

(No Model.)

3 Sheets—Sheet 1.

J. C. STEAD.

STEAM BOILER.

No. 330,438.

Patented Nov. 17, 1885.

Fig 1

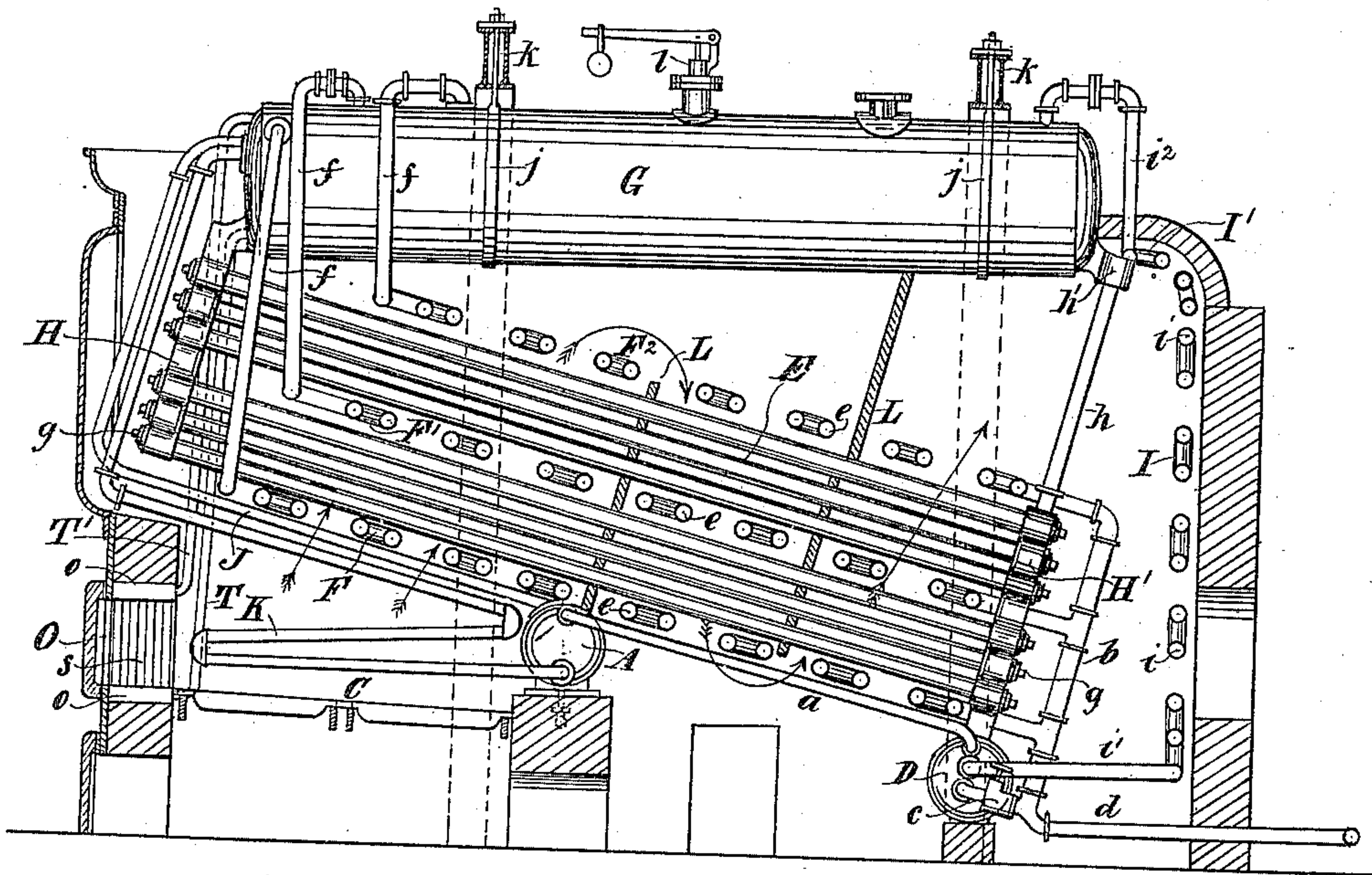
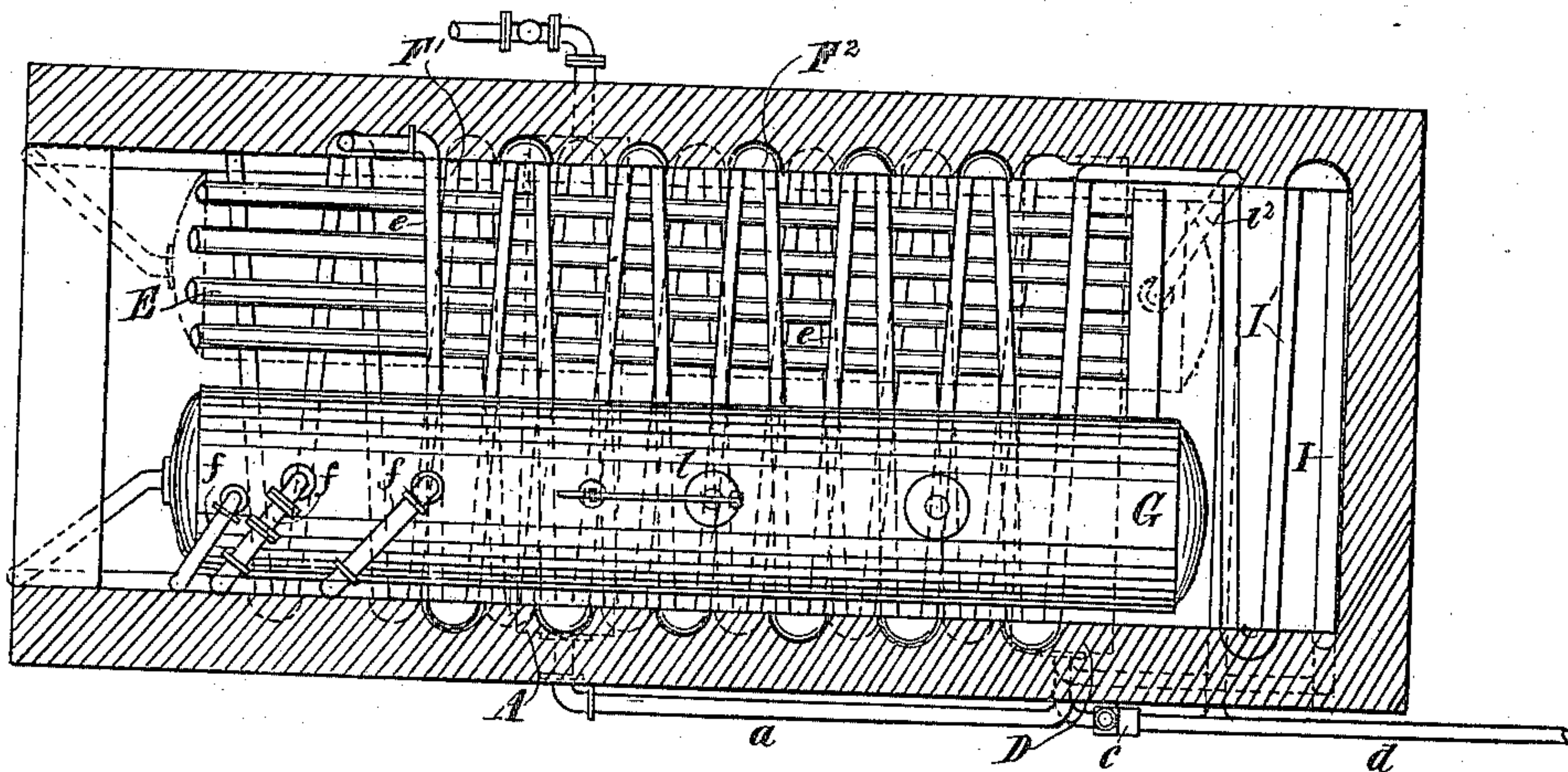


Fig 2



Witnesses
H^m G. Lipey
Geo Wadman

Inventor
James C. Stead,
by his attorneys,
Gifford & Brown

(No Model.)

3 Sheets—Sheet 2.

J. C. STEAD.
STEAM BOILER.

No. 330,438.

Patented Nov. 17, 1885.

Fig 3

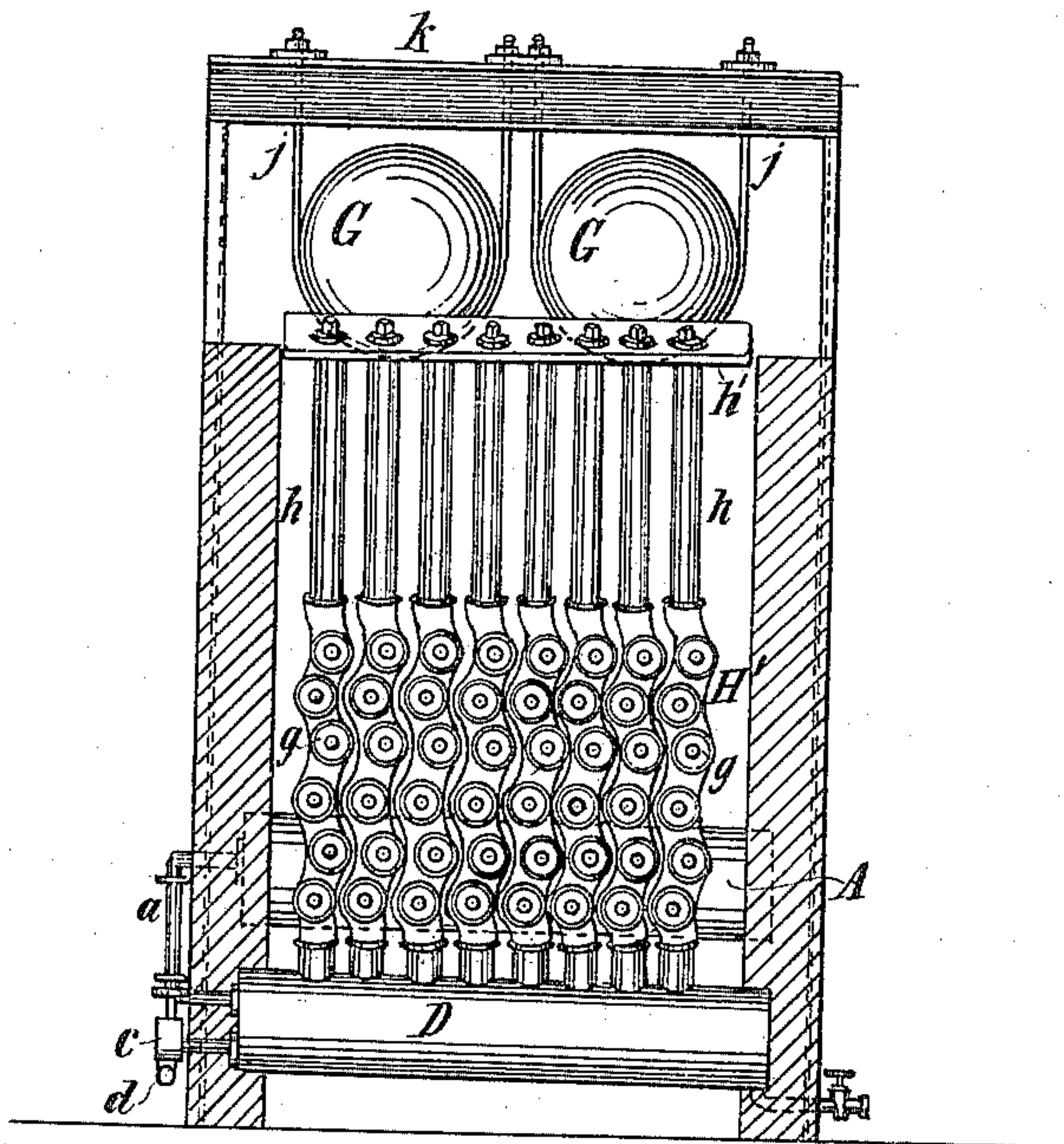
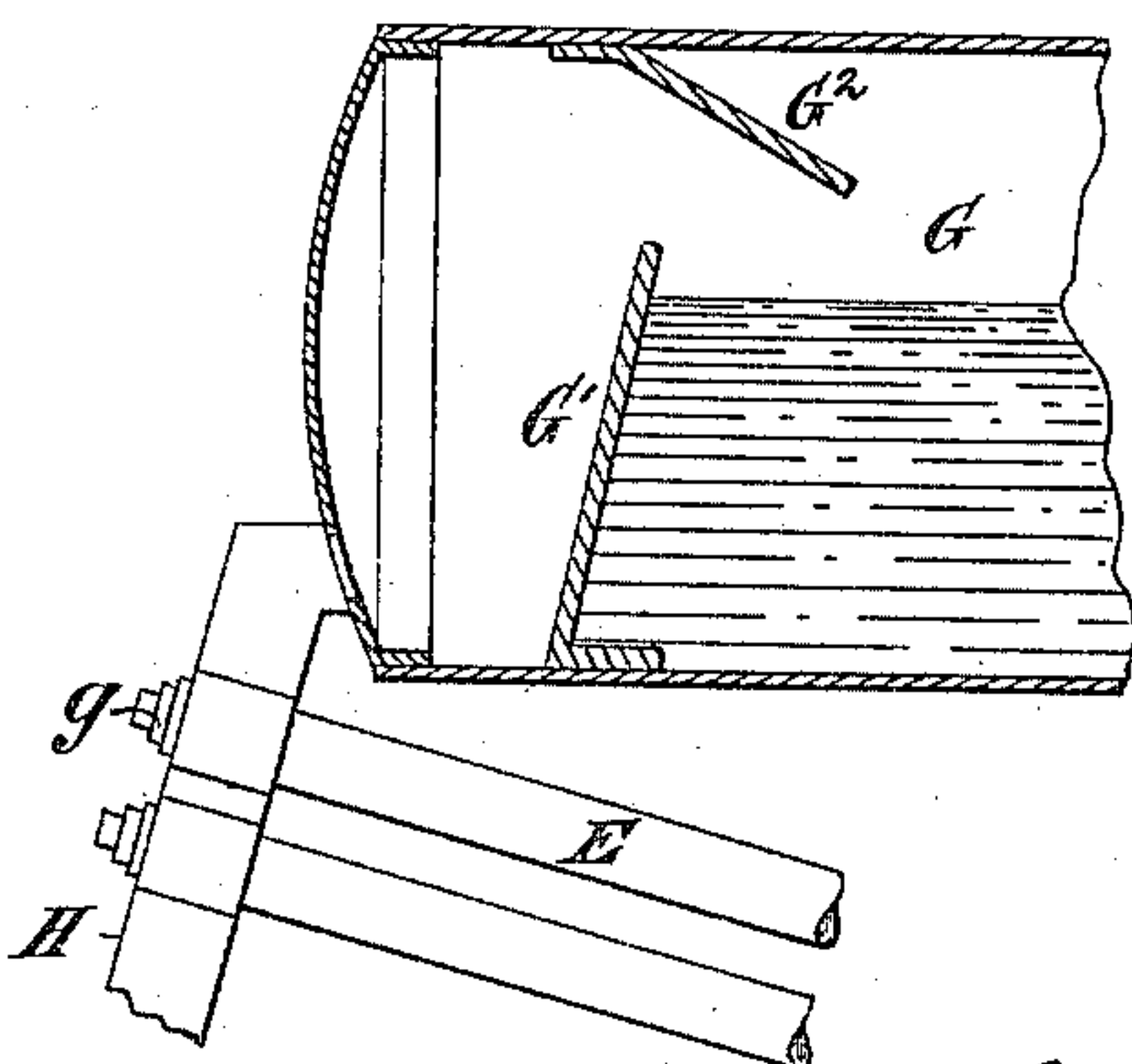


Fig. 4.



Witnesses
Wm G. Lipsey
Geo Wadman

Inventor
James C. Stead,
by his attorneys,
Gifford & Brown

(No Model.)

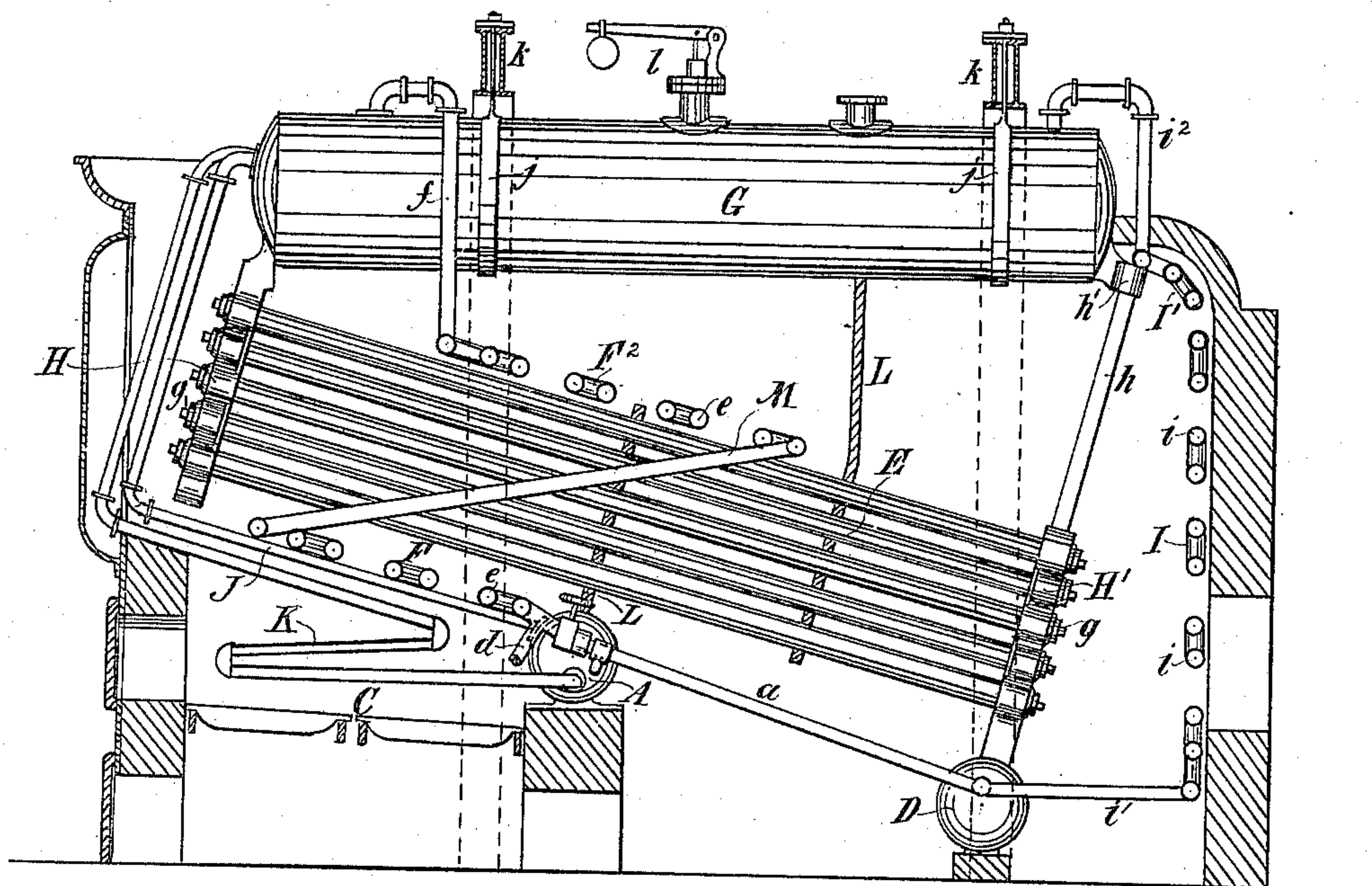
J. C. STEAD.
STEAM BOILER.

3 Sheets—Sheet 3.

No. 330,438.

Patented Nov. 17, 1885.

Fig 5



Witnesses
William G. Lipsey
Geo Radman

Inventor
James C. Stead
by his attorneys,
Gifford Brown

UNITED STATES PATENT OFFICE.

JAMES C. STEAD, OF BROOKLYN, NEW YORK.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 330,438, dated November 17, 1885.

Application filed August 6, 1885. Serial No. 173,702. (No model.)

To all whom it may concern:

Be it known that I, JAMES C. STEAD, of Brooklyn, in the county of Kings and State of New York, have invented a certain new and
5 useful Improvement in Steam Boilers or Generators, of which the following is a specification.

I will describe a steam boiler or generator embodying my improvement, and then point
10 out the various features in claims.

In the accompanying drawings, Figure 1 is a vertical longitudinal section of a steam boiler or generator embodying my improvement. Fig. 2 is a horizontal section of the same. Fig.
15 3 is a vertical transverse section thereof. Fig. 4 is a vertical longitudinal section of certain parts, drawn on a larger scale; and Fig. 5 is a vertical longitudinal section of a steam boiler or generator embodying my improvement in
20 a slightly modified form.

Similar letters of reference designate corresponding parts in all the figures.

E designates a series of straight pipes extending longitudinally of the boiler-space at
25 an upward incline from near the rear thereof to near the front of the same, in such manner that the higher elevation will be above the grate C. These pipes are connected at their ends to headers H H' by suitable connections. The
30 headers may be cast, and are shown of sinuous form, so that the pipes may be staggered. Each of the headers H may be connected separately by a thimble with separators G below the water-line thereof, or they may be connected
35 therewith by a common header. Each of the headers H' is connected by a pipe, h, with a common header, h', which latter is in turn connected with a separator or separators, G, near the rear ends thereof, below the water-
40 line. Said headers h' may, however, be omitted and the pipes h be connected directly to the separator. The headers H H' are provided with hand-holes g, by which the pipes E may be reached to be cleaned or repaired.

45 In the example of my improvement illustrated in Figs. 1, 2, and 3, A designates a mud-drum. It constitutes a bridge-wall at the back of a grate, C. This drum is shown as cylindrical and arranged horizontally; but it may
50 be conical, if desired, or arranged upon an incline, so that steam will ascend to one end

thereof. The usual blow-off cocks are provided, whereby sediment may be blown out of the drum. As shown, it acts as a support for a pipe-boiler, E, near the center of the latter. 55

In this example of my improvement water is supplied to the drum A by a pipe, a, communicating at one end therewith, and at the other end with another mud-drum, D, arranged to rearward of the drum A, and below the
60 same. I may use two or more of the pipes a, if desirable. Connected to the drum D by a suitable connection is a pipe, b, which passes upwardly at the rear of the pipes E. A valve, c, in the pipe b controls the passage of water
65 from the drum D to said pipe. This valve is arranged to open in such manner that water may flow freely from the drum D through said pipe b, but will close automatically to prevent a return of water from the pipe into the drum. 70
Water is supplied to the boiler or generator through a supply-pipe, d, having a connection with the pipe b beyond the valve c, or at a point in said pipe farther from the drum D than said valve is. Consequently water being
75 fed will not pass into the drum D, but upwardly through the pipe b.

F F' F² designate coils of pipes. Each of said coils has a connection with the pipe b, and consists of a series of pipes, e, arranged
80 transversely to the length of the pipes E, and connected together by return-bends. The coils are arranged one above the other, and extend toward the forward end of the boiler at an upward incline. The coil F is arranged
85 below the pipes E, the coil F' between certain of said pipes and the coil F² above the same. Each of said coils is connected by pipes f with one of the separators G. The pipes f open into the steam-space of said separator, 90
near the forward end thereof. Said coils are shown as supported by the side walls of the boiler-space, in which are arranged recesses receiving the return-bends connecting the pipes e; but the same may be supported in
95 any other convenient manner—as, for instance, upon the pipes E. Water supplied to the pipe b passes from thence to the coils F, &c., and, circulating through them, is partly converted into steam, which steam and water are then
100 delivered into the separator G, with which they connect. I have only shown three of the

coils F, &c.; but I may use a greater number, if desirable, or I may use only one. When more than one separator G is used, they will be connected together by the usual steam-drum.

I designates a coil of pipe situated close to the brick wall at the back of the boiler-space. This coil consists of a series of pipes, *i*, which are connected together by return-bends and extend upwardly at reverse inclines. The upper portion of the coil is curved to form a water-arch, *I'*. A pipe, *i'*, connects the lower of the pipes *i* with the drum D, and a pipe, *i''*, connects the upper of the pipes *i* with one of the separators G above the water-line, or with the steam-space thereof. The coil I may be supported by the brick-work or in any other suitable manner. It serves to protect the brick-work.

J designates a pipe, connected at one end with the mud-drum A and at the other with the steam-space in one of the separators G. From the drum said pipe extends forward along the side wall of the boiler-space to near the front of the same, and then upwardly to the separator G. I will preferably employ two of these pipes J, one upon each side. These pipes convey steam from the drum A to the separator or separators, and relieve pressure in the drum. The portions of the coil F forward of the drum A are preferably supported upon the pipes J.

K designates a coil of pipe arranged close to the brick-work at the side of the furnace. It consists of pipes connected together by return-bends extending upwardly at reverse inclines. One of said pipes is connected with the drum A, and another thereof extends upwardly and is connected with the steam-space of one of the separators G. I preferably arrange one of the coils K upon each side of the furnace. Said coils may be supported by the brick-work, or by iron plates extending therefrom, or in any other suitable manner. These coils protect the brick-work at the sides of the furnace. Diaphragms or partitions L, extending transversely of the pipes E, and between pipes of the coils F, &c., cause the products of combustion to pursue a sinuous course through said pipes, which aids in utilizing the heat thereof. The separators G are shown as supported by straps *j*, extending from trusses *k*, but the same may be obviously otherwise supported. I may use a single separator, if desirable. Partitions G' may be advantageously arranged in the separators G just in rear of the point where the pipes E are connected with them. (See particularly Fig. 4.) These partitions extend from the bottom portion of the separators to a point above the water-line and divide the front end portions of the separators from the main portions thereof. Steam issuing from the pipes E passes into the spaces between the partitions G' and the fronts of the separators, and thence over the partitions. The pipes E are therefore, in effect, connected with the steam-space.

Aprons G², affixed to the top of the inside of the separators above the partitions G', extend downwardly at an incline, and serve to direct steam issuing from the pipes E toward the rear portions of the separators. A safety-valve, *l*, is provided for the separator or separators. Water entering the supply *d* passes into the pipe *b*, thence through the coils F, &c., and issues, in the form of mixed water and steam, into the separator or separators G. From the separators the water is returned by means of the pipes *h* to the headers H'. Certain portions of the water thus returned to the headers, with any steam which may have been generated from it, pass upwardly through the pipes E, and are thence returned to the separator or separators G. Such of the water as is not thus returned through the pipes E passes downwardly into the drum D, and from thence passes, a portion through the pipe *b* and coils F, &c., together with such steam, back to the separator with which they are connected, a portion to the drum A, and thence, in the form of water and steam, through the pipes J and coils K, to the separator or separators, and another portion back by way of the coil I to the separator with which it is connected. It will therefore be seen that the circulation throughout the entire system is perfectly equalized, and that the water circulating in the system is so subjected to the products of combustion as to almost wholly utilize the latter in the production of steam.

O designates a water-arch arranged about the door of the furnace. It consists, essentially, of hollow cast-iron boxes *o*, arranged one above and one beneath the door in the brick-work surrounding the same. These boxes are connected together near each end by a series of pipes, *s*. A pipe, T, connects the lower of the boxes *o* with the water-space in one of the separators G, and a pipe, T', connects the upper of said boxes with the steam-space in the separator. Water from the separator circulates freely through this water-arch.

The example of my improvement illustrated in Fig. 5 is similar to that shown in Figs. 1, 2, and 3, except that the valve *c* is arranged at the drum A. This valve forms a connection between the pipe *a* and the pipe *b*, which, in this example of my improvement connects with the coil F only, connection being made with the pipe *e* of said coil which is farthest to the rear. The pipe *a* is also connected with the drum A by a pipe, *a'*. The supply-pipe *d* is connected with the pipe *b* forward of the valve *c*.

In this example of my improvement the coil F' is omitted, and the coil F, instead of being connected directly with the separator, is by means of a pipe, M, connected with the coil F². The pipe M extends from the pipe *e* of the coil F which is nearest the front of the boiler to the pipe *e* of the coil F² which is nearest the back of the boiler. It therefore extends backwardly at an upward incline. The pipe *e* of the coil F² which is nearest the

front of the boiler is connected by a pipe, *f*, with the steam-space of a separator, *G*.

It will be observed that in this example of my improvement the coil *F* is arranged wholly forward of the drum *A*. Water entering the pipe *b* from the supply - pipe *d* circulates through the coil *F*, pipe *M*, and coil *F*², and enters the separator *G* in the form of mixed steam and water. From the separator the water is returned to the headers *H*' and divides, a portion passing upwardly through the pipes *E*, another portion to the drum *D*, thence to coil *I* and drum *A*, and thence, further dividing, to coils *F* *F*², coils *K*, and pipes *J*. By arranging the coils *F*, &c., crosswise of the pipes *E* a net-work of pipes, as it were, is formed, through which the products of combustion, in passing, are effectually broken or divided up, and the heat thereof is imparted to the pipes to an unusual and highly economical extent.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam boiler or generator, the combination, with longitudinally-extending circulating-pipes having an upward inclination from one part of the boiler toward an opposite part, of a coil of other circulating-pipes arranged at approximate right angles thereto and extending crosswise of the same, substantially as specified.

2. In a steam boiler or generator, the combination, with longitudinally-inclined circulating-pipes, of a separator or separators with which said pipes are connected at both ends, a mud-drum also connected with said pipes, and coils of circulating-pipes arranged at approximate right angles to the pipes first named and crosswise of the same, said coils being connected with the mud-drum and the separator, substantially as specified.

3. In a steam boiler or generator, the combination, with longitudinally-inclined circulating-pipes, of two or more coils of other circulating-pipes arranged at approximate right angles thereto and extending crosswise of the

same, and a common pipe from which each of said coils is supplied.

4. In a steam boiler or generator, the combination, with longitudinally-inclined circulating-pipes, of a separator or separators with which said pipes are connected at both ends, a mud-drum also connected with said pipes, a coil of circulating-pipes arranged at approximate right angles to the pipes first named and extending crosswise of the same, a feed-water pipe connected with said coils, a connection between said feed-water pipe and the mud-drum, and a valve in said connection for preventing feed-water from entering the mud-drum, substantially as specified.

5. In a steam boiler or generator, the combination, with longitudinally-inclined circulating-pipes, of two or more coils of other circulating-pipes arranged at approximate right angles thereto and extending crosswise of the same, a separator, and a pipe connecting each of said coils with the steam-space in said separator, substantially as specified.

6. In a steam-boiler, the combination, with circulating-pipes, of a separator arranged approximately parallel with said circulating-pipes, a partition arranged in one end of said separator higher than the water-level in the main portion of the separator, dividing from such main portion a compartment into which steam from the circulating-pipes is discharged, and an apron above said partition extending downwardly at an incline, by which steam entering the separator from the circulating-pipes is deflected toward the opposite end of the boiler, substantially as specified.

7. In a steam boiler or generator, the combination of the pipes *E*, the coils of circulating-pipes *F* *F*' *F*², the separator or separators *G*, the drums *A* *D*, the coil *I*, the coils *K*, and the pipes *J*, substantially as specified.

JAMES C. STEAD.

Witnesses:

JAMES S. GREVES,
WM. G. LIPSEY.