Sheet 1 - 3 Sheets.

A. Alexander,

Making Bolts,

No. 49,484. Patented Aug. 15, 1865.

Fig. 1.

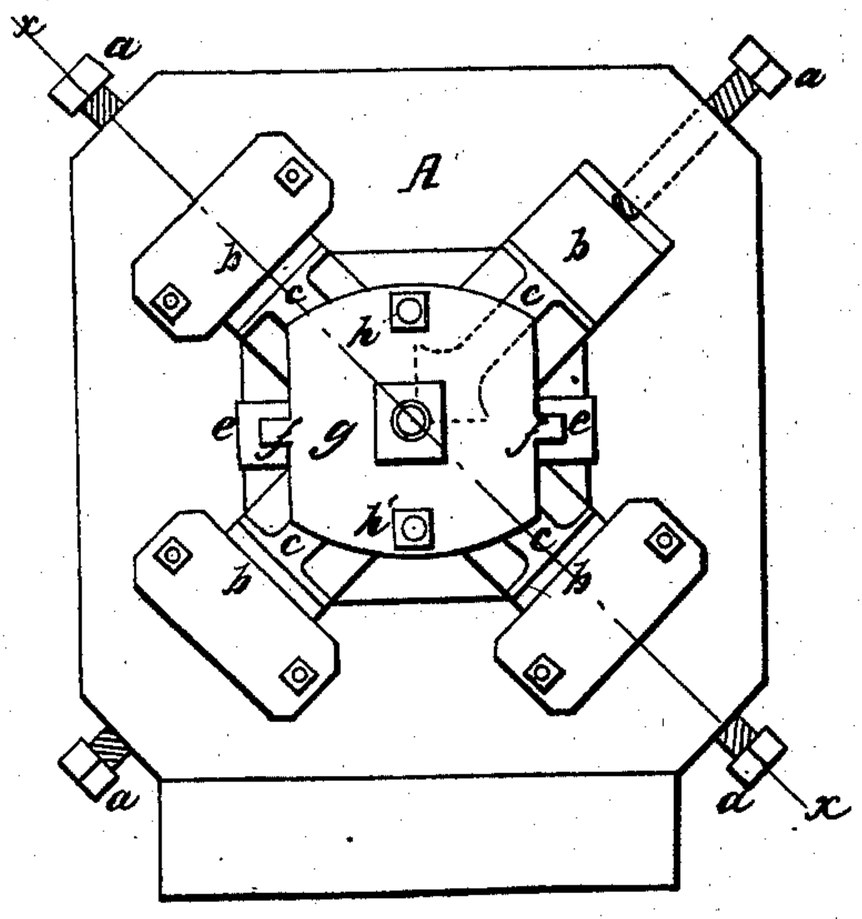


Fig. 2.

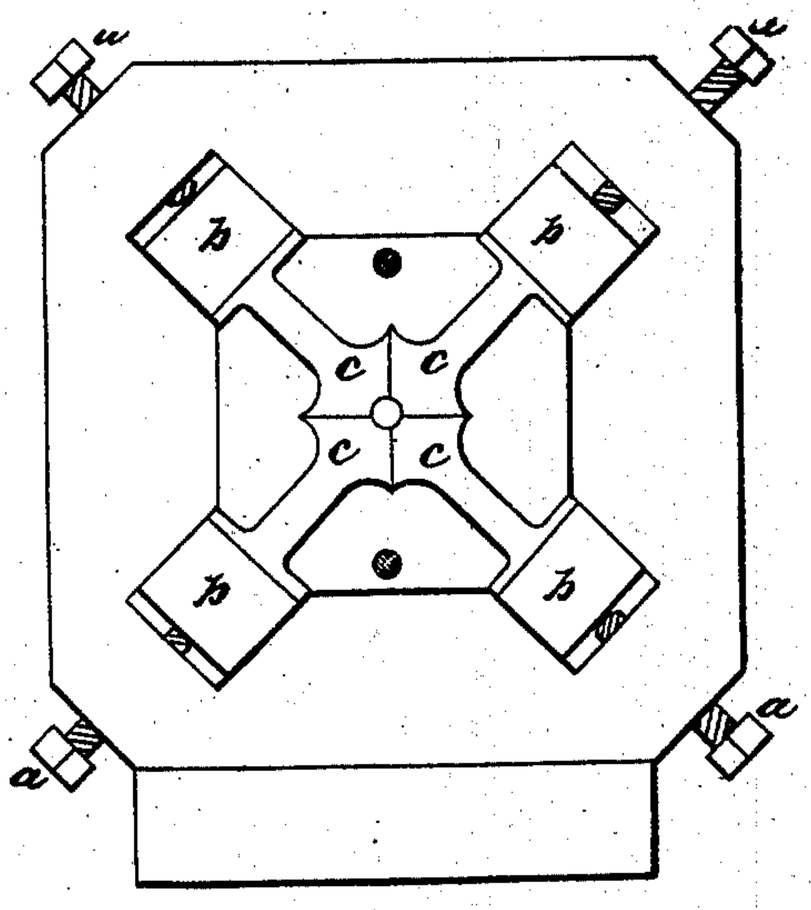


Fig. 3.

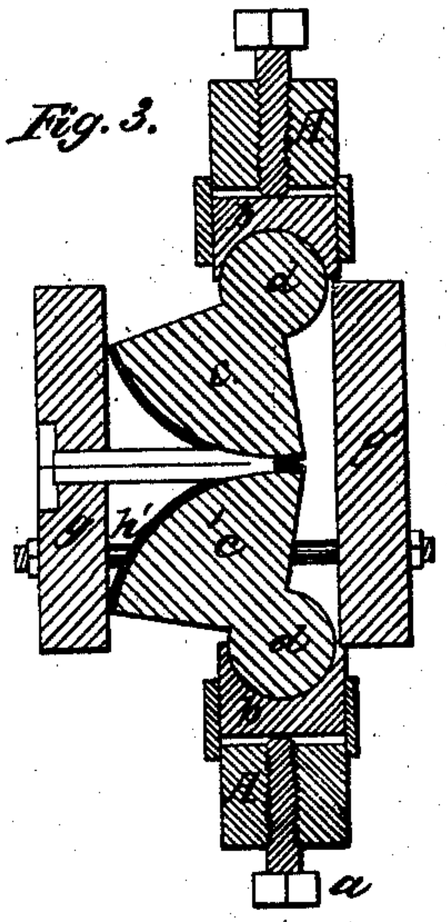
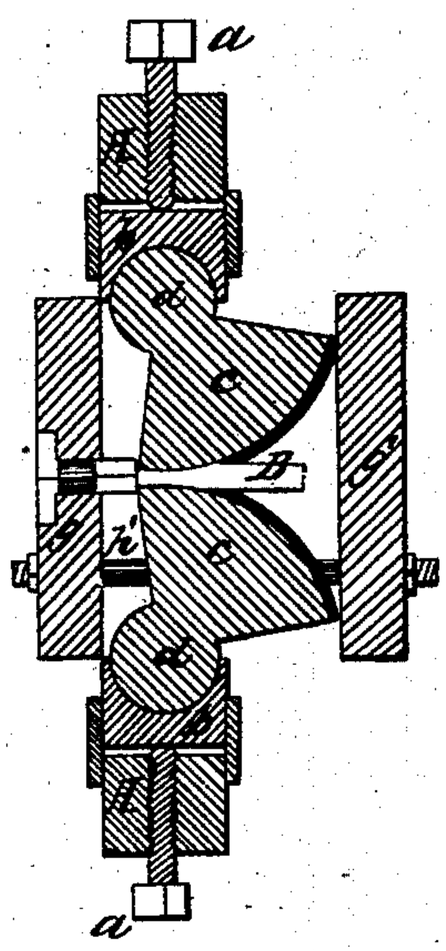


Fig. 4.



Witnesses.
W D Lewis
Allan C Bakewell

Inventor
Abram Alexander
by his atty W Bakewell

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A. Alexander,

Making Bolts,

No. 49,484 Patented Aug. 15, 1865.

Fig. 5.

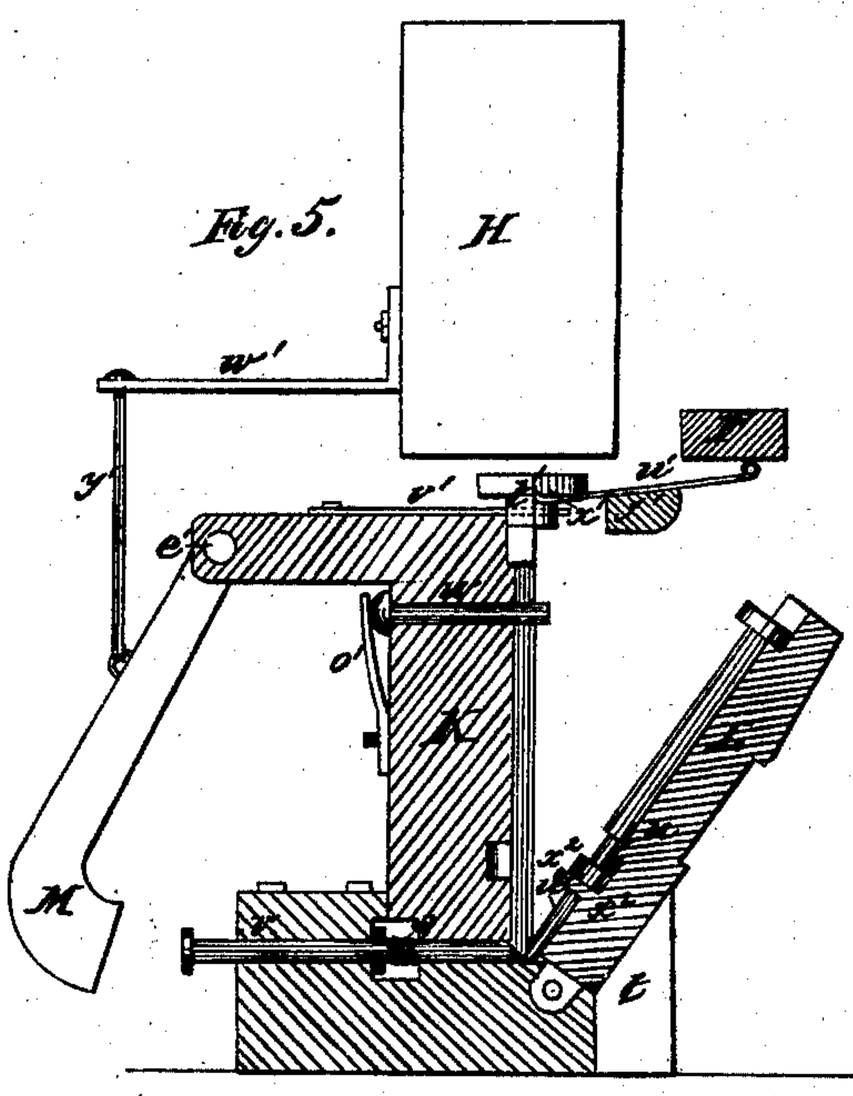

Fig. 6.

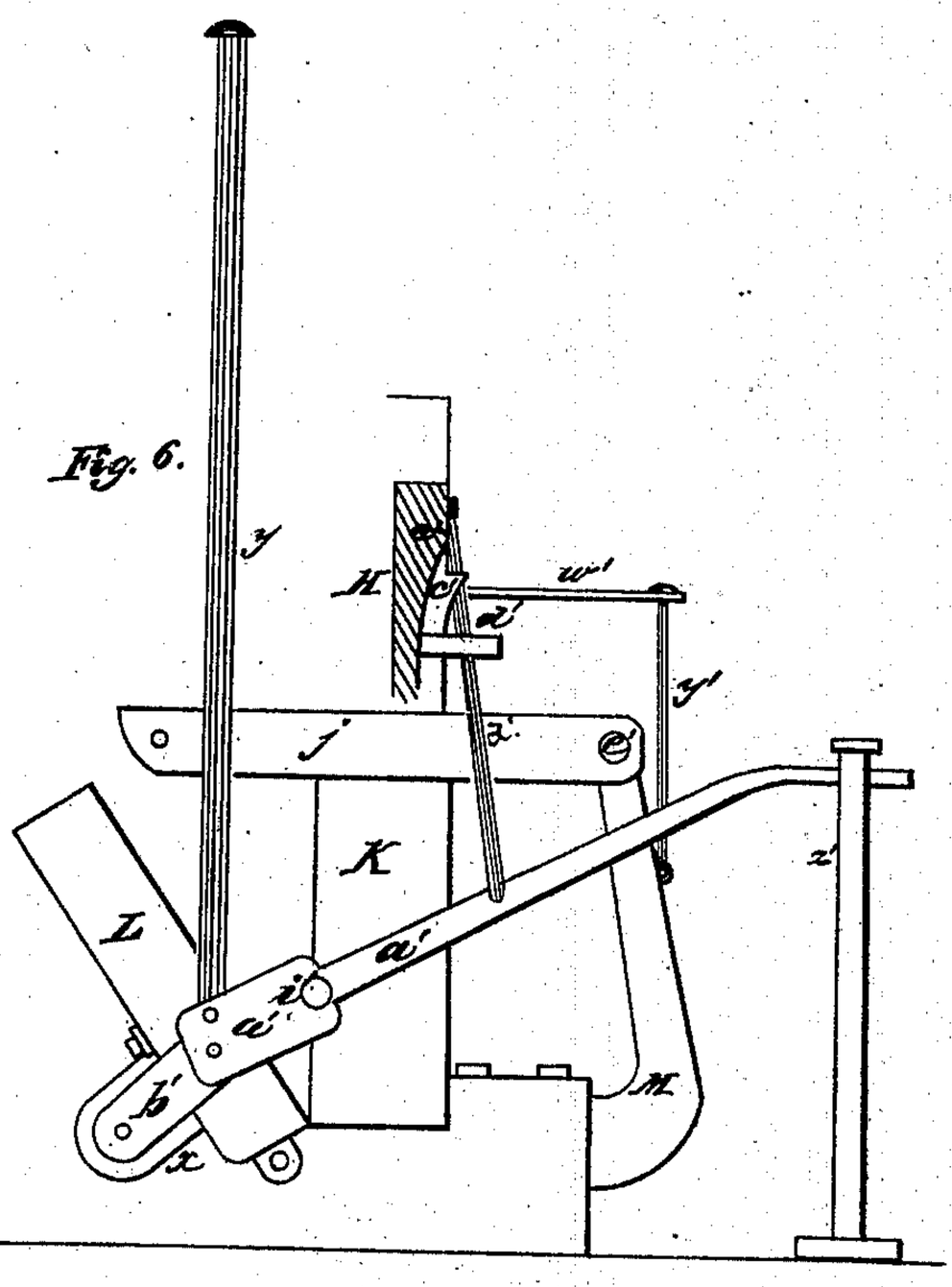

Fig. 7.

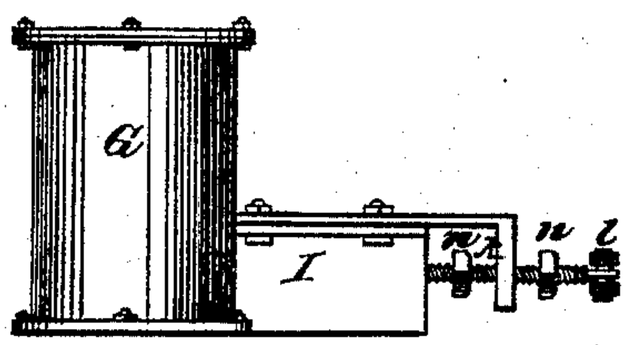

Fig. 10.

Fig. 8.

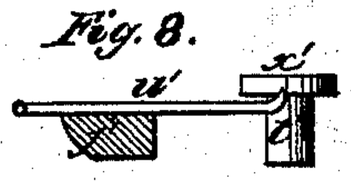

Fig. 9.

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Fig. 11.

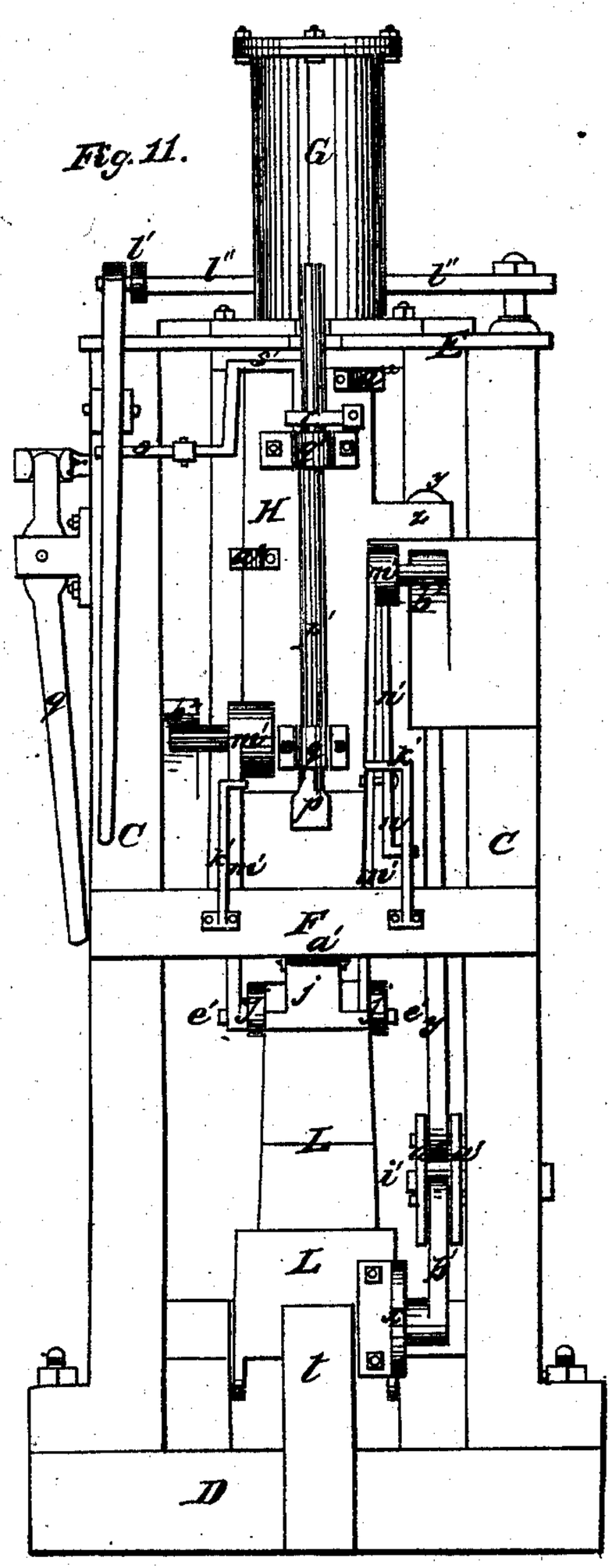
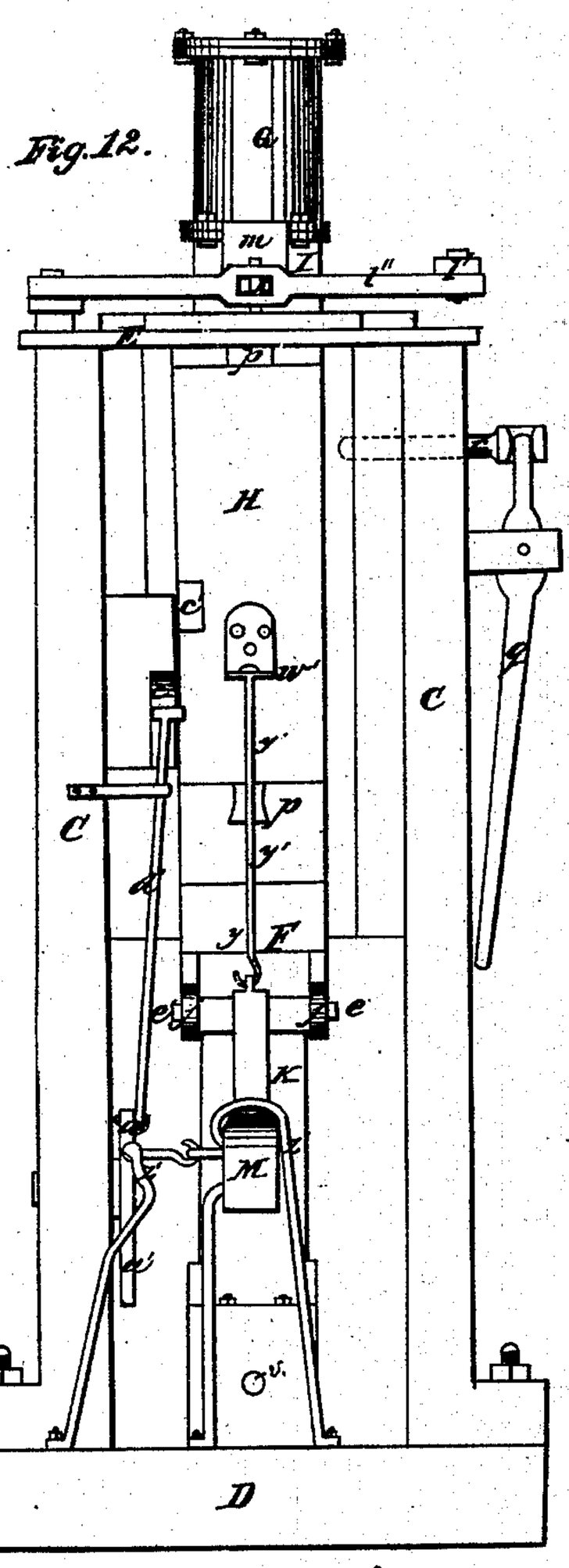


Fig. 12.



Witnesses.
W D Lewis
A. S. Nicholson

Inventor.
Abram Alexander
by his atty W. Bakewell

UNITED STATES PATENT OFFICE.

ABRAM ALEXANDER, OF PITTSBURG, PENNSYLVANIA.

IMPROVED BOLT-MACHINE.

Specification forming part of Letters Patent No. **49,484**, dated August 15, 1865.

To all whom it may concern:

Be it known that I, ABRAM ALEXANDER, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Machinery for the Manufacture of Bolts; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a front view of the swaging-machine for rounding the shanks of the bolts. Fig. 2 is a front view of the same machine, with the front plate of the sliding frame and the coverings of the bearings being removed. Fig. 3 is a diagonal section through the swaging-machine at *x x*, Fig. 1, showing the bolt-blank before it is operated upon by the swages. Fig. 4 is a similar diagonal section through *x x*, Fig. 1, after the bolt-blank is operated upon by the swages. Fig. 5 is a sectional side view of the dies and lower parts of the machine when the dies are open and just before the finished bolt is ejected. Fig. 6 is a side view of the lower parts of the machine when the dies are open and the hammer is at half-stroke after the finished bolt is ejected. Fig. 7 is a side view of the steam chest and cylinder. Fig. 8 is a side view of the heading-tool and fork and end of the clamp. Fig. 9 is a top view of the fork which upholds the heading-tool. Fig. 10 is a sectional representation of the adjustable stop for the bottom of the dies. Fig. 11 is a front elevation of the heading-machine when the dies are closed, the clamp down, and just before the drop is lowered and the hammer falls. Fig. 12 is a rear view of the machine, with the parts in the same relative position as in Fig. 11.

To enable others skilled in the art to construct and use my improved machinery for making bolts, I will proceed to describe its construction and operation.

In the manufacture of bolts having a round shank and square head a difficulty is experienced in making a solid head with well-shaped square corners when the iron rod from which the bolts are made is round iron of the diameter of the shank of the finished bolt. It is all important to have, not only a well-shaped head to the bolt, but also to have a head that shall be firm and solid. It is usual in making such bolts to gripe the iron which is to form the shank of the bolt between dies, and to form the head by the means of a header, which forces the iron by compression into a cavity in the die of the required shape for the head. The result of this process is that the bolts thus made are generally more or less unsound at the head and neck.

To remedy these defects I make my bolts out of square iron, the side of the square being equal to the diameter of the round shank of the finished bolt, and I make the head by a single quick stroke of a drop-hammer, which has the advantage of making the head more rapidly, and thus giving the iron less time to cool. As the iron rod from which the bolts are to be made is diagonally of greater diameter than the shank, (the iron being the size and shape of a circumscribed square to the round shank,) it is necessary to draw out the shank in the process of rounding it, which makes a better shank than when the iron is squeezed laterally from a square into a round shape. This drawing and rounding of the shank portion of the bolt (the part which is to form the head being left square) forms the first operation, and is performed by an auxiliary machine. (Represented in Figs. 1 to 4.)

In the drawings, A is a strong iron frame, quadrilateral in shape, excepting that the four corners are cut off to receive the four set-screws *a*. This iron frame has a square cavity, in each of the corners of which is a recess to receive the boxes or bearings *b* of one of the four swages *c*, by which the square iron rod is to be drawn and rounded. These swages are of the shape of a sector of a circle, as seen in Fig. 3, having at the center of the arc a short shaft, *d*, which has its bearing in the box *b*. The curved face of each of these swages has a groove in it of the shape of a quarter-circle, so that where the peripheries of the swages meet, as seen in Fig. 2, they form together a circular groove the diameter of which is equal to the diameter required to be given to the shank of the bolt. On two opposite sides of the frame A, at the edge of the square cavity in which the swages *c* work, are the slides *e e*, in which work the flanges *f f*, projecting from the sides of the face-plate, *g*, and back plate, *g'*, of the sliding frame, by which the swages are operated. The face and back plates, *g g'*, are connected by two bolts, *h h'*, and they are situate one in front of the frame A, and the other be-

hind it and centrally thereto. Their distance apart is a little greater than the length of the chord of the arc of the face of the swages, so that as the sliding frame moves backward and forward into the frame A there is a little lost motion—that is to say, when the front plate, *g*, is in contact with the forward extremity of the face of the swages the back plate, *g'*, is a little in the rear of the rear edges of the swages *c c*, as in Fig. 3. The operation of these swages on the square iron to form the bolt is seen from Figs. 3 and 4. The blank or piece of iron to form the bolt, being cut off the right length, is inserted through the cavity *i* in the center of the front plate, *g*, and enters the groove formed by the faces of the four swages *c*, and is pushed as far back as the swages will allow, the bolt being larger than the groove at the tangential point. The sliding frame *g g'* is then pushed backward, the front plate, *g*, causing the swages to turn on their axes, and as they turn the groove of the swages draws out and shapes the blank, that part which remains in the cavity *i* of the front plate, *g*, being out of the reach of the swages, is left square, while the residue is reduced in diameter and rounded. The sliding frame is then drawn forward, but in so doing the back plate, *g'*, is brought in contact with the rear edge of the swages, as in Fig. 4, by the slide moving forward, and the front plate is also moved forward a like distance, and as the blank B is held fast by the swages, which have not yet begun to move forward, the head of the blank is relieved from the cavity *i* of the front plate, *g*, and this lost motion of the sliding frame causes the blank B to drop down clear of the sliding frame and swages so soon as the sliding frame has pushed forward the swages to their first position. (Shown in Fig. 3.) The blanks, when they leave the swaging-machine, have a round shank of the proper diameter and length for the finished bolt, and a square portion at the upper end, from which the head is to be formed in the machine, which is shown in Figs. 5 to 12, and which I will now proceed to describe.

In the machine by which the bolts are headed, C C are two uprights, set parallel to each other on the bed-plate D, united at top by the cap-plate E, and in front by a cross-piece F. On top of the cap-plate E is set the steam-cylinder G of the hammer in a vertical position, midway between the uprights C C of the frame. The steam-chest I is connected with the cylinder G, and the valve-rod *k* of the steam-chest is operated by the levers *l l' l'*. A bracket, *m*, projects from the steam-chest, and the valve-rod *k*, which is chased, passes through without touching it. On the valve-rod are two screw-nuts, *n n*, one on each side of the bracket *m*. By these nuts *n n* being screwed toward or from the bracket *m* the stroke of the valve-rod *k* is regulated, and thereby the amount of steam let into the cylinder can be adjusted with great precision. The hammer is raised by the piston of the steam-cylinder G and falls by its own weight, one motion of the lever *l* letting on the steam to raise the hammer, and the motion in the other direction shutting off the steam and allowing the hammer to fall by its own weight. The amount of steam admitted into the cylinder should not be greater than is sufficient to raise the hammer and work the machine; any excess only serves to strain and injure the machinery.

The hammer H is a heavy block of iron set between the uprights of the frame so as to work vertically between slides *o o*, and is attached to the lower extremity of the piston-rod *p* of the steam-cylinder.

q is a lever at side of the machine, which operates a stop, *r*, which passes through one of the hammer slides *o*, and may be projected by the lever *q* far enough to stop the upward motion of the hammer at mid-stroke, which is the proper position for the hammer when the machine is ready to receive the blanks to be headed.

Under the hammer H are the dies K L, the former being fixed to the machine in an upright position, with its face in the plane of the axis of the piston-rod *p*, and the latter being hinged at its lower end, so as to open and close against the fixed die. These dies, when closed, have a cavity between them of the shape of a bolt, the square cavity for the head at top, and the round cavity below, both of these cavities being longer than is the bolt to be made in them. A rest, *t*, is placed in front of the moving die, to prevent its being opened too wide. Fig. 5 is a vertical side view, in section, of these dies, and represents them open.

In the bottom of the moving die is placed an adjustable stop, *u*, shown detached in Fig. 10, and of the shape of a small cylinder, with a shaft passed through its axis. The upper part of the shaft screws into the cylinder *u*, and the lower part of the shaft is fixed to the cylinder. The upper shaft may be removed and a longer or shorter one substituted to suit the length of bolt to be made. The stop *u* is placed in a suitable cavity near the bottom of the dies, the cavity for the cylindrical part *u* of the stop being longer than the cylinder, so as to allow it to move upward about an inch. The top of the upper shaft of *u* forms a false bottom to the cavity of the dies, against which the bolt rests, and the lower shaft of the stop *u* is held in place by a ring, x^2, attached to the moving die L, and extends to the bottom of the dies, where it rests on the wedge-shaped end of a bolt, *v*, which is inserted horizontally through the base of the fixed die K and projects slightly from the rear of that die. It may be kept pressed backward by a spring, *s*, in a cavity in the die, as shown in Fig. 5, or by other suitable device. A drop-hammer, M, hung in the rear of the machine so as to fall at the proper moment and strike the projecting end of the bolt *v* when the dies are open, as in Fig. 5, will force the beveled end of the bolt *v* forward, and by suddenly raising the

stop *u* will throw the finished bolt out over the top of the dies.

Near the top of the stationary die K, just below the cavity for the head, is a pin, *w*, the point of which enters the round cavity of the stationary die K, when pushed forward, by the spring *o'* pressing against its head. This pin *w* is to clear the bolt from the stationary die K and cause it to follow the opening-die L when the dies are opened. It is pushed back out of the way by the bolt-blank when the dies are closed. The mode of operating the drop-hammer M will be hereinafter described. The moving die L will fall open by its own weight when thrown a little back out of the perpendicular, and is closed by raising a rod, *y*, attached to a bracket, *x*, at the bottom of the die L. The mode of opening and closing the die L will be better seen by reference to Fig. 6. The dies being open, as shown in the figure, and the hammer at half-stroke, the hammer is made to rise, and in so doing it draws up the rod *y*, a button on the end of the rod being engaged by a bracket, *z*, projecting from the face of the hammer. The lower end of the rod is pivoted to the front end of the lever *a'*, which is attached to the bracket *x* of the moving die by a link, *b'*, so that as the rod *y* is raised the moving die L is closed and assumes a vertical position. After the hammer has fallen it rises immediately to mid-stroke—that is, to the stop *r*—and as it rises a bracket, *c'*, on the back of the hammer comes in contact with the end of the rod *d'*, which is attached to the lever *a'* in the rear of its center of motion, (which is at *i'*,) and thus raises the lever up to the position shown in Fig. 6 and opens the moving die.

Pivoted to the fixed die K at its upper end, at *e'*, is a clamp, which consists of two side pieces, *j*, and a cross-piece, *j'*, in front. The side pieces are attached to each side of the die *k*, and when the clamp is pressed down the cross-piece *j'* passes over the front edge of the moving die L, when it is closed, thus holding the dies firmly together at the top. When the dies are closed the clamp, having been held up by the spring *k'* attached to the cross-piece F, which lies under notches in one of the clamp-arms *m'*, is now released and allowed to fall by the small lever *n'*, which is pivoted to one of the clamp-arms, pressing out the spring *k'* from its notch. In order to secure the dies from opening under the pressure of the operation of heading the bolt, the clamp is forced down over the die just previously to the fall of the hammer H by means of a drop, *p'*, which is placed in front of the hammer and works in staples, *q'*, projecting from the side of the hammer. When the hammer is at half-stroke, as in Fig. 5, and until the hammer begins to fall, this drop is held up by a spring-pawl, *r'*, entering a groove in the drop; but as soon as the lever *l* is pushed in to exhaust the steam from the steam-cylinder G the spring-pawl *r'* is pushed out of its groove by the lever *s'*, and the drop instantly falls on the top of the cross-piece *j'* of the clamp, pressing it firmly over the dies. As this takes place before the lever *l* is sufficiently moved to allow the escape of the steam from under the piston of the cylinder G, the drop *p'* is sure to fall before the hammer H does. The heading-tool *t'*, of the shape of a short square shanked-bolt with a head, (see Fig. 8,) is placed with its shank just entering the cavity of the stationary die K and immediately under the hammer H. It is held up so as to allow the moving die L, with the bolt-blank in it, to close by means of a fork, (see Fig. 5,) which is pivoted to the cross-piece F in front of the machine at one end, the other extremity resting on the free end of a leaf-spring, *v'*, which is fastened on top of the stationary die K, excepting when the fork and header are raised up by the cross-piece *j'* of the clamp *j*, which is situated under the fork. The prongs of the fork embrace the heading-tool, and the ends of the prongs are turned up and enter a notch at *x'* on the under side of the heading-tool *t'*, which serve to keep it in a vertical position over the cavity of the closed dies K L. As soon as the hammer H rises after the operation of heading the bolt, the clamp *j* is raised, which lifts the fork sufficiently to raise the heading-tool nearly but not quite out of the cavity of the dies. The fork *w'* has a round hole through it, in the proper place, to allow the drop *p'* to pass through to strike the clamp, as before described.

Having thus described the main features of my machine for heading the bolts, I will proceed to explain its operation, and in so doing will refer to any minor details of the machinery not already described.

When the hammer is raised to the height of the stop *r*, or at half-stroke, and the moving die is open, and those parts of the machine seen in Fig. 5 are in the relative position shown in that figure, the machine is ready to receive the bolt-blank, which, having been previously shaped by the swaging-machine, as already described, is placed in the cavity of the moving die L, in the position occupied by the finished bolt in Fig. 5, the lower end of the bolt-blank touching the rest *t*, and with its square part resting in the angular cavity of the die L. The lever *q* is then operated to withdraw the stop *r*, and the lever *l* is pulled outward, which operates the valve-rod *k* to let steam under the piston of the cylinder G. The hammer then rises up to full-stroke, (to the position shown in Fig. 11,) but as it rises the bracket *z* raises the rod *y*, and thereby draws up the link *b'* and closes the moving die L. The hammer in rising to full-stroke also raises the drop-hammer M, the arm *w'*, projecting from the rear side of the hammer H, lifting the rod *y'*, which is attached to the drop-hammer M. When the drop-hammer M is raised it passes over a spring-latch, *z'*, (see Fig. 12,) which holds it up until after the heading-hammer H has fallen and the dies are opened to discharge the finished

bolt. As before stated, the rod *y*, which is raised to close the moving die, releases the detents of the arms *m'* of the clamp and allows the clamp to fall as soon as the dies are closed. When the hammer H falls the pawl *r'*, being attached to it, slides down the face of the drop *p'* and resumes its position in the notch in the drop, so that when the hammer H is raised again it carries the drop with it. When the parts are in this position (seen in Fig. 11) the lever *l* is pushed in, which first releases the drop *p'* to press down the clamp over the dies, and then reverses the valves of the steam-chest I and allows the steam to escape from under the piston of the steam-cylinder G, when the hammer H immediately drops by its own weight on top of the heading-tool *t'*, forcibly compressing the iron in the square cavity of the closed dies, so as to form the head at one stroke. The lever *l* is then reversed, so as to introduce steam into the cylinder G, when the hammer rises to the stop *r*, the stop-lever *q* naturally hanging in such position as to press the stop inward and project it into the path of the hammer H.

As the hammer is rising to half-stroke the clamp, which fastened the dies K and L together, is raised by means of two lugs, a^2, projecting from the front side of the hammer H, which engage a projection at the end of each of the clamp-arms *m' m'*. So soon as the clamp is raised to the proper height the wedge-shaped brackets b^2 b^2 push the clamp-arms *m'* outward sufficiently to release them from the lugs a^2, which pass up (when the hammer is raised for full-stroke) above the extremities of the clamp-arms *m'*, and at the same time one of the springs *k'* passes under a notch in one of the clamp-arms *m'* and retains the clamp in its position. As soon as the hammer is raised the heading tool *t'* rises in the dies, but not out of them, being lifted by the fork *u'* which is tilted up by the rising of the cross-piece *j'* of the clamp, as before described. The moving die is also opened, as the hammer rises to half-stroke, by means of a lug or bracket, *c'*, on the rear side of the hammer, which, as the hammer H rises, engages the end of the rod *d'* attached to the lever *a'*, and throws the moving die outward, when it falls open as before stated. A wedge-shaped projection, c^2, attached to the frame of the machine releases the rod *d'* from the lug *c'* as soon as the lever *a'* is raised sufficiently to open the die L. When the die L has fallen open the rear end of the lever *a'* is thereby raised up, and its extremity presses back the spring-latch *z'*, which holds up the drop-hammer M, and the hammer M falling strikes the projecting end of the bolt *v*, which, suddenly raising the stop *u*, ejects the finished bolt from the dies. The machine is now in its first position, ready to receive another bolt-blank, when the operation just described is repeated.

I have described my heading-machine as worked with a steam-hammer; but this is not necessary, as the hammer may be raised by power otherwise applied; but the method I have described is the most simple and convenient, and works with less gearing and a smaller amount of steam than if a separate steam-engine were employed to drive the machinery.

Having thus described my improved machinery for making bolts, what I claim as my invention, and desire to secure by Letters Patent, is—

1. The use of sector-dies, operated and arranged, substantially as described, for rounding the shank of the bolt previous to the heading.

2. The combination of the sector-dies or swages *c*, swage-frame A, and sliding frame *g g'*, for the purpose of rounding the shank of the bolt and leaving that part which is to form the head square, substantially as hereinbefore described.

3. The combination of the drop-hammer, griping-dies, and detached heading-tool, constructed and arranged, substantially as described, for the purpose of heading bolts while the iron is hot by a single stroke.

4. Delivering the finished bolt from the dies by means of the stroke of a hammer, acting in the manner substantially as hereinbefore described, on the end of the bolt.

5. The use of the adjustable stop *u* to support the end of the bolt-blank in the dies and regulate the depth of the round cavity of the dies to suit the required length of the shank of the bolt.

6. The combination of dies K L, the clamp *j j'*, the drop *p'*, the heading-tool *t'*, and hammer H, constructed, arranged, and operated substantially as described, for heading bolts.

In testimony whereof I, the said ABRAM ALEXANDER, have hereunto set my hand.

ABRAM ALEXANDER.

Witnesses:

ALLAN C. BAKEWELL,

A. S. NICHOLSON.