E. Ingalls,

Boiler-Furnace Draft-Regulator.

No. 4,554. Patented May 30, 1846.

Fig: 1.

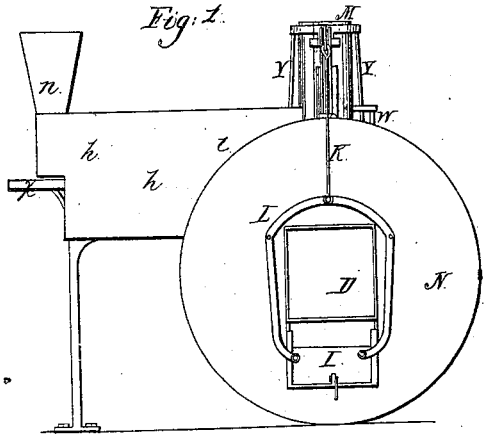


Fig: 2.

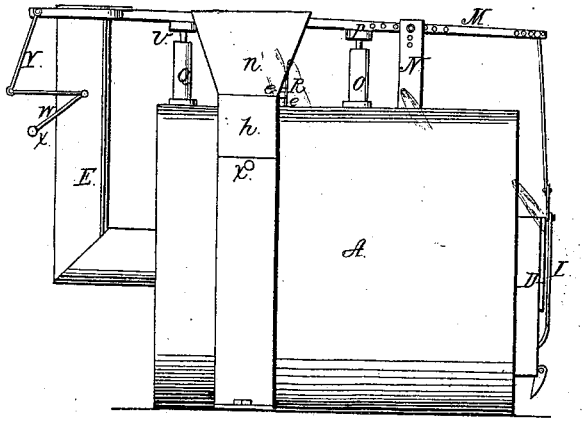


Fig: 4.

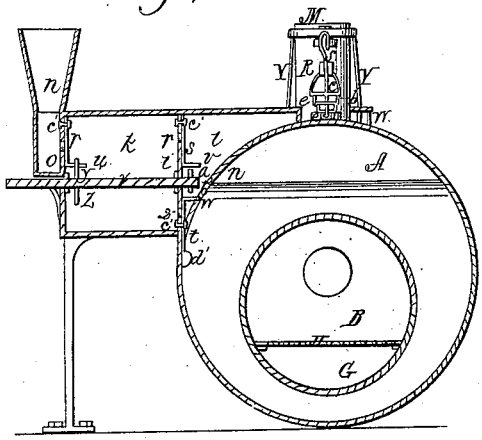


Fig: 3.

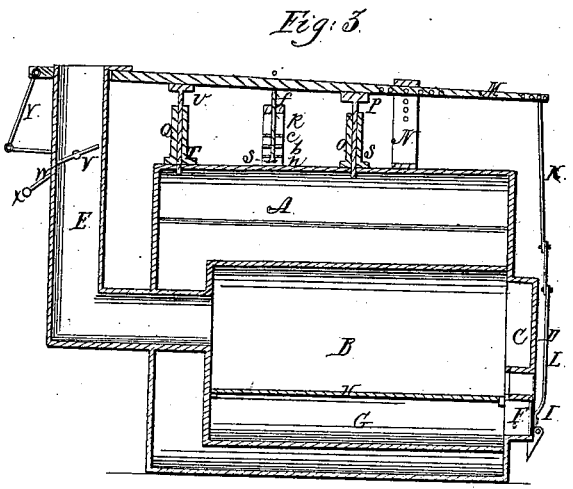
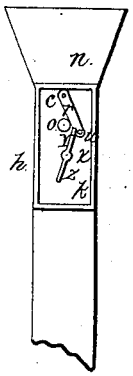


Fig: 5.



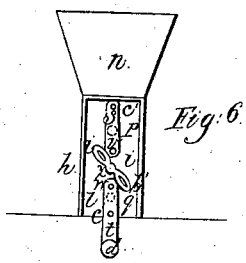


Fig: 6.

UNITED STATES PATENT OFFICE.

ELKANAH INGALLS, OF PROVIDENCE, RHODE ISLAND.

STEAM-BOILER AND FURNACE.

Specification of Letters Patent No. 4,554, dated May 30, 1846.

To all whom it may concern:

Be it known that I, ELKANAH INGALLS, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements to be Applied to Boilers for Generating Steam for the Purpose of Preventing Them from Exploding; and I do hereby declare that the nature of the same and the manner in which they operate are fully set forth and represented in the following specifications, accompanying drawings, letters, figures, and references thereof.

Of said drawings, Figure 1 represents a front elevation of a steam boiler having my improvement applied thereto, Fig. 2 is a side elevation of it, Fig. 3 is a longitudinal, central and vertical section of it, and Fig. 4, is a vertical and transverse section of it, taken centrally through the part or apparatus, by which a regular flow of water into the steam generator is kept up, as will be hereinafter described.

The nature of my invention consists first, in a peculiar apparatus to be applied to the air induction opening of the fireplace and to the valve or damper of the eduction flue or smoke pipe, for the regulation of the combustion of fuel, according to any required pressure of steam, and under the circumstances of the continued admission of cold or warm water into the boiler. Second, in an apparatus applied to the boiler in connection with or independent of that first described, to supply the said boiler with a regular flow of water.

In the drawings, A denotes a cylindrical boiler having a fireplace B disposed within it, and so as to be entirely surrounded by water. The said fire place has an opening C, at the front end of the boiler, for the admission of fuel, the said opening having a door D applied to it, by which it may be entirely closed when necessary, or opened only whenever it may be desirable to increase the supply of fuel.

E is the exit or smoke pipe, and F an induction opening made below the fire door, and so as to allow air to pass into the ash hole G, beneath the fire grate H. The said induction opening has a sliding door or valve I, applied to it, so as to readily move or slide up or down in a vertical plane. The said door or valve is suspended by a rod K and bail L to the front end of a long lever M, placed over the boiler and turning upon a fulcrum in the top of a standard N, as seen in the drawings.

Near the standard N and under the lever M, and communicating with the interior of the boiler is a cylinder or barrel, as seen at O, having a piston S moving within it whose stem P rests in contact with the under side of the longest arm of the lever M. Near the opposite end and upon the top of the boiler and directly under the lever, another and similar cylinder or barrel and piston are disposed, as seen at Q and T, the piston rod being seen at V, and between the said two cylinders is a frame R, made to support a series of weights *a*, *b*, *c*, arranged the one over the other, as seen in Fig. 4. The said weights are sustained upon shoulders or offsets made in the frame, as seen at *e*, *e*, &c., in Fig. 4, and each weight has a hole bored through its center to receive and permit freely to pass through it a vertical rod *f*, which has a head *g*, fixed upon its lower end, and at its upper end is jointed or suspended to the lever M.

V represents a damper valve, placed in the eduction flue, and having applied to its horizontal shaft one or more bent levers W, shaped and having a weight X applied to it as seen in Fig. 2. The outer end of the horizontal arm of the said bent lever is connected to the extreme end of the long arm of the lever M by a rod Y jointed to both, the damper being so arranged upon its shaft that when the end of the lever M, adjacent to it, is raised, it shall so turn the damper as to decrease the opening for the smoke to pass around it and by it.

When the boiler is put in operation, and the steam attains a degree of tension sufficient to elevate the piston S, the rod P thereof will bear against the lever M, and as the steam increases will raise the long arm of the said lever and depress the other one, and the door or valve I, and thereby narrow the opening for the admission of air into the ash hole and to the fuel in combustion. And as the pressure of the steam continues to increase, the weights *a*, *b*, *c* will be raised in succession according as the said increase may be sufficient to accomplish the same. The continued rise of the lever M will gradually turn the damper V, so as to diminish the opening or passage for the smoke of the smoke flue around it.

The auxiliary cylinder and piston seen at Q, is for the purpose of acting in conjunc-

tion with the other cylinder and piston, in order to prevent accident in case the latter should fail to perform its office. The peculiar feature of novelty in the above described mechanism is the application of the regulating apparatus to the induction and eduction passages at one and the same time, in order that, when the induction opening is contracted, the eduction or smoke passage may be also contracted in a corresponding and proper manner. Were one of said passages contracted and the other left open, the external atmospheric air will gain access to the fuel in combustion through the opening not contracted; and, by so doing, will prevent the perfect action of the regulating apparatus, so far as the combustion of fuel is concerned. By thus contracting both the induction and eduction passages, by which air is supplied to the fire, and the smoke allowed to escape from it, a greater saving of fuel is effected than when but one is operated on by the piston cylinder and lever, on the top of the boiler, as above described.

When the steam attains the maximum pressure it will operate, through the piston *s*, and lever M, upon the valves of the induction and eduction passages in such manner as to regulate the supply of air to the furnace and escape of smoke therefrom, and perform the same in a much more effectual manner than when applied to either one of them alone.

If desired, the draft may be made to enter the fire arch or furnace through the top of the boiler, and after passing through the fire, may be made to pass out of the boiler at or near its bottom part. If the boiler is set in brickwork, the draft may be made to pass on the outside of the boiler as high as the brickwork extends, before it enters the chimney, and, if coal is used in the boiler, it may be burned on the bottom of the fireplace, and not in grates, as is generally practised, this being a very good method of burning anthracite coal. In fact, the draft may be admitted to the fireplace, through the top of the boiler, and let out at any convenient part of it that will answer the best purpose, or it may be admitted at or near the bottom part of it, as seen in the drawings.

The next portion of my invention, to be used in connection with the above, is as follows: *h*, represents a close cistern applied to the side of the boilers, and having a vertical partition *i*, placed within and extending entirely across it, in the position as seen in the drawings, and thereby dividing it into two parts *k*, *l*. The part *l* communicates freely with the interior of the boiler, there being a hole or passage *m* cut through the boiler to allow of the same. The part *k* has a small cistern *n*, joined to it, in the situation with regard to it, as seen in Fig. 4. This second cistern is open at top, and is to be filled and supplied with water by a force pump or any other proper means. An opening or passage *o*, is made near the bottom of the cistern *n*, and so as to cause the two cisterns *n* and *h*, to communicate with each other, when said opening is not closed. Similar openings *p*, *q*, are made through the partition *i*, the one near the top, and the other near the bottom part of it. Each of said openings has a swinging or pendulous valve applied to it, as seen in Fig. 4, and in Figs. 5 and 6, Fig. 5 being a cross section of the cistern *h*, showing its end to which the valve *r*, which closes the opening *o*, is applied. Fig. 6 is a cross section of said cistern taken between the partition *i* and boiler, and representing the valves *s* and *t* applied to the openings *p* and *q* respectively. Each of said valves has an arm projecting from it, in a horizontal direction, as seen at *u*, *v* and *w*. A horizontal shaft *x* passes through the central part of the cistern *h*, as seen in the drawings. It has two arms or cams *y*, *z* projecting from it, and under the arm *u* of the valve *r*. It also has two other arms or cams *a'*, *b'*, extending from it, and between the arms *v* and *w*, as seen in Fig. 6. The aforesaid arms or cams should be so disposed upon the shaft *x* that when one of the two termed *y*, *z*, is in action upon the arm *u* of the valve *r*, and is pressing it sidewise, in order to open the passage *o*, to allow water from the cistern *n* to rush through said passage and into the cistern *h*, the others shall produce no action upon the arms of the other two, but allow them and their valves to be stationary, and thereby to close the passages to which said valves belong. The valves *r*, *s*, and *t* are pendulous valves, that is to say, they swing back and forth in lateral directions upon pins *c'*, *c'*, *c'*, and fall into vertical positions, either by their own respective weights, or by weights applied to them, as in the case of the valve *t* which has a weight *d'* hung to it below its pin *c'*, the valve in this case being above the pin, as seen in Fig. 6.

The cams or arms, before mentioned, as applied to the several valves and the horizontal shaft, should be so disposed that when the cams *y*, *z* are not in operation upon the valve *r*, the other arms or cams *a'*, *b'*, should be operating upon and moving the valves *s* and *t*, so as to open the passages to which they are applied, and thereby admit steam from the boiler to pass through the upper opening into the cistern *h*, and water from said cistern to flow into the boiler through the lower of said openings. When said openings are closed by their valves all communication is cut off between the cistern *h* and boiler. At this time

the valve r is to be moved aside, so as to permit water from the cistern n to flow or pass into the cistern h, and thus supply it with a quantity equivalent to what previously escaped from the boiler.

The horizontal shaft x may be revolved by any proper mechanism applied to it for the purpose. By the above cisterns and valves, operated as hereinbefore explained, a constant and regular supply of water to the boiler may be kept up at all times.

Having thus explained my improvement, I shall claim—

1. The combination of the regulating apparatus (or pistons, cylinders and weighted levers, &c.,) placed on the top of the boiler, with induction and eduction valves IV applies to the induction and eduction passages of the chamber of combustion respectively and acting in conjunction as above set forth.

2. Also, the combination of the cisterns n and h, their valves, valve openings and turning shaft, and its cams, as applied to and combined with the boiler, and for the purpose of supplying it with water, as above specified.

In testimony whereof, I have hereto set my signature, this thirteenth day of February A. D. 1846.

ELKANAH INGALLS.

Witnesses:
R. H. Eddy,
Geo. H. Bailey.