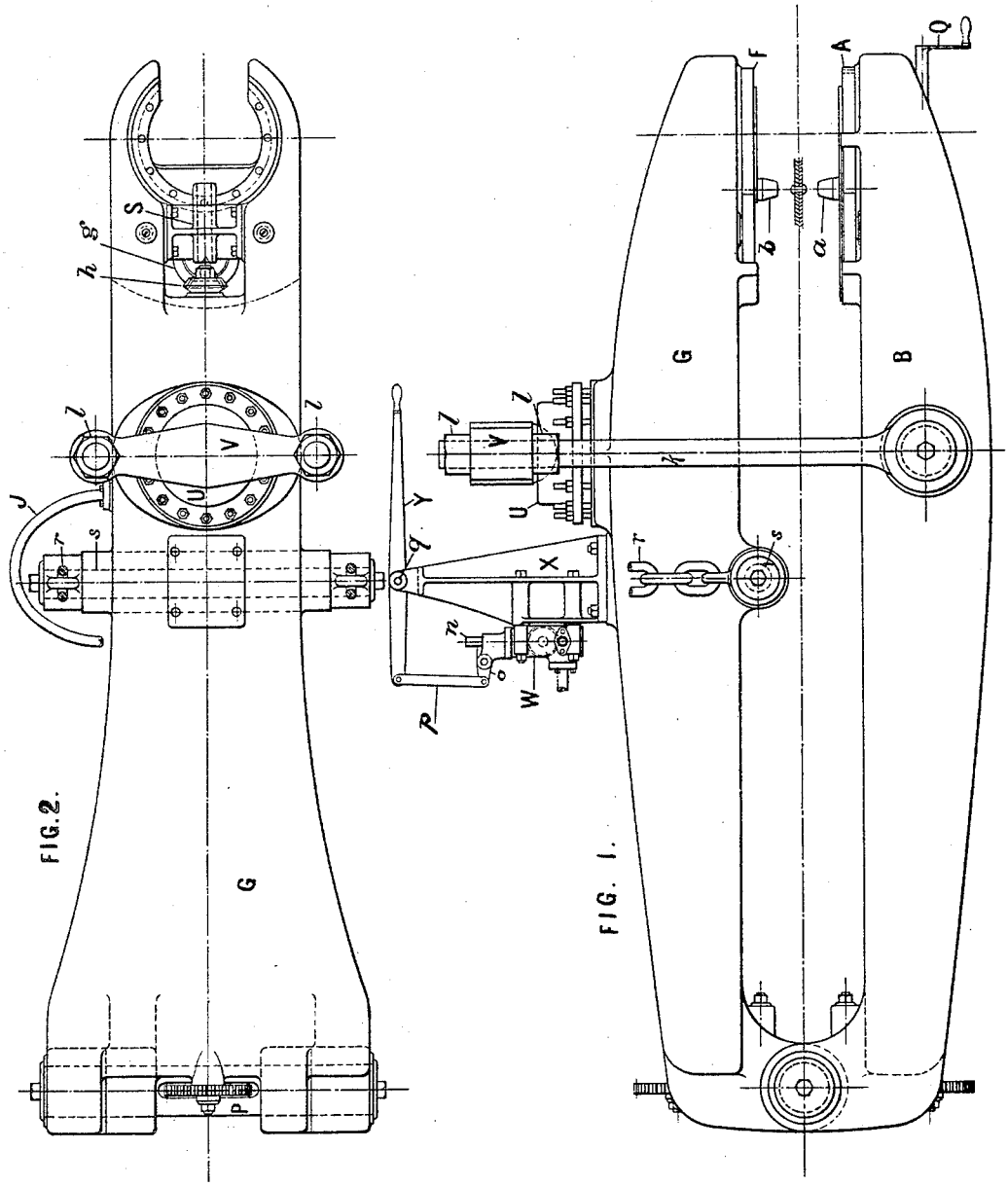
(No Model.) 5 Sheets—Sheet 1.

W. SELLERS.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

No. 454,571. Patented June 23, 1891.



WITNESSES:

John C. Phillips

E. C. Harper.

INVENTOR

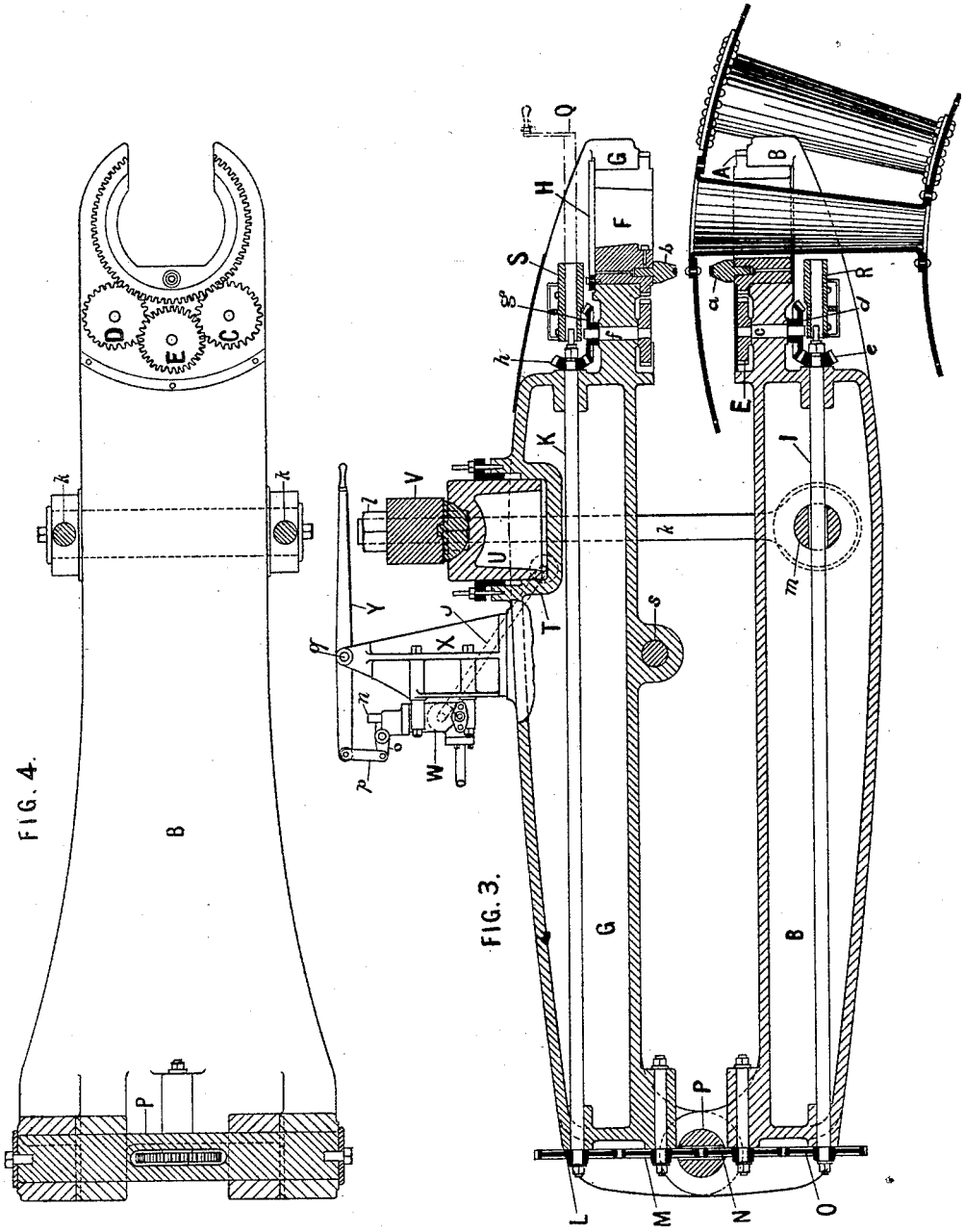
Wm. Sellers

(No Model.) 5 Sheets—Sheet 2.

W. SELLERS.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

No. 454,571. Patented June 23, 1891.



WITNESSES:

John C. Phillips

E. A. Harper.

INVENTOR

Wm. Sellers

(No Model.) 5 Sheets—Sheet 3.

W. SELLERS.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

No. 454,571. Patented June 23, 1891.

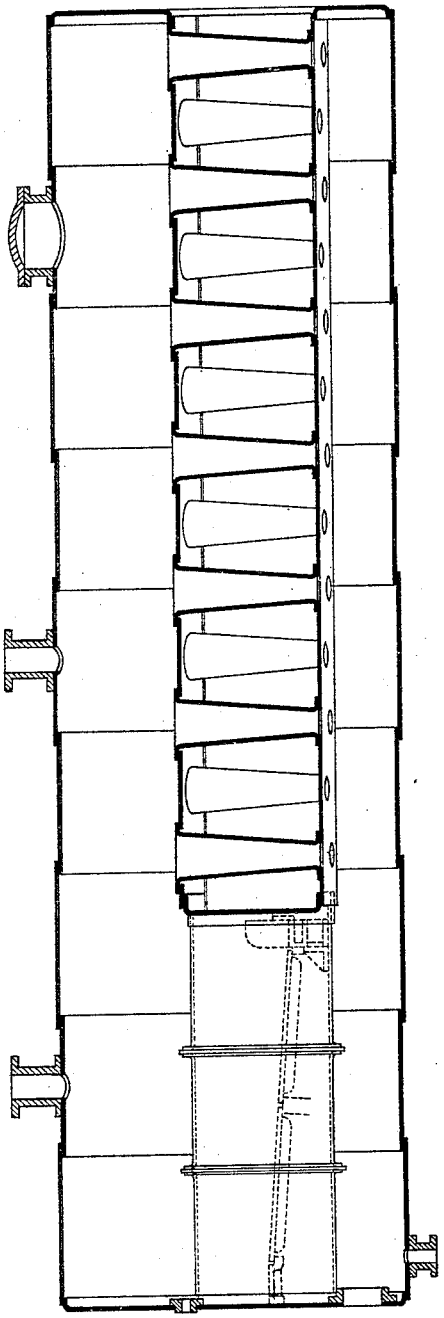


FIG. 5.

WITNESSES:

John L. Phillips

E. R. Harper.

INVENTOR

Wm. Sellers

(No Model.) 5 Sheets—Sheet 4.

W. SELLERS.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

No. 454,571. Patented June 23, 1891.

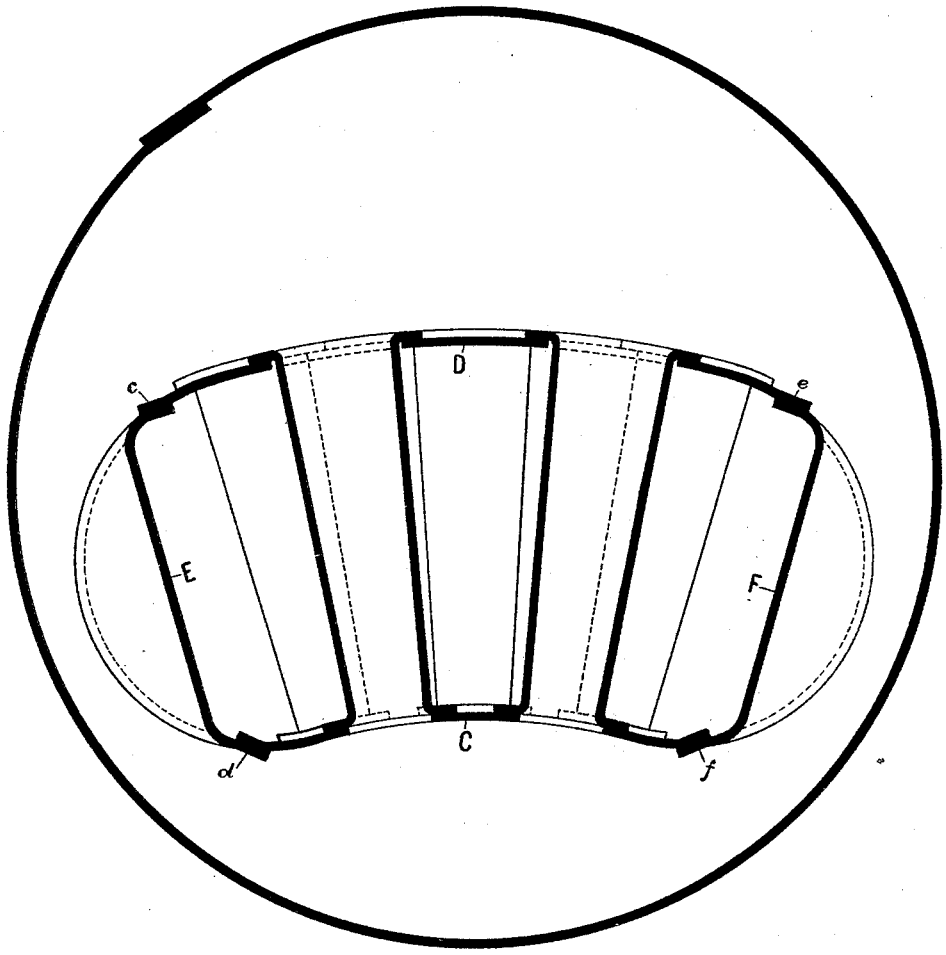


FIG. 6.

WITNESSES:

John L. Phillips

E. A. Harper.

INVENTOR

Wm. Sellers

(No Model.) 5 Sheets—Sheet 5.

W. SELLERS.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

No. 454,571. Patented June 23, 1891.

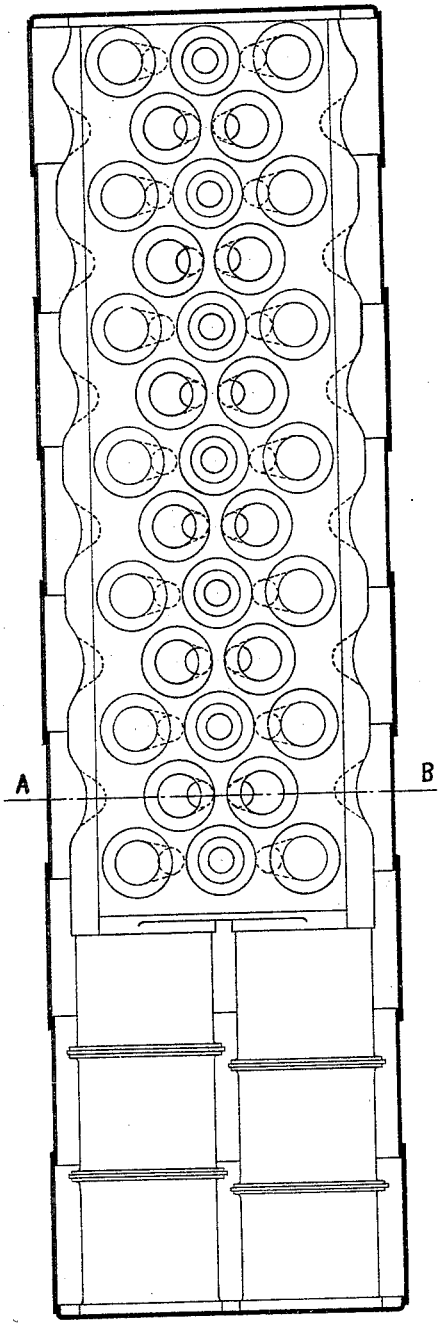


FIG. 7.

WITNESSES:

John L. Phillips

E. R. Harper.

INVENTOR

Wm. Sellers

UNITED STATES PATENT OFFICE.

WILLIAM SELLERS, OF PHILADELPHIA, PENNSYLVANIA.

MODE OF CONSTRUCTING THE FLUES OF GALLOWAY BOILERS.

SPECIFICATION forming part of Letters Patent No. 454,571, dated June 23, 1891.

Application filed December 5, 1890. Serial No. 373,699. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM SELLERS, of the city and county of Philadelphia, in the State of Pennsylvania, have invented an Improved Mode of Construction for the Flue of the Galloway Boiler, of which improvement the following is a full and exact description.

The flue of the Galloway boiler is now shaped as shown in United States Patent No. 180,863, issued to Charles John Galloway and Charles Herbert Holt the 8th day of August, 1876, and it contains many series of tubes, such as shown in that patent. These series are arranged one behind the other, so that the tubes will be staggered—that is to say, the first series is of three tubes, as shown in the aforesaid patent. Next follows two tubes opposite the spaces between the tubes of the first series, and behind these, a second series like the first, followed by two tubes, as before, and so on until the whole length of the flue is occupied. Heretofore this main flue has been constructed by riveting together, first, the exterior plates, so as to form the flue, then assembling the tubes upon the interior and bolting them to place through the rivet-holes, and finally driving the rivets by hand when so assembled. I have invented a riveting-machine, which is applicable to such work as riveting the top and the bottom flanges of the tubes to plates, and I have an application for a patent for the same now pending, filed December 5, 1890, Serial No. 373,700, and that the object and nature of my present invention may be fully understood, I will here describe the same, referring to the copies of the drawings in the above application, which are hereunto attached.

Figure 1 represents a side elevation of my improved riveting-machine. Fig. 2 is a plan of same with the valve case and stand removed. Fig. 3 is a sectional view of Fig. 1, and Fig. 4 is a plan of the lower lever in Figs. 1 and 3.

In all of the drawings similar letters refer to similar parts.

The riveting-die and the holder are alike; but for convenience of description I will call the lower die *a* the "riveting-die," which makes the upper one *b* the holder. In their operation *b* rests upon the rivet-head, and *a* moves forward *b* to close the rivet. The riveting-die *a* is supported in the circular table A, the upper flange of which rests upon the end of a lever of the third order B, and a hub under this flange is fitted to a hole in the lever, so that it will turn freely therein. An opening through this table and hub is provided large enough to admit the tube to be operated upon freely. An opening from this hole through to its periphery is made wide enough for the tube to pass through, and an opening of corresponding width is made in the end of the lever B, so that by raising the tube or lowering the lever the tube, when in the position shown in Fig. 3, can pass freely into the center of the circular table A.

The shape of the hole in the circular table and of its opening to the periphery of the table, as also of the opening in the end of the lever B, is shown in Fig. 4. It will be observed that the opening in the end of the lever B is not so large as the hub under the circular table A, so that this table is held securely in its position by the hub, while it is free to rotate about its axis. The distance from the center of the riveting-die *a* to the center of the circular table A corresponds with the radius of the circle of rivets, which is to be driven in the upper or large end of the tube. (Shown in Fig. 3.) When the flange on the small end of this tube is to be riveted, the circular table A is removed and another similar one is put in its place, in which the distance of the riveting-die *a* from the center of the table corresponds with the radius of the circle of rivets in the smaller flange. The periphery of the circular table A is provided with teeth, into which the teeth of the pinions C and D mesh, and these two pinions are geared together by the pinion E. The distance between the pinions C and D is such that when the opening in the periphery of A is turned to the pinions one or the other pinion must always be in gear with the circular table, so that this table can always be turned by rotating the pinion E. The circular table F in the upper lever G and the lever itself, which is also of the third order, are arranged in the same manner as the table A and lever B. The table F is turned about its axis by gearing similar to that on lever B and in like

manner; but as the flange of the circular table F is on the under side of the lever G provision is made for holding up this table by a circular ring H, which is bolted to the hub on the upper side of the table F.

Provision is made for rotating the pinion E and table A by means of the vertical shaft *c*, bevel-wheels *d* and *e*, and the shaft I, and similar provision is made for the table F by means of the vertical shaft *f* and bevel-wheels *g* and *h*, and the shaft K. The shafts I and K are geared together by the train of wheels L M N O, which pass through the fulcrum-pin P, that unites the levers B and G by a hinged joint, and so geared the rotation of the two circular tables must be concurrent, and the relative position of the riveting-die *a* and the holder *b* in their circular path must always be the same. The fulcrum-pin P and the hinged joint are made so long that in in whatever position the riveting-die and the holder may be in their circular path the line of strain in driving a rivet will always fall within this fulcrum-pin, so as thereby to avoid the distortion of the hinged joint.

Provision for turning the shafts I and K is made by the socket-wrench Q, which fits upon either shaft, and is held in position by the the bearing R, which is bolted to the lower lever B, and by the bearing S, which is bolted to the upper lever G. The wrench Q is transferrable from one shaft to the other to suit the character of the work—as, for example, in riveting the top flange on the large end of the tube—the wrench must be placed on the shaft I, which is above the flue, as shown in Fig. 3; but in riveting the bottom flange on the small end of the tube the shaft I would be within the tube, and the wrench could be operated only in connection with the shaft K, which would then be underneath the flue.

Provision for operating the levers B and G is afforded by the hydraulic cylinder T, plunger U, and cross-head V, connected with the upper lever G, and the eyebolts *k k*, which are secured to the cross-head V by the adjustable nuts *l l l l* and to the lower lever B by the pin *m*, which passes through this lever and the eyes on the bolts *k k*. High-pressure water is admitted to and discharged from the cylinder T through the bent pipe J, which connects this cylinder with the valve-case W. This valve-case is mounted upon the stand X, which is bolted upon the top of the upper lever G. The stem *n* of the valve in the case W is connected through the lever *o* and link *p* to the hand-lever Y, which latter has its fulcrum *q* in the top of the stand X. The whole apparatus is suspended at any convenient height by chains *r r*, secured to the pin *s s*, which passes through the under side of the upper lever G as nearly as possible in the center of gravity of the whole mass.

It will be obvious from the above description that if the tubes were accessible to the riveting-machine above described it would be capable of performing all of the work of riveting the tubes to the top and bottom plates of the flue. It is the object of my present invention to render these vertical tubes accessible to the riveting-machine hereinbefore described, and also more accessible for riveting by hand than the present mode of assembling the parts of this flue now permits, and that the mode of accomplishing this may be clearly understood I will now refer to the drawings, forming a part of this specification, in which—

Fig. 5 represents a vertical longitudinal section through the center of the flue of a Galloway boiler. Fig. 6 is a vertical cross-section of the same on the line A B, Fig. 7, sight being toward the rear end; and Fig. 7 is a horizontal cross-section of the same boiler, showing the exterior of the flue and its two furnaces.

In all of these drawings similar letters refer to similar parts.

It will be noted that the flue of the boiler in which the vertical tubes are placed is composed of four plates C D E F, joined together by four longitudinal lines of rivets *c d e f*. If, therefore, the tubes were bolted to the top and bottom sheets of the flue before the longitudinal lines *c d e f* were riveted, the side sheets E and F could be removed, which would afford access to the interior of the tube for the riveting-machine to rivet the flanges of the vertical tubes; but if all of the vertical tubes were placed in position at one time the tubes themselves would prevent the machine from having access to all of them, as will be evident from an inspection of Fig. 7. It is therefore necessary to limit the number and to determine the position of the tubes which can be first riveted, and at the same time to make it certain that after the tubes have all been riveted in place the rivet-holes in the side sheets E and F will fit the rivet-holes in the bottom and top plates C and D. To this end I assemble the sheets which compose the flue and ascertain that the rivet-holes match properly for the four lines of rivets *c d e f*, and then bolt them through these holes, so as to maintain their true position exactly. Next I place all of the vertical tubes in proper position, ascertain that the rivet-holes match properly, and bolt them through these holes to secure them. I then remove one side plate of the flue and a row of tubes nearest thereto, which will afford access for the riveter to the two rows of tubes on the opened side, while the alignment of all the holes is maintained by the other side plate of the flue and by all of the vertical tubes, except one row. The two rows of vertical tubes on the opened side are then riveted, the row which was removed is replaced and riveted, and the side sheet is replaced. The flue is then turned end for end, or the riveter is transferred to the other side of the flue, as most convenient, the other side sheet is removed, and the two rows of tubes on that side are riveted, and the side

sheet is replaced. The four longitudinal lines of rivets *c d e f* may now be driven, which will complete the formation of the flue.

It may not always be necessary to place all of the tubes in position and then remove one row; but it is safer to do so in the present state of the art. If with more perfect machinery the flanged tubes and the curved plates of the flue shall be made with less variation than at present, it may be sufficient to assemble all of the tubes, except a row next the side sheet. Then remove the side sheet and rivet the two rows of tubes on the opened side and then assemble and rivet the row on the opposite side.

The drawings show a flue in which the tubes are arranged in series of three, with two tubes interposed, making five rows longitudinally. In the next smaller boiler the tubes are two in a cross-plane with one interposed, making three rows, and in the next smaller there are but two rows. In these two smaller sizes of boilers it is only necessary to remove first one side plate and then the other to complete the riveting of the tubes. If the boiler was larger than that shown in the drawings, the tubes might be arranged in series of four and three alternately, in which case, after assembling, it would be necessary to remove a side plate and the two rows of tubes nearest thereto to enable the riveter to rivet the next two rows, after which those removed could be replaced and riveted and the side plate replaced. For the other side it would only be necessary to remove the side plate and one row of tubes nearest thereto. The riveter could then rivet the other two, after which the row removed could be replaced and riveted and the side replaced.

The flue described herein is composed of four sheets only, as set forth in the Patent No. 372,572, dated November 1, 1887; but whether composed of four sheets or of many more, as was the custom prior to the granting of the aforesaid Letters Patent, it will be evident that if it is composed of bottom, top, and side sheets the side sheets can be removed and replaced as above described, so that the rivets in the flanges of the tubes can all be driven by the machine hereinbefore described. It will also be evident that if the tubes are to be riveted in the flue by hand they will be far more accessible for this operation when the side sheet next the operator is removed than as at present, when the side sheets are first riveted, and then all of the tubes are bolted in place and then riveted.

Having thus described the object and nature of my improvement, what I claim as new, and desire to secure by Letters Patent, is—

The mode hereinbefore described for constructing the flue of a Galloway boiler, which mode consists in first assembling the flue with its vertical tubes in place and securing the parts in proper position by bolts, then removing a side sheet, then riveting the central row of tubes and all others that can be reached from the opened side, then replacing the side sheet, then removing the side sheet from the opposite side, then riveting the tubes upon that side, then replacing the side sheet, and finally driving the rivets which unite the side sheets to the bottom and top sheets of the flue.

WM. SELLERS.

Witnesses:
JOHN D. PHILLIPS,
E. R. HARPER.

Correction in Letters Patent No. 454,571.

It is hereby certified that in Letters Patent No. 454,571, granted June 23, 1891, upon the application of William Sellers, of Philadelphia, Pennsylvania, for an improvement in "Mode of Constructing the Flues of Galloway Boilers," an error appears in the printed specification requiring correction, as follows: In line 52, page 1, the word "forward" should read *toward;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 7th day of July, A. D. 1891.

[SEAL.]

GEO. CHANDLER,
First Assistant Secretary of the Interior.

Countersigned:

N. L. FROTHINGHAM,
Acting Commissioner of Patents.