(No Model.) 4 Sheets—Sheet 1.

R. JOY.

STEAM BOILER.

No. 576,197. Patented Feb. 2, 1897.

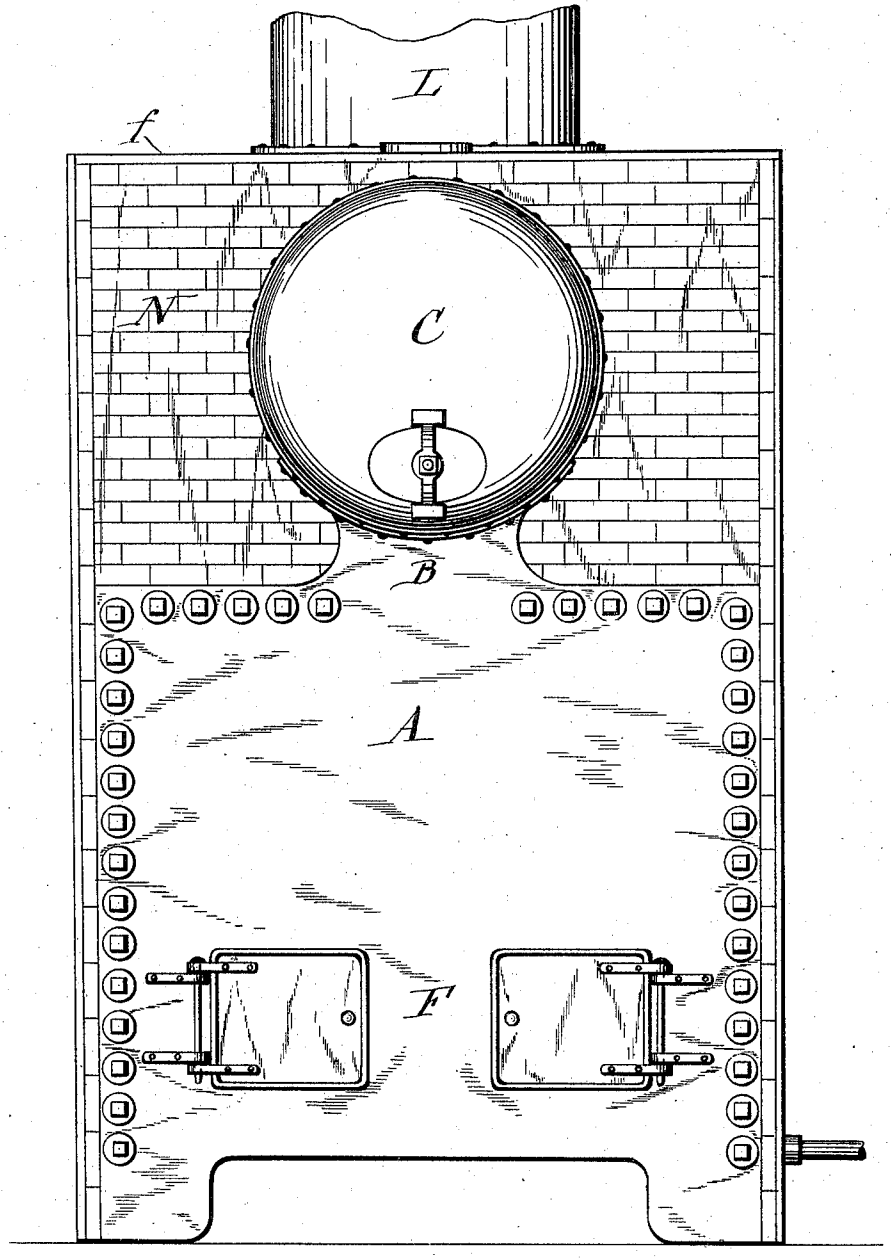

Fig. 1

WITNESSES:

C. L. Bendixon

J. J. Laass

INVENTOR

Robert Joy

By E. Laass

his ATTORNEY

(No Model.) 4 Sheets—Sheet 2.

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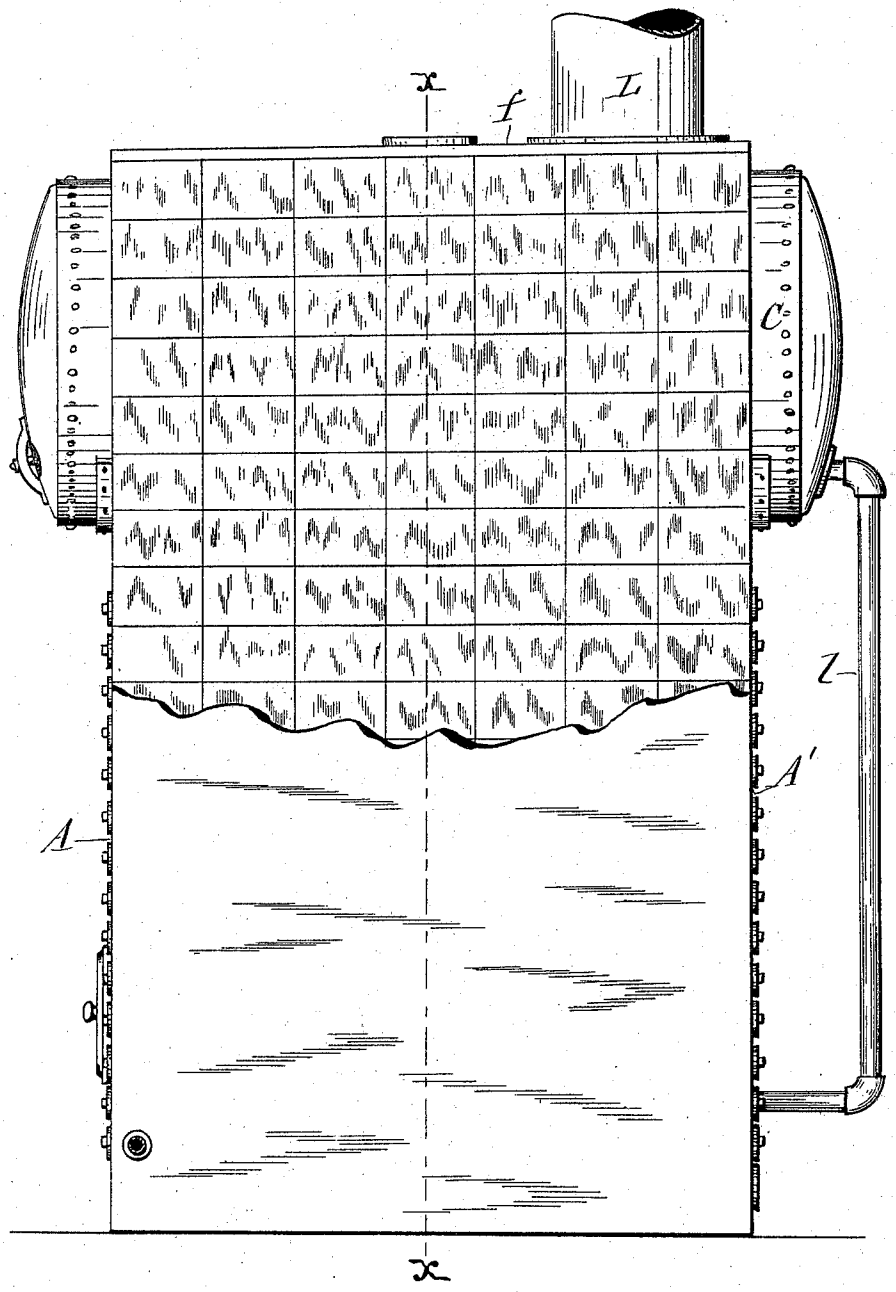

Fig. 2

WITNESSES:
C. L. Benedixen
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(No Model.)

4 Sheets—Sheet 3.

R. JOY.

STEAM BOILER.

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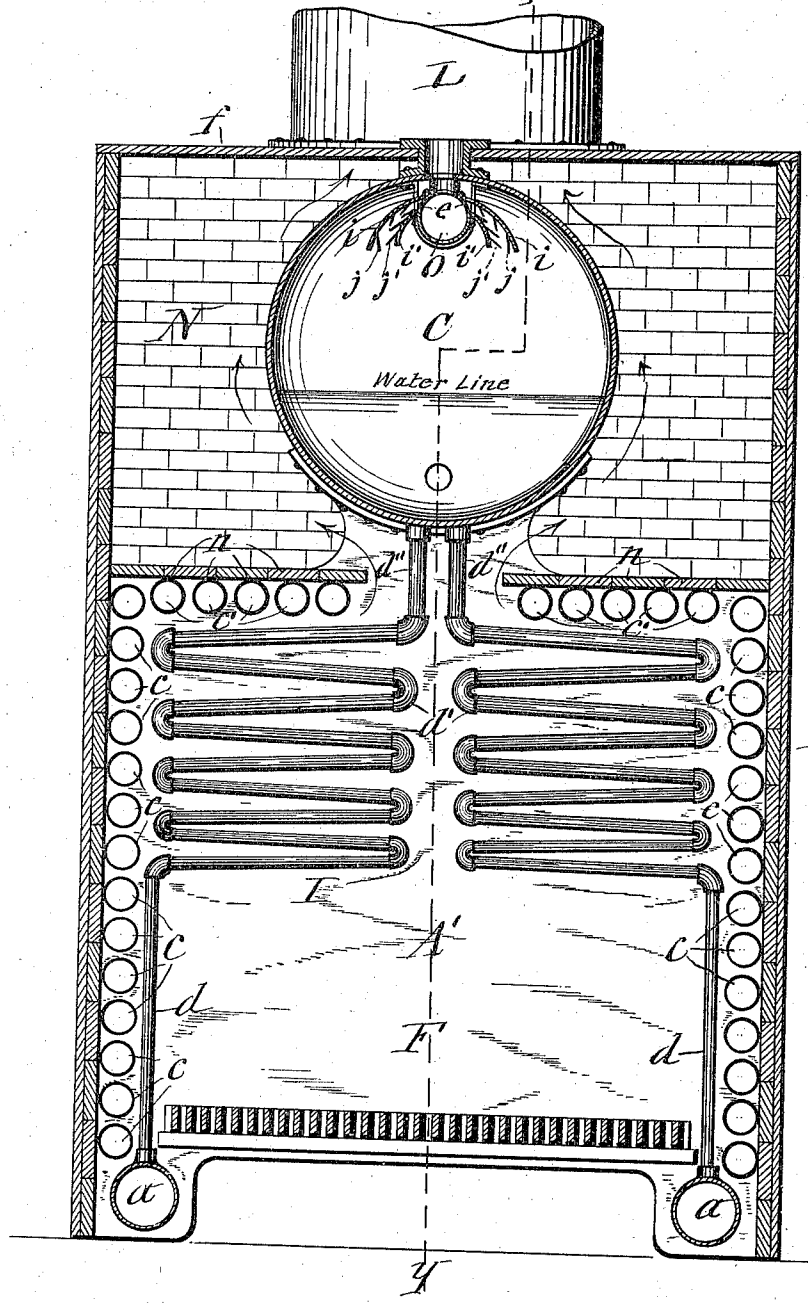

Fig. 3

WITNESSES:

C. L. Burdick

J. J. Laass.

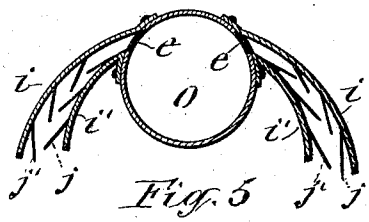

Fig. 5

INVENTOR

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(No Model.) 4 Sheets—Sheet 4.

R. JOY.

STEAM BOILER.

No. 576,197. Patented Feb. 2, 1897.

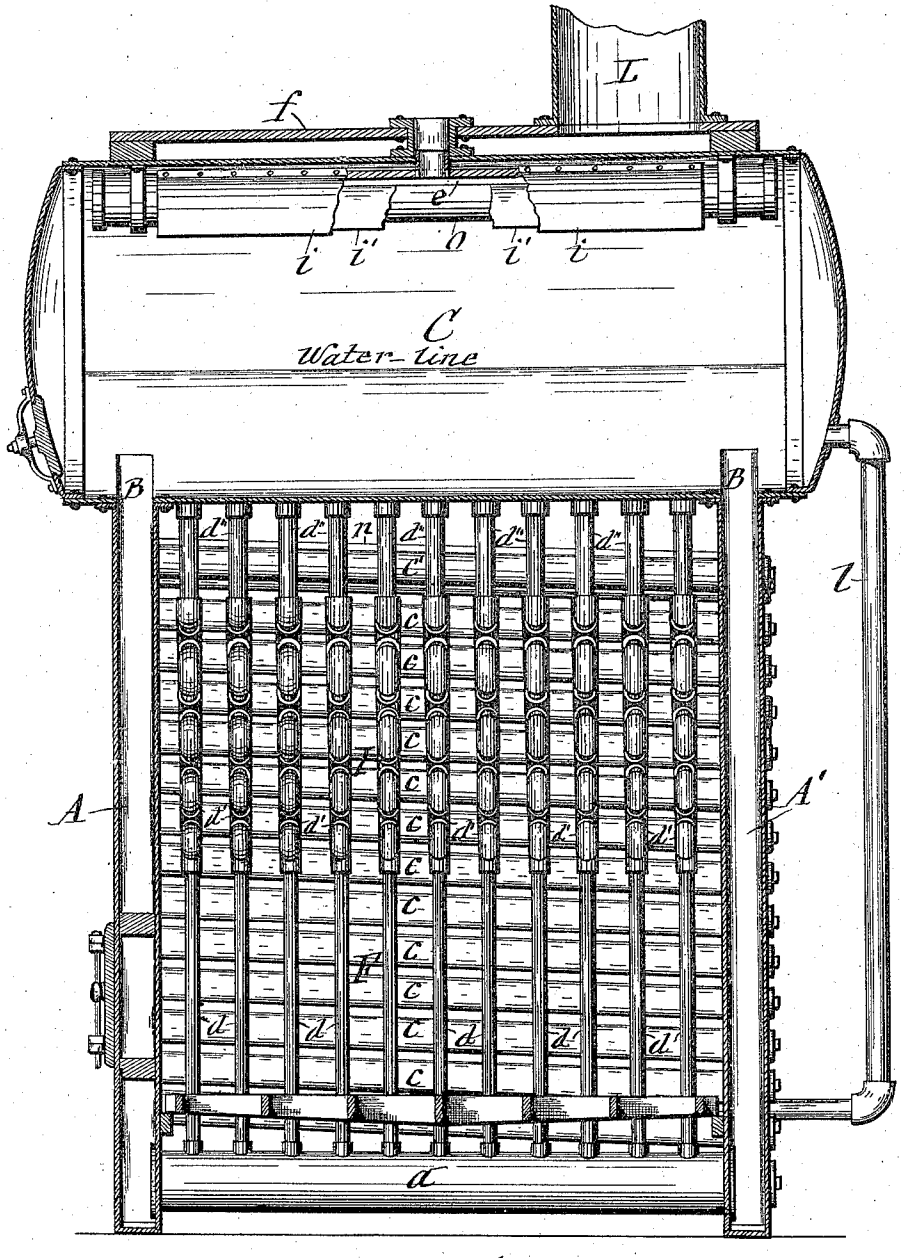

Fig. 4.

WITNESSES:

C. L. Bendixon

J. J. Laass

INVENTOR:

Robert Joy

By E. Laass

his ATTORNEY

UNITED STATES PATENT OFFICE.

ROBERT JOY, OF OSWEGO, NEW YORK, ASSIGNOR TO THOMSON KINGSFORD, OF SAME PLACE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 576,197, dated February 2, 1897.

Application filed March 18, 1896. Serial No. 583,656. (No model.)

To all whom it may concern:

Be it known that I, ROBERT JOY, of Oswego, in the county of Oswego, in the State of New York, have invented new and useful Improvements in Steam-Boilers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention consists in a novel organization of a steam-boiler which is composed chiefly of water-tubes arranged to permit free circulation of the water and in positions to be effectually impinged by the products of combustion from the fire-box and is provided with a dry-pipe which is equipped with shields for separating water from saturated steam, all as hereinafter more fully described, and summed up in the claims.

In the accompanying drawings, Figure 1 is a front elevation of a steam-boiler embodying my invention. Fig. 2 is a side elevation of the same. Fig. 3 is a vertical transverse section on line X X in Fig. 2. Fig. 4 is a vertical longitudinal section on line Y Y in Fig. 3, and Fig. 5 is an enlarged transverse section of the dry-pipe.

Similar letters of reference indicate corresponding parts.

A and A′ are two water-walls which are parallel and constitute the front and rear ends of the boiler. Each of these walls is formed with an upwardly-extending throat B in the center of its top, and upon the two throats is mounted the combined water and steam drum C, which communicates with the interior of said water-walls. These walls are connected with each other along their ends and at their tops by two series of longitudinal water-tubes *c c′*, distributed the entire heights of said walls and from the ends of their tops to the throats B B, which tubes form water side walls of the fire-box and combustion-chamber and part of a crown over the latter, which walls and crown portion have interstices by which the heating-surfaces are increased, while the water is permitted to freely circulate through said side walls and crown portion.

Under each of the vertical series of water-tubes *c c* is a longitudinal large or main water-tube *a*, which is connected at its ends to the bases of the front and rear water-walls A A′, and thus further promotes the circulation of the water from wall to wall. To each of these main water-tubes *a* is connected a series of vertical water-tubes *d*, which extend part way the heights of the series of longitudinal tubes *c c*, and extend thence laterally part way toward the center of the space between the two series of aforesaid longitudinal tubes, and thence in a zigzag direction upward, as at *d′*, in vertical parallel planes, and terminate with vertical extensions *d″*, which are connected to the drum C.

In order to insure free circulation of the water through the zigzag tubes *d′*, I make each of the successive sections thereof of a larger diameter than the subjacent section. This obviates the liability of forming steam in the returns of said tubes, which steam would force the water in opposite directions from the tubes, as has been found in straight water-tubes of steam-boilers. The vertical tubes *d d*, with the adjacent longitudinal tubes *c c*, form reticulated water-walls at the sides of the fire-box F, and the lower sections or branches of the zigzag tubes *d′* form the crown of the fire-box, directly over which is the combustion-chamber I, in which the said zigzag tubes are distributed, so as to be thoroughly exposed to the products of combustion rising from the fire-box and circulating upward between the tubes and finally escaping through the smoke-stack L. In said circulation of the products of combustion the heat is effectually absorbed therefrom by the water-tubes. The zigzag tubes *d′ d′* being directly over the fire-box F, and thus subjected to intense heat, causes the water to be drawn up through said pipes and into the superposed drum C, in which the steam rises from the water and is collected for use. By a return-pipe *l* the water passes from the drum to the base of the rear water-wall A′, from which it circulates through the tubes *c c′* and *a* to the front water-wall A, and thence it again ascends in the latter wall and through the tubes *d d′ d″* to the drum C.

O denotes the so-called "dry-pipe," which is supported in the upper part of the drum C and extends lengthwise thereof. To effectually separate the water from the steam entering the said dry-pipe, I provide this pipe with

longitudinal slots or steam-induction ports *e e*, preferably at opposite sides of the center of its top, and attach to said pipe the shields *i i*, which are over the steam-induction ports and extend laterally and downwardly from the pipe and are provided with fins *j j* on their under sides to deflect the water held in suspension in the steam passing to the induction-ports of the dry-pipe. This separation of the water from the steam I further promote by additional shields *i' i'*, attached to the pipe beneath the ports and projecting in a similar manner therefrom and provided with fins *j' j'* on the sides facing the other shields, as more clearly shown in Fig. 5 of the drawings.

The aforesaid entire group of water-tubes, and also preferably the drum C, is inclosed by a suitable casing, preferably formed of a wall of fire-brick or tiles laid close to the exteriors of the series of longitudinal tubes *c c* and extended to a sufficient elevation above said tubes to permit iron covering-plates *f* to be laid from the tops of the brick walls to the top of the drum. The front and rear ends of the boiler above the water-walls A and A' are closed by brick walls N.

In order to confine the circulation of the products of combustion close to the exterior of the drum C, I cover the tops of the two series of water-tubes *c' c'* with suitable tiles *n*, as shown.

What I claim as my invention is—

1. The combination of two parallel water-walls formed with upward-extending throats and constituting the front and rear ends of the boiler, a combined water and steam drum mounted on and communicating with said walls, two series of longitudinal water-tubes connecting the two water-walls at corresponding ends throughout the heights thereof and along the top portions to the aforesaid throats, and two series of water-tubes located within the space surrounded by said longitudinal tubes, the tubes of each of said inner series consisting of vertical portions extending from the base of the aforesaid space part way the height thereof and thence in zigzag direction in a vertical plane parallel with the aforesaid end walls and part way toward the center of the aforesaid space and terminating with vertical extensions connected to the aforesaid combined water and steam drum as set forth.

2. The combination of two parallel water-walls formed with upward-extending throats and constituting the front and rear ends of the boiler, a combined water and steam drum mounted on and communicating with said walls, two series of longitudinal water-tubes connecting the two water-walls at corresponding ends throughout the heights thereof and along the top portions to the aforesaid throats, two series of water-tubes located within the space surrounded by said longitudinal tubes, the tubes of each of said inner series consisting of vertical portions extending from the base of the aforesaid space part way the height thereof and thence in zigzag direction in a vertical plane parallel with the aforesaid end walls and part way toward the center of the aforesaid space and terminating with vertical extensions connected to the aforesaid combined water and steam drum, a dry-pipe extending along the top of the interior of the aforesaid drum and provided with longitudinal steam-induction ports in opposite sides of the center of its top, shields projecting laterally from said ports, and fins projecting from the shields, as set forth and shown.

In testimony whereof I have hereunto signed my name this 3d day of February, 1896.

ROBERT JOY. [L. S.]

Witnesses:
J. J. LAASS,
M. A. LEYDEN.