3 Sheets—Sheet 1.

A. L. IDE.

MACHINE FOR WELDING THE ENDS OF TUBES.

No. 172,443. Patented Jan. 18, 1876.

Fig. 1.

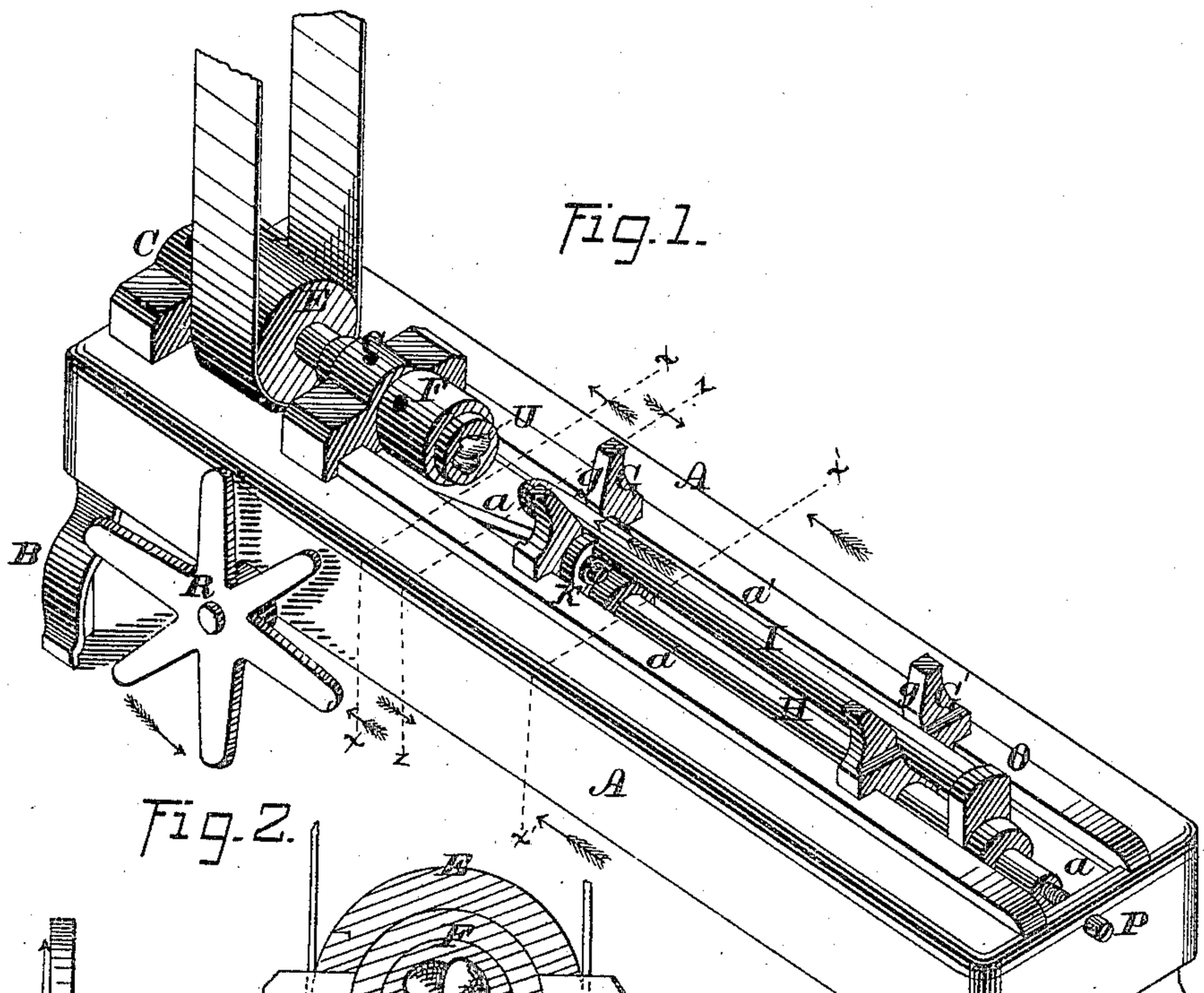
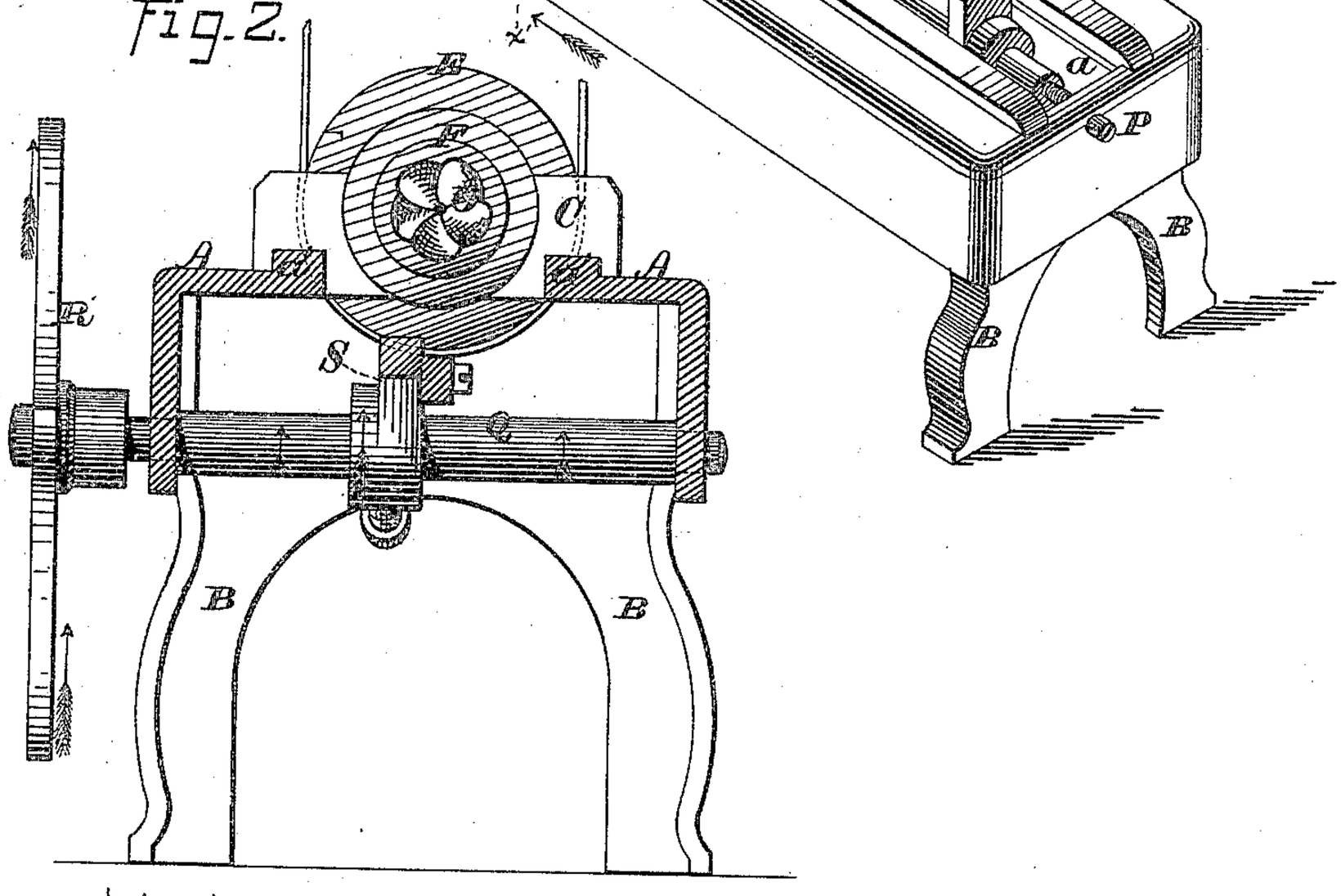


Fig. 2.



WITNESSES:

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3 Sheets—Sheet 2.

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Fig. 3.

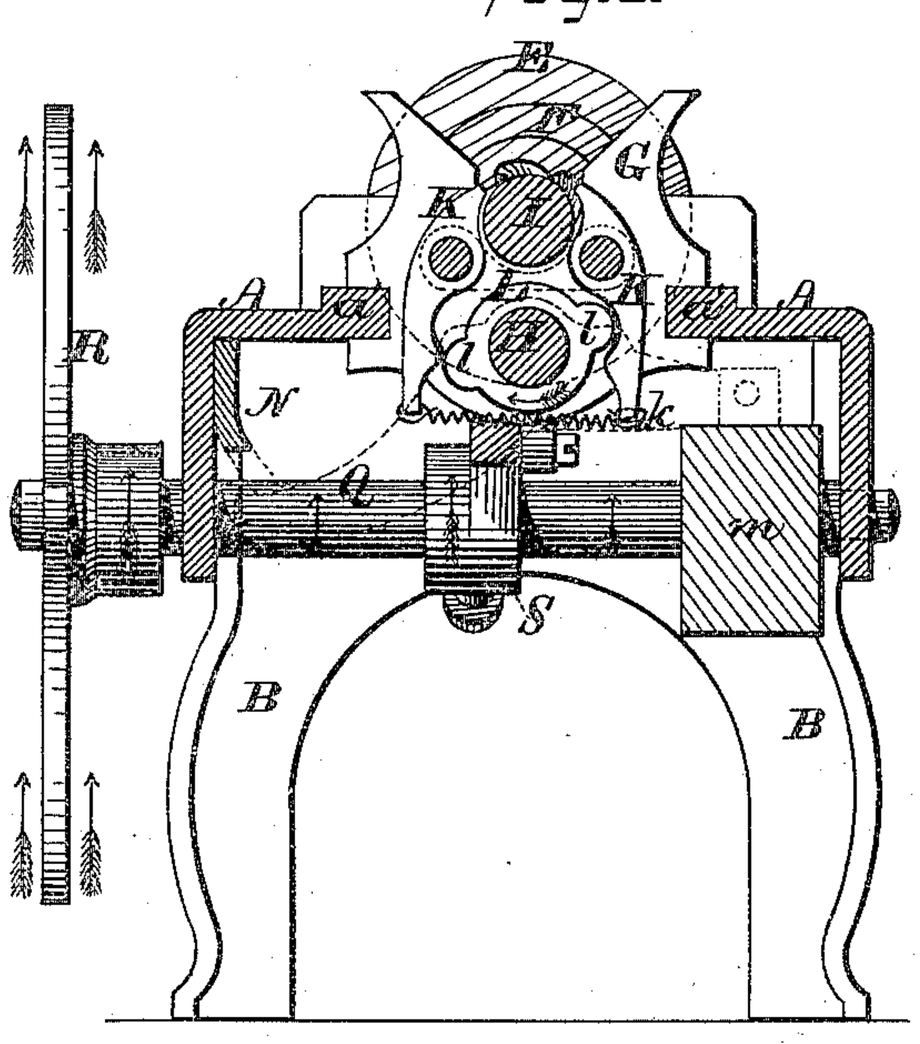


Fig. 4.

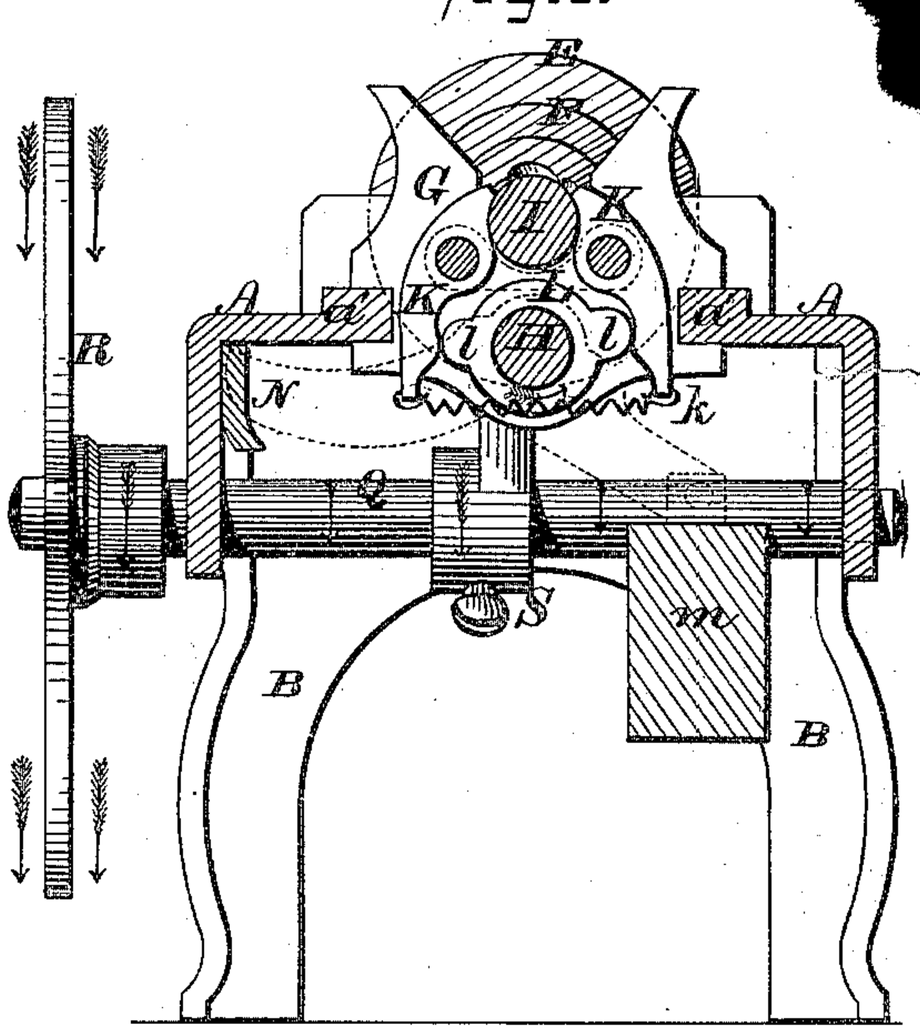


Fig. 6.

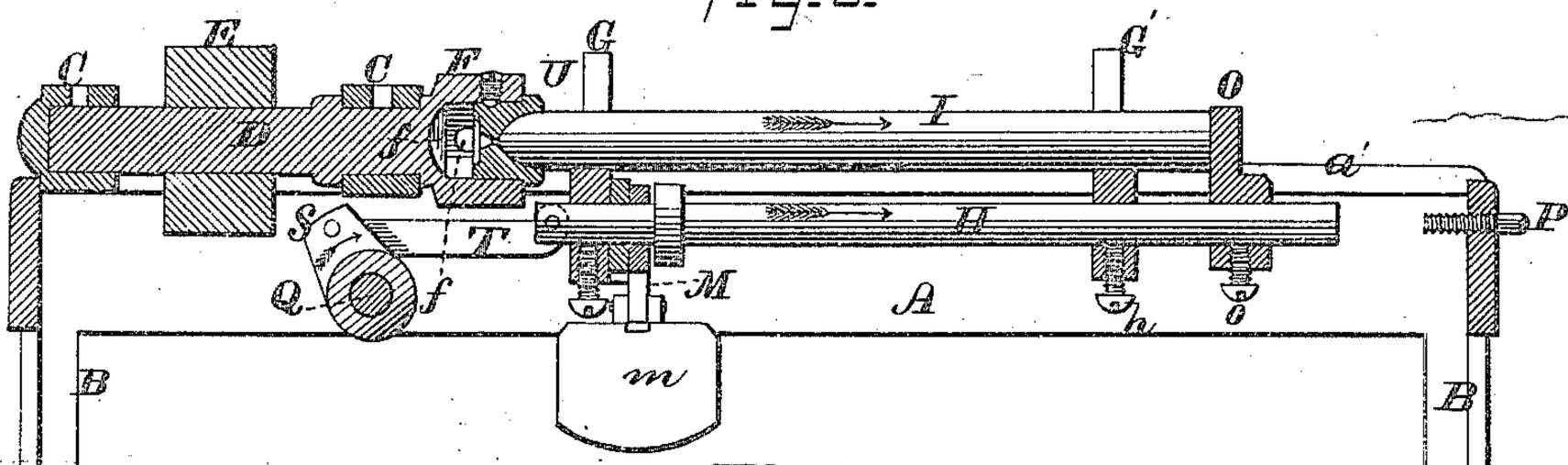
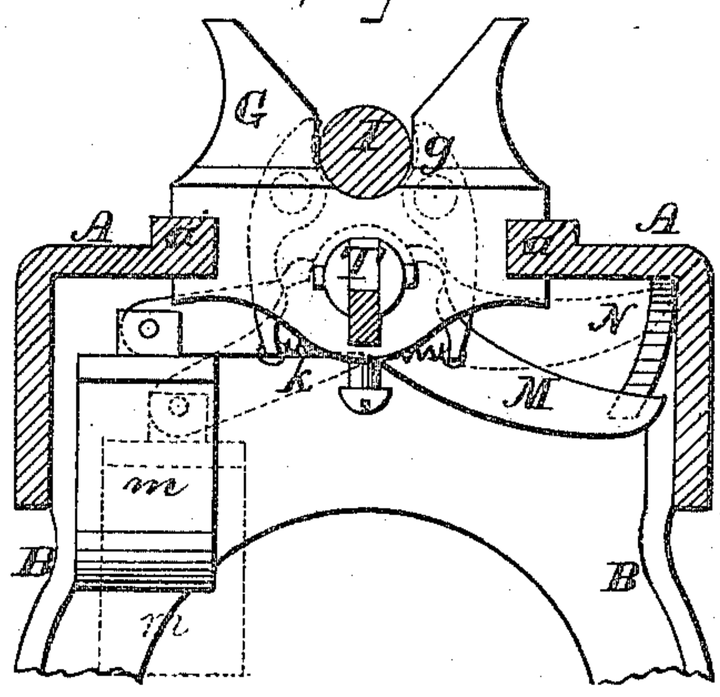


Fig. 5.



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3 Sheets—Sheet 3.

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Fig. 7.

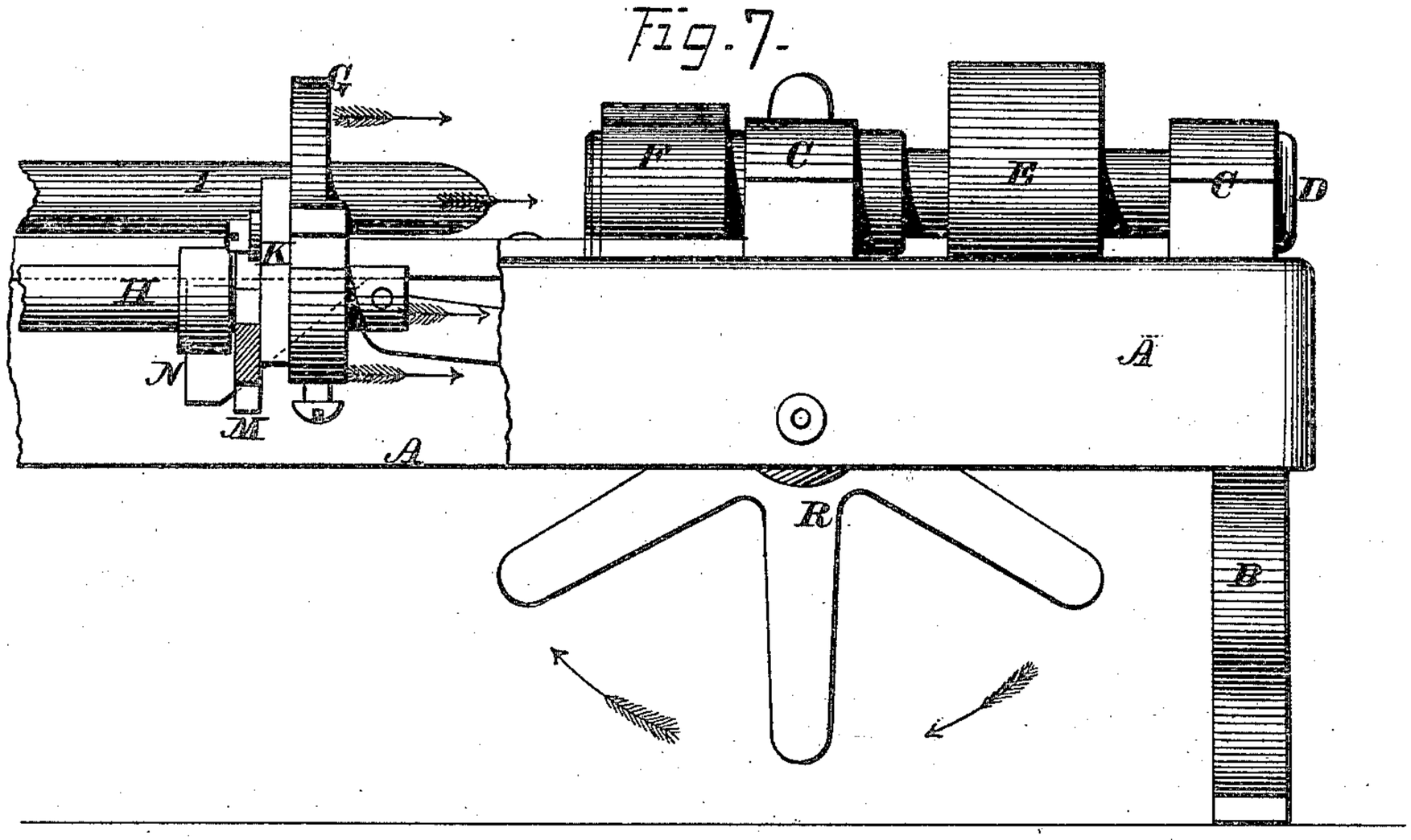


Fig. 8.

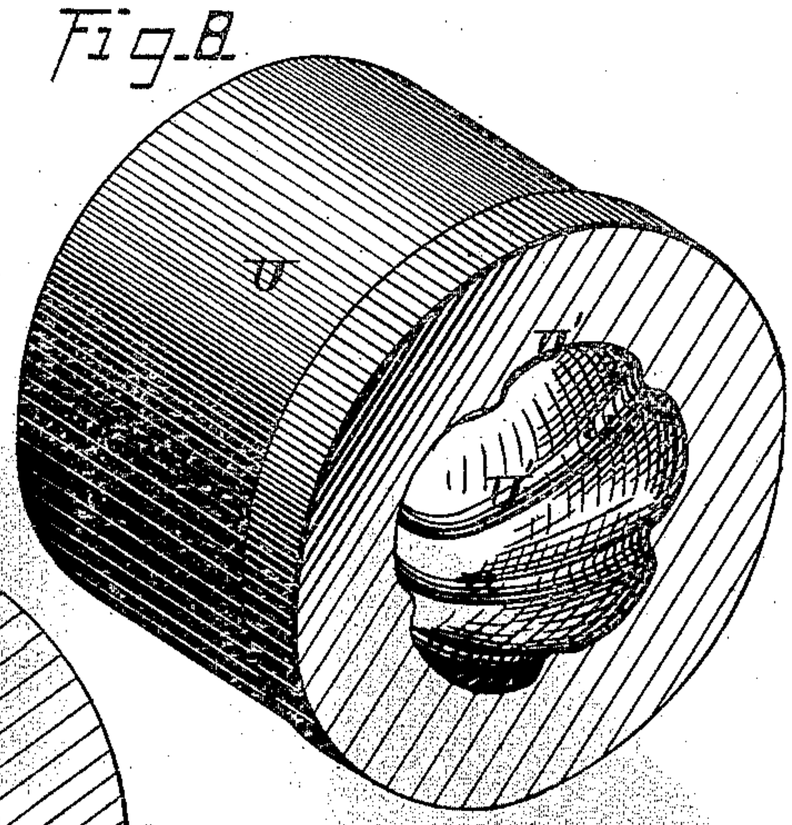


Fig. 9.

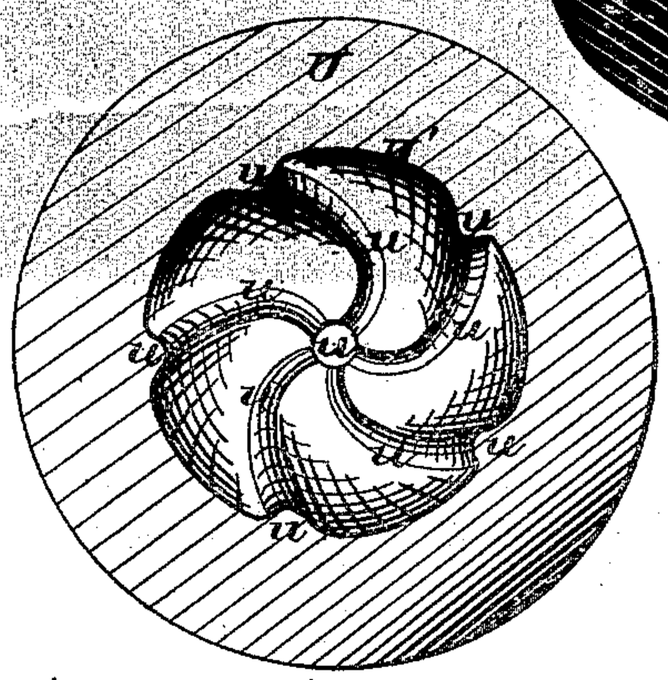
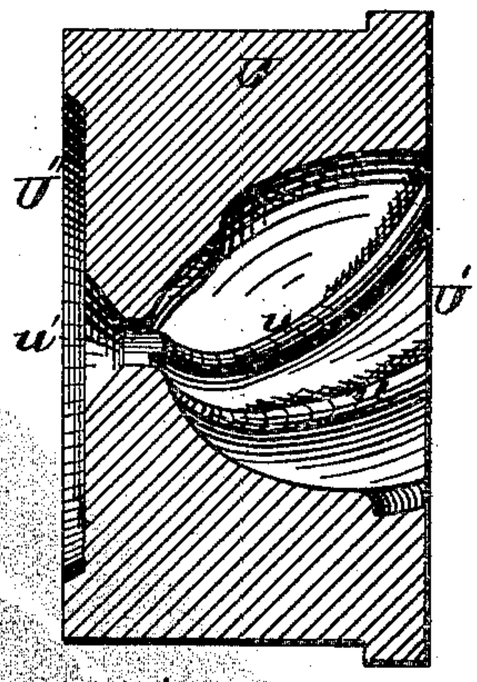


Fig. 10.



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UNITED STATES PATENT OFFICE.

ALBERT L. IDE, OF SPRINGFIELD, ILLINOIS.

IMPROVEMENT IN MACHINES FOR WELDING THE ENDS OF TUBES.

Specification forming part of Letters Patent No. **172,443**, dated January 18, 1876; application filed December 2, 1875.

To all whom it may concern:

Be it known that I, ALBERT L. IDE, of Springfield, in the county of Sangamon and in the State of Illinois, have invented certain new and useful Improvements in Apparatus for Welding Pipe; and do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a perspective view of my improved apparatus as arranged for use. Fig. 2 is a cross-section of the same upon line *x x* of Fig. 1. Figs. 3 and 4 are like views upon line *x' x'* of said Fig. 1, and show, respectively, the clamping-jaws for holding the tube in position, opened and closed. Fig. 5 is a like view of said apparatus upon line *z z* of Fig. 1. Fig. 6 is a central longitudinal section of the same upon a vertical line. Fig. 7 is a rear elevation of the head end of the apparatus, a portion of the frame being broken away, so as to show the inclined lug employed for operating the clamping-jaw lever. Fig. 8 is a perspective view of the die employed for closing the ends of tubes. Fig. 9 is a front elevation of the same, and Fig. 10 is a central section upon a line passing from front to rear.

Letters of like name and kind refer to like parts in each of the figures.

In the construction of steam-radiators in which vertical tubes are employed it is necessary that the upper end of each tube should be closed, and in order to render the same permanent, and to cause said closed end to present a sightly appearance, it has been customary to weld the same in a semi-spherical form, which operation has been performed by hand. Experience has shown that tube ends closed by hand were, in a large percentage of instances, imperfect, and contained openings for the escape of steam; that they lacked uniformity; and that the operation involved large expense, and materially increased the cost of the radiator.

To obviate these objections is the design of my invention, which consists, principally, in the method of closing and welding the ends of metal tubes by drawing the same inward by means of a revolving die, substantially as is hereinafter specified. It consists, further, in the peculiar construction of the die employed for drawing and welding the tube ends, substantially as and for the purpose hereinafter shown. It consists, further, in the means employed for supporting the tubes, and for moving the same longitudinally toward or from the revolving die, substantially as and for the purpose hereinafter set forth. It consists, finally, in the means employed for automatically confining the tubes in position upon the carriage when moved toward the revolving die, and for releasing said tubes when moved in an opposite direction, substantially as and for the purpose hereinafter shown and described.

In the annexed drawings, A represents the bed or frame of my machine, which has a rectangular shape in plan view, is open beneath, as seen in Fig. 2, is provided with a central longitudinal opening, *a*, that has parallel sides, and is suitably supported upon, and by means of, four legs, B and B. Journaled within suitable bearings C and C, at one end of the frame A, is a spindle, D, which is provided between said bearings with a belt-pulley, E, and at its forward end has a chuck, F, that is constructed with an axial circular cavity, *f*, which opens to the front, and has parallel sides. Fitted between, and sliding upon, the ways *a'* and *a'*, which form the edges of the central parallel opening *a*, are two blocks, G and G', which loosely embrace the upper, lower, and inner sides of said ways, and are capable of being moved lengthwise of the same. A round bar, H, rigidly attached to the front block G, passes through a corresponding opening in the rear block, and is secured in place within the latter by means of a set-screw, *h*, said bar, thus constructed and connected with said blocks, operating to combine the same, so as to form a carriage for, and upon which are supported, the tubes I to be welded. By loosening said set-screw *h*, said blocks can be adjusted toward or from each other, and then secured in relative position once more. Within the upper side of each block G and G' is formed a recess, *g*, which has a general V shape, and at its bottom is made semicircular, to correspond with the size and shape of the tube

I to be contained; but as it is required that said tube shall be firmly held in place, and prevented from turning within said carriage, the following-described clamping mechanism is provided: Two bars, K and K, which have the form shown in Figs. 3 and 4, are pivoted upon the rear side of the forward head G, in such position as to cause their upper ends to be moved together, and confine between the same the tube I whenever their lower ends are moved apart. Upon the bar H, between the lower ends of the jaws K and K, is journaled a cam, L, which is provided with two semicircular projections, *l* and *l*, that, when said cam is partially rotated in one direction, bear against and press said jaws apart, as seen in Fig. 4, while by rotating said cam in an opposite direction said enlargements are removed from engagement with said jaws, and the latter are permitted to assume the position shown in Fig. 3, so as to release the tube I from engagement. A spring, *k*, attached to, and extending between, the lower ends of said jaws, causes the latter to be automatically returned to their normal position whenever released by said cam.

The cam L is automatically operated so as to close the jaws K and K whenever the carriage moves forward by means of a lever, M, which is attached to its rear face, and extends transversely across the machine, with its forward end in contact with an inclined lug, N, that is secured upon the inner side of the frame, while from the rear end of said lever is suspended a weight, *m*. As the carriage moves forward, the end of the lever M, in contact with the inclined lug N, is permitted to rise, while the weight *m*, upon the rear end of said lever, depresses said end, and causes the cam L to rotate and close the jaws K and K, as shown in Fig. 3. When the carriage is moved rearward, the lever M is returned to the position shown in Fig. 4, by means of the inclined lug N, upon which the forward end of said lever bears. Longitudinally the tube I is held in position upon the carriage by means of a head, O, that surrounds and is secured upon the bar H, and projects upward sufficiently to enable it to receive the rear end of said tube. Said head, being confined in position upon said rod by means of a set-screw, *o*, can readily be adjusted forward, or to the rear, in order to accommodate tubes of different lengths. The rearward motion of the carriage is limited by means of a set-screw, P, which passes horizontally inward through the rear end of the frame, and receives upon its inner end the rear end of the bar H. The carriage is moved upon its ways by means of a shaft, Q, that is journaled horizontally and transversely within the frame A, beneath the inner bearing C, and is provided upon its outer end with a hand-wheel, R, and upon its inner portion, midway between the sides of said frame, with a crank-arm, S, to which latter is pivoted one end of a bar, T, that from thence extends rearward, and at its opposite end is pivoted to or upon the front end of the bar H.

As thus arranged, it will be seen that by turning the shaft Q in a forward direction, the crank-arm S, which, as seen in Fig. 6, extends upward, will cause the carriage to be moved toward the head of the frame, while, by reversing the motion of said shaft, said carriage will be moved rearward.

Fitted into the axial recess *f*, at the inner end of the spindle F, is a die, U, (shown in Figs. 8, 9, and 10,) which, at its outer side, is provided with a recess, U′, that has, in cross-section, a circular form, and in longitudinal section is semi-spherical. Within the recess U′ are formed a series of corrugations, *u* and *u*, which extend from its bottom and axial center, outward and forward, in a spiral form, while transversely each corrugation is highest at its rear edge, and from thence slopes forward toward the next corrugation. From the axial center of the recess U′ a small opening, *u′*, communicates with a recess, U″, that is formed within the rear side of the die U, which latter recess communicates with the open air through a radial opening, *f′*, in the spindle F.

The operation of the machine thus constructed is as follows: The spindle being caused to rotate at about eight hundred revolutions per minute, the carriage is moved to its rear limit, and a tube, having its forward end, heated to the welding-point, is placed within said carriage, and the latter moved forward until the heated end of said tube enters the cavity of the die, when, by a gentle forward pressure upon said tube, its end will be drawn together and welded so as to present the form shown in Figs. 6 and 7. The carriage may now be moved rearward, and the completed tube replaced by a fresh one.

The operation of the spiral ribs of the die is to compress and round inward the open end of the tube; but experience has shown that if said die is solid in rear of the outer cavity, there will be an accumulation of scale and cinders at the extreme end of said tube, and the welding will be imperfect at such point. The axial opening *u′* obviates the difficulty named, as it furnishes a vent for all cinders, scale, and surplus metal which are pressed into said opening in the form of a teat, and upon the removal of said teat it is found that the entire end of the tube is formed of solid perfectly welded metal.

By the use of this machine, the capacity of a workman is increased from two hundred to six hundred tubes per day, and the tube ends are uniform in shape, while but a fraction of the percentage of leaky tubes is produced by the machine, that is unavoidable where the welding is done by hand.

While the tube is preferably confined in position and the die caused to revolve, the operation will be as perfect if the opposite is true, the result produced being due to the motion of one part with relation to the other, and it

being only a matter of convenience which part shall be rotated.

Having thus fully set forth the nature and merits of my invention, what I claim as new is—

1. The method employed for closing and welding the ends of metal tubes, by pressing the same, properly heated, within a concave revolving die, substantially as is specified.

2. The die U, provided with a semi-cylindrical recess, U′, spiral corrugations *u* and *u*, and axial opening *u′*, substantially as and for the purpose shown.

3. In combination with the ways *a′* and *a′* of the frame A, the tube-carriage composed of the blocks G and G′, connected together by the bar H, and moved upon said ways by the shaft Q, hand-wheel R, crank-arm S, and connecting-bar T, substantially as and for the purpose set forth.

4. In combination with the carriage employed for supporting the tube I, the pivoted jaws K and K, cam-lever L, *l*, and *l*, lever M, weight *m*, and inclined lug N, all arranged to operate in the manner and for the purpose substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand this 8th day of November, 1875.

ALBERT L. IDE.

Witnesses:
F. E. WILLIAMS,
J. BENNETT.