H. S. Otis.

Boring Metals.

No. 13,117. Patented Jun. 19, 1855.

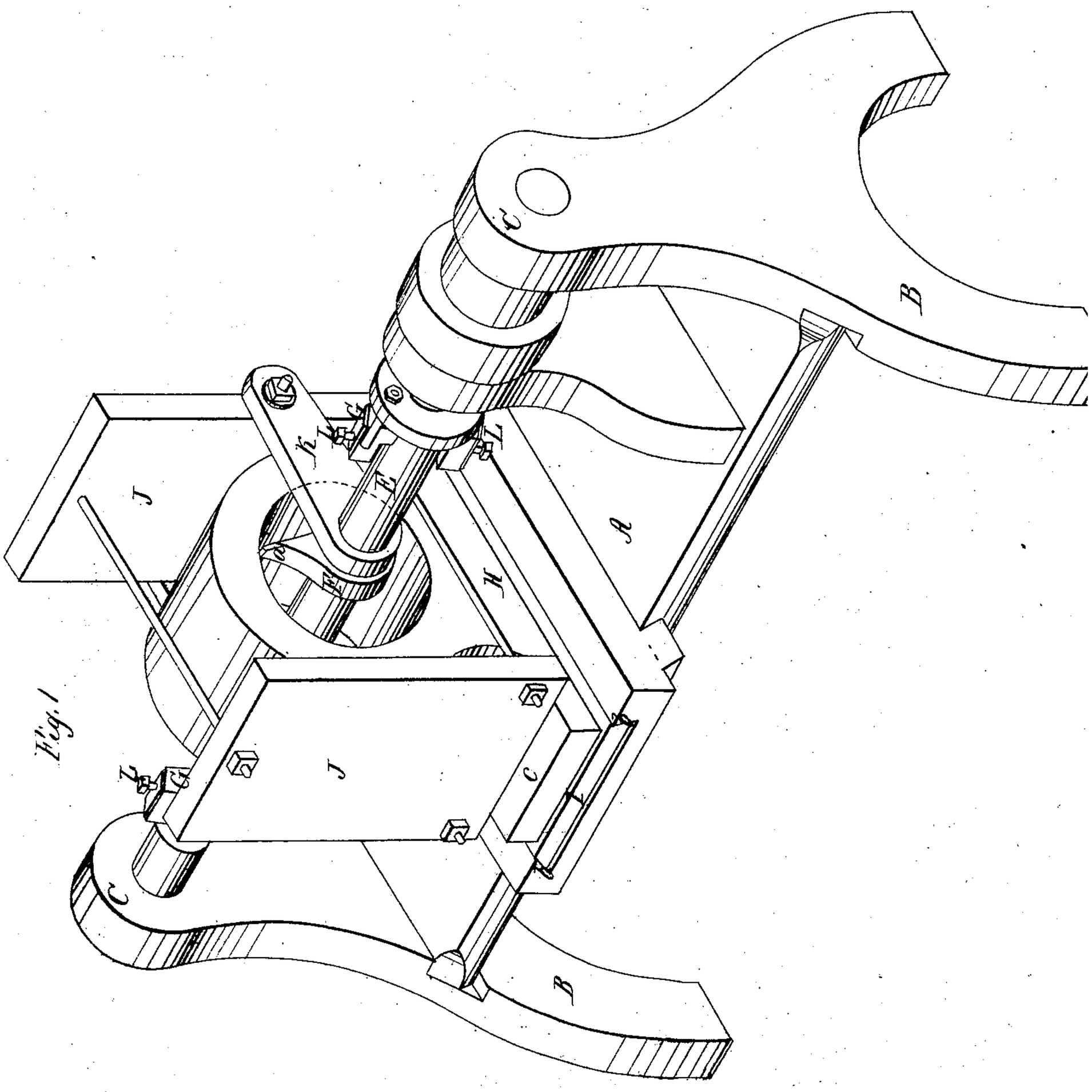

Fig. 1

THE GRAPHIC CO. PHOTO-LITH. 29 & 42 PARK PLACE, N.Y.

Sheet 2. 2 Sheets.

M. S. Otis.

Boring Metals.

No. 13,117. Patented Jun. 19, 1855.

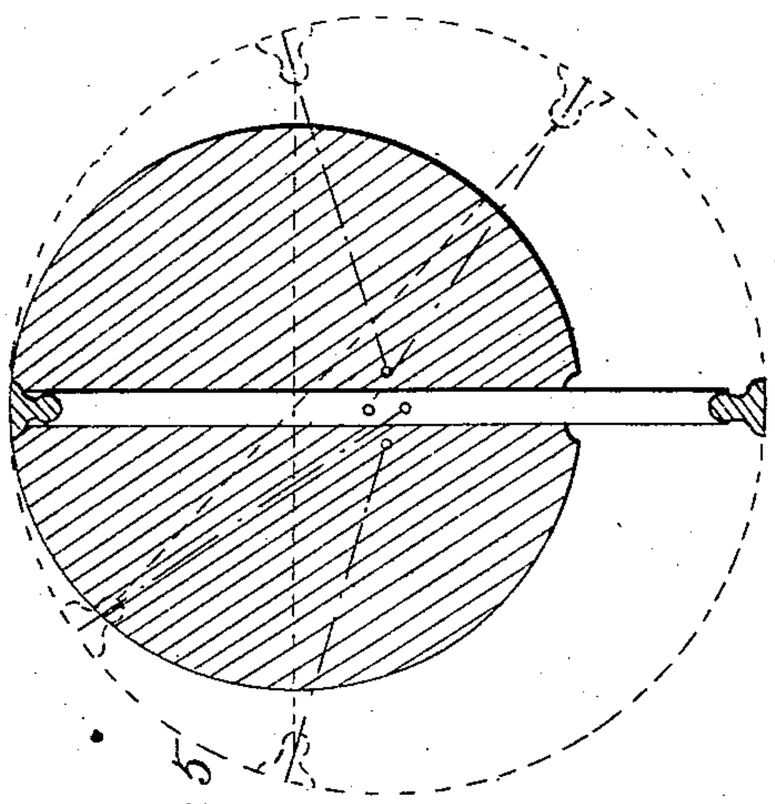

Fig. 5

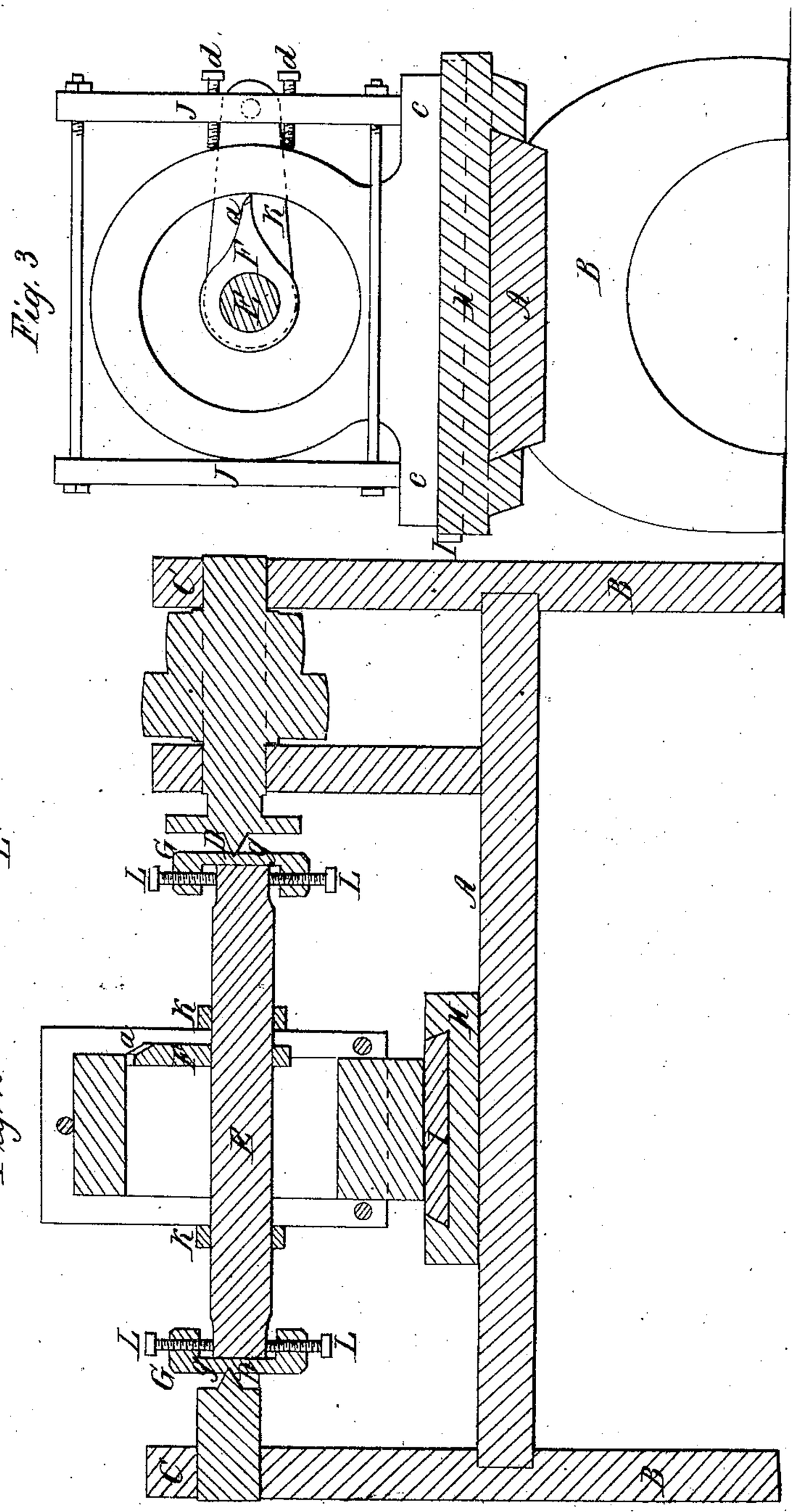

Fig. 3

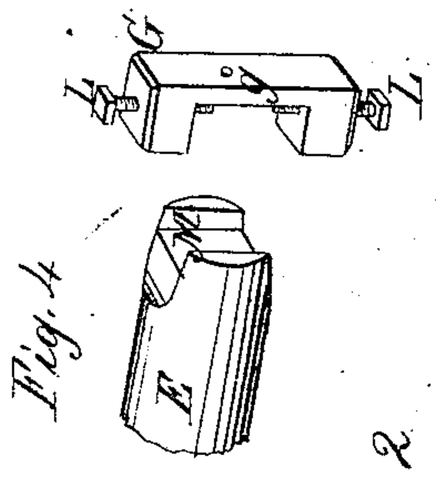

Fig. 4

Fig. 2

THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

UNITED STATES PATENT OFFICE.

MARVIN S. OTIS, OF ROCHESTER, NEW YORK, ASSIGNOR TO CHAS. RUMLEY.

MACHINE FOR BORING CYLINDERS.

Specification of Letters Patent No. 13,117, dated June 19, 1855.

To all whom it may concern:

Be it known that I, MARVIN S. OTIS, of Rochester, in the county of Monroe and State of New York, have invented certain new and useful Improvements in Machines for Boring the Cylinders of Charles Rumley's Rotary Engines, which require to be of a peculiar form in order to work with smoothness and accuracy, so that while the piston is on the one hand prevented from binding it shall fit the cylinder so close as to prevent leakage and waste of steam, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings and in which—

Figure 1 represents a view in perspective of a machine embracing my improvements; Fig. 2 a longitudinal section; and Fig. 3 a transverse section of the same at the line *x x* of Fig. 2.

When steam of low tension is used it is not as important to have the cylinder and piston reciprocally fitted to each other with such a degree of nicety as when steam of high tension is used, and hence while experiments were made with Rumley's engine with steam of low pressure or tension, it was thought that a cylinder bored from two centers would conform sufficiently near to the irregular circular or elliptical figure described by the revolution of the piston. This view of the case was found to be incorrect for although the boring of the cylinder, from two or even three centers, causes an approximation to the true form required, yet it has been found necessary to bore it from four centers in order to make it of the requisite accuracy to work satisfactorily with steam of high tension. The boring of an elliptical cylinder from four centers it was found, involved more than four times the labor and time usually expended in boring an ordinary circular cylinder, and as the boring of the cylinder is one of the principal items of expense in fitting up a steam engine, this quadrupling of the cost and time of boring the cylinder of Rumley's engine was a very serious objection, and therefore it was a desideratum to contrive some means by which such a cylinder could be bored at a single operation, with the same form of perimeter as if bored from the four centers. To produce this result is the object of my invention which consists in combining with the continuous rotating motion of the cutter a reciprocating transverse movement of the cylinder being bored, the progressive motion of the cutter through the cylinder being produced by a longitudinal movement of the cutter or cylinder in the usual manner.

In the accompanying drawing A, represents the bed and ways or slide of a horizontal boring engine; B, the legs to support the same; C, the head stocks; D, the centers on which the mandrel turns; E, the mandrel which carries the cutter head; F, the cutter head and *a* the cutter.

G, are chucks for supporting the ends of the mandrel, and adjusting it so as to give it more or less eccentricity, for a purpose to be hereafter described.

H, is a carriage for carrying the cylinder back and forth to bring its interior from end to end under the operation of the cutter, it has a motion parallel to and along the horizontal ways or bed (A), on which it slides. This carriage may be moved back and forth by a screw rack and pinion, or any of the usual contrivances for such purposes. On the top of this carriage (H) a second carriage (I) is mounted in horizontal slides (*b*) which are at right angles to the slides or ways of the bed, so that the movement of this transverse carriage in its slides is at right angles to the movements of the other carriage on which it is mounted. On this transverse carriage the cylinder to be bored is secured by means of screws that pass through feet (*c*) cast upon the cylinder. A pair of plates (J) adjusted to the diameter of the cylinder by set screws (*d*), are clamped upon the cylinder for the purpose of supporting a pair of wrist pins in the proper position; which wrist pins project from one of those plates, on a level with, and parallel to the axis of motion of the boring bar or mandrel. The purpose of these wrist pins is to support one end of the eccentric rods, (K) and joint them to the cylinder to move the same back and forth transversely, while the opposite ends of these rods are supported on the mandrel, which passes through apertures in their ends. The mandrel is cylindrical and hung on the centers on which it rotates eccentrically to its own axis, and the apertures through the rods (K) fit the mandrel closely, it follows therefore at each revolution of the mandrel a reciprocating movement will be communicated to the cylinder transversely to its own axis, and the transverse carriage (I) to which the cylinder is secured

will slide back and forth on the guides upon the carriage (H) to admit of the reciprocating movement communicated to the cylinder by the eccentric rods (K) which rods are free to slide along the mandrel to accommodate themselves to the progressive longitudinal motion of the cylinder, during the operation of boring.

The cutter which may be of the usual or any approved form is set so as to radiate from that side of the mandrel which has the shortest radius from the center of rotation, and the transverse reciprocating movement of the transverse carriage, and of the cylinder, is at right angles to the radii of the cutter when it is pointing either up or down in a vertical line, and the same movements of the cylinder are parallel to or in a line with the radii of the cutter when the latter is pointing in a horizontal line. It follows from the relative positions and movements of the parts that the bore of the cylinder will have the greatest radius in a horizontal line passing through its center, and the least in a vertical line passing through its center, and the difference between its greatest and least diameter will be precisely double the eccentricity of the mandrel. From this it is apparent that the form of the cylinder will be elliptical, but its curvature will be of a peculiar form, for as the eccentric mandrel (E) acting through the rods (K) communicates a comparatively rapid transverse motion to the cylinder at and near the time when the cutter is pointing up or down in a vertical line and acting upon that part of the perimeter of the cylinder which is of the shortest diameter; and communicates a comparatively slow transverse movement to the cylinder at and near the time when the cutter is pointing in a horizontal line, and acting upon that part of the perimeter of the cylinder which is of the longest diameter. It follows that the periphery of the bore of the cylinder will bulge or be fullest at and near the four points which are respectively 45° from its vertical and horizontal diameters. This will give the ellipse an appearance of being flattened above and below with its two ends more round and curves of larger radius than the corresponding curves of a common symmetrical ellipse. This peculiar form of the perimeter of the bore is thus produced in a simple manner, and at a single operation which heretofore could only be produced by four several operations, and that too, with less perfect results than are obtained by this one operation.

The construction of the cutter and cutter head, the carriages, slides, head stocks, and other parts except the chucks for supporting the ends of the mandrels; and the manner of connecting the mandrel and cylinder may be of the usual construction of similar tools used in other boring and turning machines, and therefore do not require any more particular description here.

One of the chucks for the ends of the mandrel, is shown in Fig. 4 detached from the mandrel. Each of these chucks consists of a straight bar (g) with its ends bent round at right angles to form a bracket to support set screws (L) by which the mandrel is adjusted. The ends of the mandrel have notches (M) formed in them to fit upon the bar (g) of the chucks, to embrace the same firmly and form guides to assist in keeping the mandrel and chucks connected while being adjusted and in maintaining the adjustment. The cavity to receive the center of the head stock, is in the middle of the bar (g) which allows the mandrel to be adjusted to either side of the center. The screws (L) serve to clamp the mandrel firmly to the chuck as well as to adjust its eccentricity.

The transverse reciprocating movement of the cylinder it is obvious might be communicated by means of an eccentric upon the mandrel instead of giving eccentricity to the mandrel itself. In this case a feather or some other means of aliowing the eccentric to slide along, but not to turn around the mandrel, would be necessary.

The degree of eccentricity to be given to the mandrel in any particular case can easily be determined from a geometrical projection of a section of the cylinder. The adjustment of the eccentricity for the tool to bore the cylinder represented in the drawings was obtained from Fig. 5, which is a projection of a transverse section of the bore of the cylinder required. The red lines in this figure represent the ascertained radii of the perimeter of the cylinder, while the black lines represent the position of the shoe, joint, and the end of the piston slide.

Having thus described my improved method of boring Rumley's cylinder what I claim therein as my invention and desire to secure by Letters Patent is—

The arrangement of the parts substantially as described so as to produce an alternating transverse motion of the cylinder in combination with a rotating movement of the cutter or vice versa, substantially as herein set forth.

In testimony whereof, I have hereunto subscribed my name.

MARVIN S. OTIS.

In presence of—
CHARLES H. POMEROY,
TIMOTHY WHALEN.