

(No Model.)

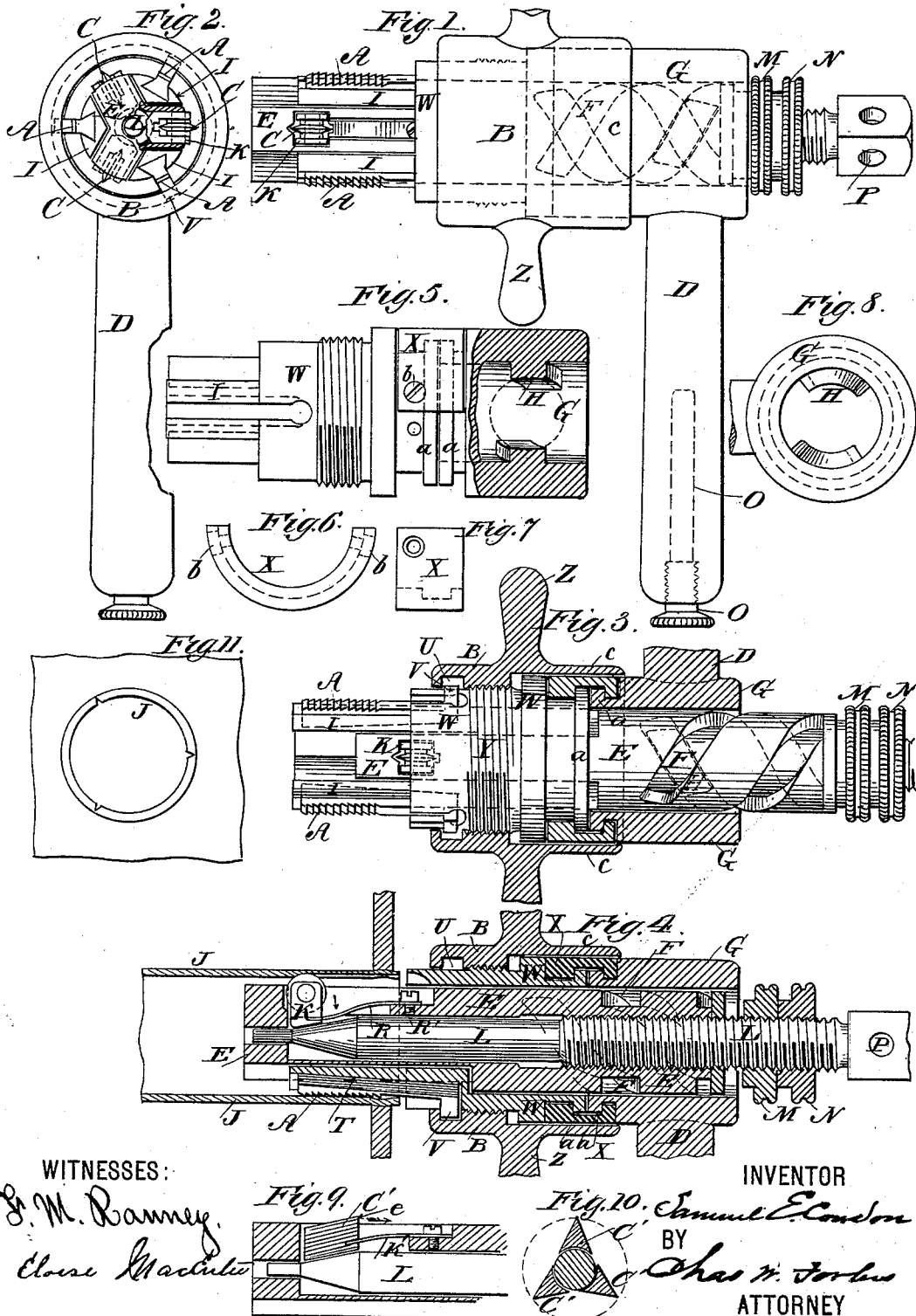
2 Sheets—Sheet 1.

S. E. CONDON.

TOOL FOR CUTTING OUT BOILER TUBES.

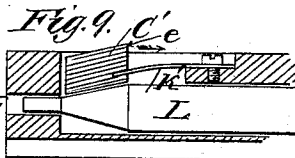
No. 408,162.

Patented July 30, 1889.



WITNESSES:

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(No Model.)

2 Sheets—Sheet 2.

S. E. CONDON.

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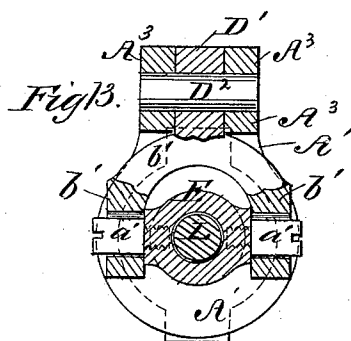
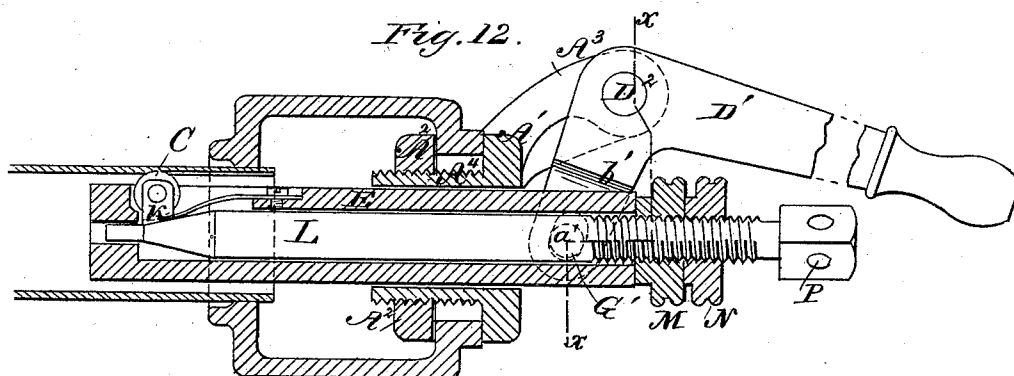
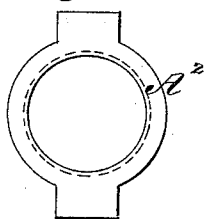


Fig. 14.



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UNITED STATES PATENT OFFICE.

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M. MICKLEBOROUGH, AND N. W. PRATT, OF SAME PLACE.

TOOL FOR CUTTING OUT BOILER-TUBES.

SPECIFICATION forming part of Letters Patent No. 408,162, dated July 30, 1889.

Application filed May 28, 1888. Serial No. 275,359. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL E. CONDON, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Tools for Cutting Out Boiler-Tubes, of which the following is a specification.

The purpose of this invention is to accomplish the removal of old or damaged tubes or flues from the interior of a shell or other boiler, the said tubes or flues having been expanded or otherwise secured at their ends to and within the apertures made therefor in the tube-sheets of a shell-boiler, or the headers of a sectional tubular boiler, as the case may be. In practice the ends of the tubes are detached from their fastening in the tube-sheet or its equivalent, by first cutting longitudinal slits from within the expanded or upset margins of the tube at several points about its circumference, and subsequently driving the several sections of the end thus split inwardly, so as to part the metal from the margins of the opening in which it fits, the withdrawal of the tube then being permitted. This process has heretofore been accomplished by driving a cold-chisel, held at an angle to the tube and projected within its end. It is important that the incisions should not extend entirely through the margins of the tube, or so nearly through as to indent or rupture the tube-sheet, whereas the surface in the aperture of the latter must be left smooth to receive the tube to be substituted. In the manner of practice above stated the operation requires great care, and a considerable time, therefore, to accomplish the work.

The object of my invention is to effect a saving of labor and to perform the cutting of all the slits simultaneously, and to a proper depth that will insure against rupture of the tube-sheet.

To this end my invention consists of a special tool adapted to be inserted within the end of a tube, having expansive grippers adapted to seize upon the interior of the tube, and consisting, essentially, of a series of rotary anti-friction or other steel cutters capable of longitudinal reciprocation, provided with actuating mechanism to effect said reciprocation, and mechanism for effecting their

expansion into the sides of the tube simultaneously or between each reciprocation.

Referring to the accompanying drawings, forming a part of this specification, and in which similar letters of reference indicate like parts, Figure 1 is a side view of the device, showing the cutters projected to the inward termination of the stroke; Fig. 2, an end view of Fig. 1; Fig. 3, a partially-sectioned view of Fig. 1, showing the cutters at the retired termination of their stroke; Fig. 4, a sectional elevation of Fig. 1; Fig. 5, a detail view, partly in section; Figs. 6 and 7, detail views pertaining to Fig. 5; Fig. 8, an end view of Fig. 5; Figs. 9 and 10, detail views of a modification of the cutters; Fig. 11, an end view of a cut tube within the aperture of the tube-sheet after subjection to the cutting operation of the present device. Fig. 12 is a sectional elevation of a modification of the device; Fig. 13, a cross-section of Fig. 12 on the line *x x*, Fig. 12; and Fig. 14, a detail view pertaining to Fig. 12.

A A, Fig. 1, are the gripping devices, which are actuated by the rotative sleeve B.

C are the cutters, actuated longitudinally by the lever D, which is rotative upon the reciprocating stock E. The stock E is provided with spiral grooves F and the collar G of the lever D; provided with corresponding spiral teeth H fitting therein, whereby the rotation of the lever D will effect the longitudinal movement of the stock E, which is rotatively stationary but longitudinally movable within the bearings or guides I, and the sleeve W, integral therewith, sustained at a fixed position from within the tube J by the grippers A, mounted within said guides. The collar G of the lever D is connected to the sleeve W by means of the interiorly-recessed sectional collar X, which fits the adjacent flanges *a* of the said collar G and sleeve W, respectively, and couples them together. The collar X thereby retains the lever-collar G and imparts longitudinal motion to the stock E by the rotative motion of said collar G. The collar X is separable and removable by its sectional construction in halves, as shown, held upon the sleeve W by the screws *b*.

It is obvious that the spiral grooves F and teeth H may be reversed in location—that is

to say, the grooves located in the collar G and the teeth or male ridges of the spiral upon the stock E.

The cutters C are adjusted outwardly by the entrance between their bearing-blocks K of the conical end of the screw-spindle L, which latter is entered or retracted through the stock E by its screw-threads therein. Its extent of entrance is limited according to the adjustment of the nut M thereon, the latter being fastened at its point of adjustment by the jam-nut N. The screw-spindle L is turned by a wrench applied to its squared head, or, preferably, by the insertion of a pin, as O, (conveniently stored when out of use in the lever D, as indicated,) into the holes P of the said squared head. The extreme end of the screw-spindle L has a bearing Q in the extreme end of the stock E to center it accurately between the bearing-blocks K of the cutters C.

The cutters C have a V-shaped cutting-edge, sufficiently deep to cut the required maximum depth of incision, and their bearing-blocks K are set within the radial slots or mortises, as shown, which guide them in their outward or their receding movement. The cutters C have their bearing-blocks K mounted upon the extremities of the springs R, fastened by the screws R', Fig. 4, and the said springs tend to retire the cutters as against the outward thrust of the tapered spindle L.

The sleeve W is sustained in a fixed position to the interior of the tube to be operated upon by means of the grippers A, expansive from its projecting guides I, which latter fit corresponding V-shaped sliding grooves in the inner end of the stock E, as appears in Fig. 2. The stock E is thereby kept from turning out of place when the cutters are reciprocated and the latter guided always in the same line of incision.

The grippers A are capable of sliding longitudinally on the incline of their wedge-shaped bearing-surfaces upon the inclined surfaces I, so that the retracting movement of the sleeve B will cause their expansion. For this purpose the sleeve B is interiorly recessed by a circumferential groove U, which engages with the spurs V of the grippers, and by its rotation upon its screw-thread Y upon the stationary sleeve W moves inward or outward by the application of the hand to its exterior projecting arms Z.

The grippers A are dovetailed in their sliding grooves, as shown in Fig. 2, whereby they are retained from dropping outward when the tool is withdrawn from the tube.

The extension *c* of the sleeve B confines the sectional collar X, so that the latter may be held in place without the use of the screws *b*, if desired.

The modification of the cutters shown in Figs. 9 and 10 consists of the substitution of steel cutting-blades C' for the rotary cutters C. The cutting-blades C' are prismatic in shape, presenting a cutting-point at *e*.

They are similarly mounted in the stock E to the rotary cutters by means of springs, as K', (shown in said Fig. 9,) which likewise retain them against the tapered portion of the spindle L. The cutters C' act in the direction of the arrow shown, the abutment from which they draw being that of the sleeve W against the end of the tube.

It is manifest that the grippers and the cutters used may be substituted by different sizes—that is to say, greater depths radially from the axis of the tool—whereby the same instrument may be adapted for tubes of various sizes.

The operation of my invention is as follows: The screw-spindle L being withdrawn, so as to retire the cutters, and the sleeve B being moved to retract the grippers, the tool is inserted within a tube J, Figs. 4 and 11. The sleeve B is now screwed outward—that is to say, toward the operator—and the grippers A thereby expanded to seize the tube from within, and thus hold the sleeve stationary and firmly in place. The cutters C are now expanded by inwardly screwing the spindle L, and simultaneously the lever D, rotated (in the present instance to a half-turn) to and fro to actuate the cutters from a suitable point—as that indicated in Fig. 4—to their outward limit of stroke—as that indicated in Fig. 3—repeatedly until the required depth of incision is acquired. Fig. 11 illustrates the completed operation, the incisions being, preferably, three in number.

It is obvious that any number of cutters may be thus employed in lieu of three, but the said number is found preferable in practice.

The cutter-stock E may be operated by any other means than by the spiral groove F and lever-collar G, shown as engaging therewith by a rotative motion—as, for instance, the stock E may be directly reciprocated by the hand, said stock having a suitable handle or lever on its outer end therefor. This feature is illustrated by Figs. 12, 13, and 14, which show the device as applied to the header of a sectional tubular boiler. The stock E is in this instance reciprocated by the lever D', fulcrumed at D² in bearings or lugs A³, projected from the clamping-nut A', which, with the clamping-nut A³, substitutes for the expansive grippers A in the preceding device. The cutters C are similarly carried in the stock E, and the latter has projecting pins *a'*, upon which the bifurcated arm *b'* of the lever D' engages to reciprocate the stock. The clamping-nut A' has an externally-threaded sleeve A⁴, upon the inner extremity of which the nut A² is screwed.

The device is introduced by first placing the nut A² inside the header through the hand-hole opposite the tube, which can be done owing to the shape of the said nut, as shown in Fig. 14; and the threaded sleeve of the nut A' is then screwed into it as the tool is inserted. The nut A' is then screwed tight,

clamping the flange of the hand-hole between the two nuts, and the cutters expanded against the interior of the tube by the conical screw-spindle L, as before, while reciprocated by the lever D'.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A tool for cutting boiler-tubes inserted in and secured to the tube to be cut, having an internal tool-stock capable of reciprocation, and provided with cutters operating longitudinally against the interior surface of said tube.

2. A tool for cutting boiler-tubes, consisting of a body bearing expansive grippers to

seize upon the interior of a tube, and a stock capable of reciprocation bearing expanding cutters that operate in a direction parallel with the length of the tube.

3. In a tool for cutting boiler-tubes, the combination of a sleeve connected to the interior of a tube, a cutter-stock capable of reciprocation within said sleeve, and a lever-collar rotating upon said sleeve and engaging with said stock by means of spiral teeth and grooves, as described.

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Witnesses:

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