

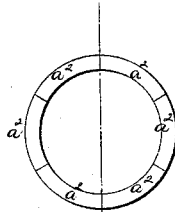
J. H. Knickerbocker,

Pine Expander.

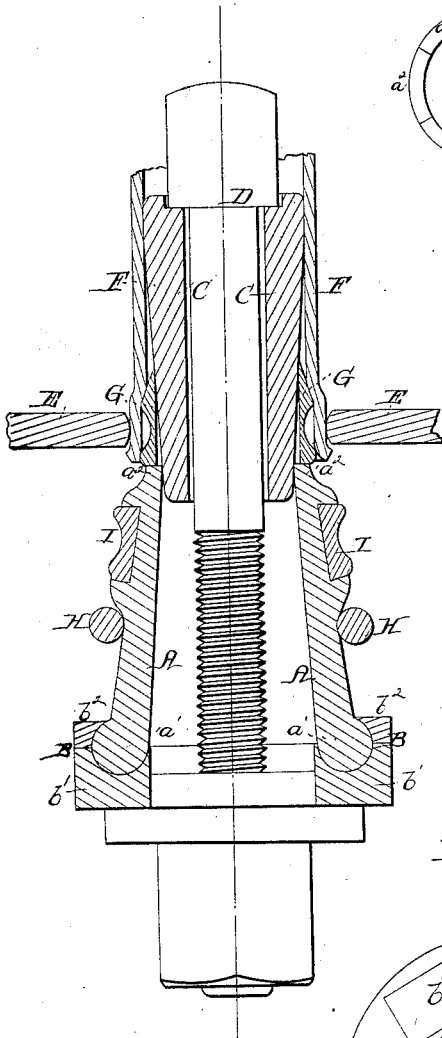
N^o 49,765.

Patented Sep. 5, 1865

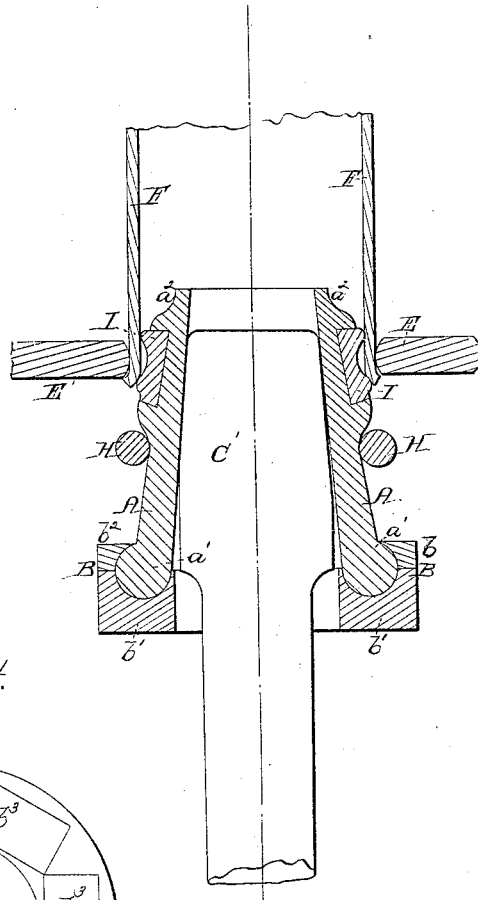
Fig; 3.



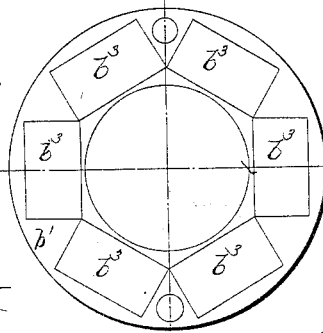
Fig; 1.



Fig; 2.



Fig; 4.



Witnesses;
Benj. Morison
James H. Moore

Inventor;
John H. Knickerbocker

UNITED STATES PATENT OFFICE.

J. H. KNICKERBOCKER, OF PHILADELPHIA, PENNSYLVANIA.

TUBE-EXPANDER.

Specification forming part of Letters Patent No. **49,765**, dated September 5, 1865.

To all whom it may concern:

Be it known that I, JOHN H. KNICKERBOCKER, of the city of Philadelphia, in the State of Pennsylvania, have invented a new and useful Improvement in the Expander for Fastening Flues in Boiler-Plates; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a longitudinal central section, showing the expander as applied in fastening a ferrule and flue in a boiler-plate; Fig. 2, the same device as applied in fastening a flue without the ferrule; Fig. 3, a plan view of the upper ends of the arms of the expander; and Fig. 4, a horizontal section through the bottom or socket ends of the same and the supporting-ring, like letters of reference indicating the same parts when in the different figures.

The object of my invention is to afford a more simple, effective, and durable device for expanding or fastening the ends of flues in steam-boiler plates.

It consists, substantially as hereinafter described and specified, of a series of arms arranged and secured in an annular socket-piece, so as to admit of their free ends being simultaneously forced outward radially by the passage of a conical frustum drawn through the tube or ferrule and centrally between the said arms, under the operation of any suitable power applied thereto, for the purpose of expanding the flues or ferrules, or both of them together, in fastening them in boiler-plates; in the employment of removable or changeable dies in the said radially-moving arms for the purpose of adapting the same expander to different sizes of flues or ferrules; and, also, in combination with the said expander, the employment of a conical frustum having longitudinally through it a hole of an oval or oblong cross-section for the purpose of allowing of the introduction and withdrawal through it of a corresponding bolt-head, which, on the bolts being turned quarter-way around in the said hole, will be retained thereby for the purpose of enabling the operator, in using the expander, to more readily and quickly attach and detach the said draw-bolt and conical frustum to and from each other, as occasion may require.

In the drawings, A A are the radially-moving arms, B the annular socket-piece, C the conical frustum, and D the headed-bolt. E represents a section of a steam-boiler plate, F a section of a flue, and G a section of a ferrule.

Letters Patent dated the 24th day of June, 1862, were granted to me for the application of grooved ferrules in fastening flues in boiler-plates; and the difficulties encountered in the application of means for producing the requisite expansion of the same have led me to the present invention.

The arms A and the annular socket-piece B are each made of metal, and about of the size shown in the drawings. The socket-piece B is in two parts, b' b^2 , screwed together by suitable screws. (Not shown in the drawings.) The bottom piece, b' , has a series of separate straight sockets, b^3 , with semicircular bottoms, and the lower end of each of the arms A is made in the form of a cylindrical boss, or rounded, so that it will fit and turn in its respective socket, while the top ring, b^2 , is recessed at its inner or underside, so that it will fit partly over on the projecting part of the cylindrical boss a' when screwed down firmly upon b' , and allow all the said arms A, to be moved radially on their bosses within proper limits. An elastic ring, H, is applied around the outside of the series of arms A, which serves to keep them closed together sufficiently when not in use in the tubes, as seen in Fig. 3, and at the same time allows of their easy separation on the passage of the conical frustum C or C' between them, as seen in Figs. 1 and 2. Each arm A is provided with a dovetailed socket in its outer side, which carries one of a like series of dies, I, there being several series provided, and each series being adapted in thickness to suit correspondingly different sized flues F, so that the same expander can be readily varied for the different occasions.

The conical frustum C has its larger end made to fit the diameter of the flue F, while its smaller end is reduced sufficiently to make it enter the center of the expander. It has a hole of an oval or oblong section longitudinally through its center, and the head of the bolt D is made of a corresponding section, so that it can be readily introduced head foremost through the hole, and, when turned quarter round therein, retained by its longer shoulders,

so as to draw the frustum C forward when the bolt D is drawn by a sufficient power. A screw-nut and collar are shown in Fig. 1 for operating the bolt and frustum by a lever, which arrangement will answer in some cases; but the application of hydraulic pressure, as patented to Reuel Blackwood, April 5, 1864, is found to be much more expeditious and economical for the purpose, and is therefore intended to be generally used.

Operation: When the tubes F are intended to be fastened by the application of the ferrule G the conical frustum C is applied over the head of the bolt D projecting through the expander, or, if hydraulic pressure be used, over the correspondingly headed and projecting piston-rod or ram of the press, and the free ends of the arms of the expander applied in direct contact against the thicker edge of the ferrule G in the flue E, arranged as seen in Fig. 1, and the frustum C then drawn entirely out through the ferrule, and thus tightening the flue and ferrule as required. When the tubes are to be fastened without the ferrules the smaller end of the expander is introduced into a tube, F, until the dies I I correspond with the edges of the boiler-plate E, when a solid conical frustum, C', is driven or pressed in so as to effect the expansion required to fasten the tube or flue, as indicated in Fig. 2. This solid frustum C' may be made to fit on the ram of a hydraulic press, so as to adapt it, in this case also, directly to the purpose of apply-

ing hydraulic pressure, as before described for the ferrules.

It will be readily seen that this expander will be more effective and durable, and also more easy and simple of construction, than any device heretofore used for the purpose.

I do not desire to claim the application of hydraulic pressure, in combination with a conical frustum, to the purpose of expanding ferrules or flues in boiler-plates; but,

Having fully described my improved expander and shown its utility, what I claim as new therein of my invention, and desire to secure by Letters Patent, is—

1. The series of radially-moving arms A A, arranged and supported in an annular base, B, so as to operate or be operated together substantially as described, for the purposes specified.

2. The employment of removable or changeable dies I I, in combination with the radially-moving arms A A, substantially as and for the purposes described.

3. In combination with an expander provided with radially-moving arms A A, as described, the employment of the hollow conical frustum C, operated together by any suitable power, as and for the purposes described.

JOHN H. KNICKERBOCKER.

Witnesses:

BENJ. MORISON,
JAMES WINSMORE.