a furnace-wall therein, a water-drum mounted above the furnace-wall and having a plurality of stirrups supported therein near the bottom thereof, a plurality of tubes supported on the stirrups and forming a water-divider above the bottom of the water-drum, inlet-tubes connected to the water-drum, a deflector extending from the wall of the water-drum to one side of the plurality of water-divider tubes, an evaporator, water-tubes connected to the water-drum and to the evaporator, a water-head connected to the tops of the inlet-tubes, a mud-drum arranged behind the furnace-wall, and ducts extending through the furnace-wall and connected to the water-drum and to the mud-drum.

5. A steam-producer including inclosing walls forming a furnace, a water-drum in the furnace, two heat-passages extending upwardly and divergently from the water-drum and connected together at their upper

ends, one of the heat-passages communicating with the furnace, there being a draft-passage connected at the water-drum with the other heat-passage, a dead space being formed between the two heat-passages, a pair of evaporator-drums above the heat-passages connected together with connections between the evaporator-drums and the water-drum, a hot-air chamber formed between the evaporator-drums and having passages connected therewith and with the dead space, and a steam-drum mounted in the hot-air chamber and connected with the pair of evaporator-drums.

6. A steam-producer including inclosing walls forming a furnace, a water-drum in the furnace, a pair of connected evaporator-drums having each a water-divider therein, a steam-drum connected with the evaporator-drums and having deflectors therein, a heat-passage extending from the furnace to the evaporator-drums, a heat-passage extending from the evaporator-drums to the water-drum with a draft-passage connected therewith, a dead space between the heat-passages, a hot-air chamber beneath the steam-drum, ducts between the dead space and the hot-air chamber, water-tubes in the heat-passages connecting the water-drum with the evaporator-drums, a water-head connected with the water-drum, a mud-drum connected with the water-drum, and an auxiliary heat-passage extending from the furnace to the evaporator-drums and there connecting with the heat-passages.

In testimony whereof I affix my signature in presence of two witnesses.

ISAAC H. BOYER.

Witnesses.

WM. H. PAYNE,
E. T. SILVIUS.