W. S. PLATT.

Making Metal Tubing.

No. 16,630.

Patented Feb. 10, 1857.

Fig. 1.

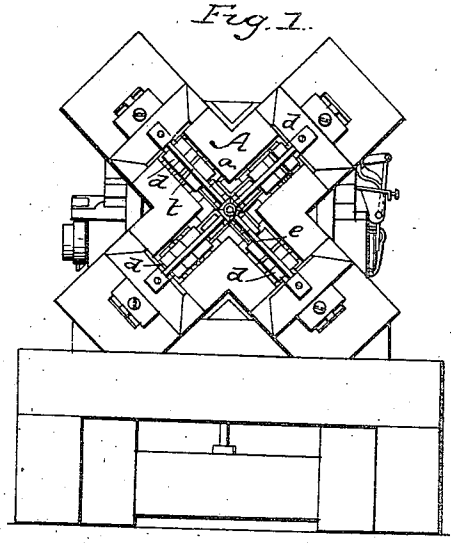


Fig. 2

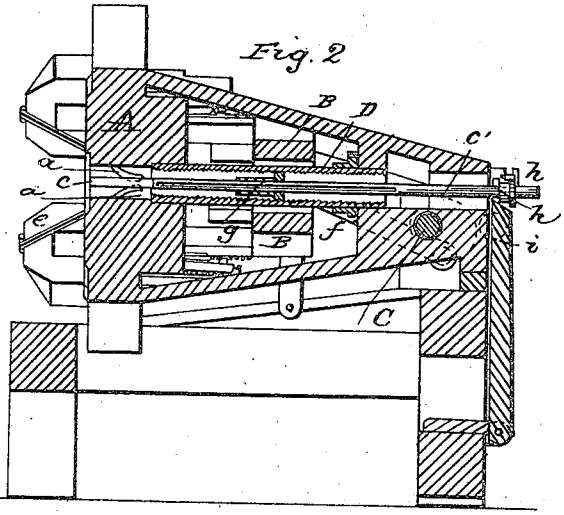


Fig. 4

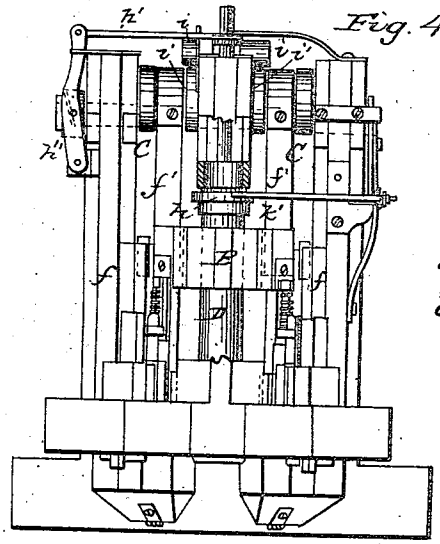


Fig. 3

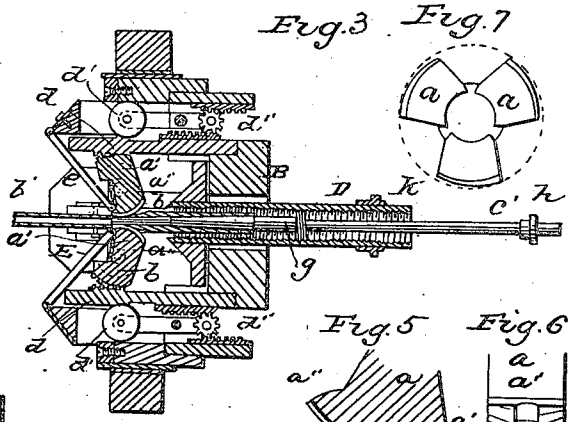


Fig. 7

Fig. 5

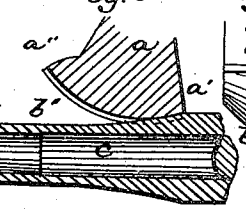


Fig. 6



Fig. 8.



UNITED STATES PATENT OFFICE.

WILLIAM S. PLATT, OF WATERBURY, CONNECTICUT, ASSIGNOR TO W. S. ALFRED AND CLARK M. PLATT.

MAKING SEAMLESS TUBES.

Specification of Letters Patent No. 16,630, dated February 10, 1857.

To all whom it may concern:

Be it known that I, WILLIAM S. PLATT, of Waterbury, county of New Haven, and State of Connecticut, have invented certain new and useful Improvements in Making Tubes or Pipes of Metal; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawings, making a part of this specification, in which all the figures are fully referred to herein, and similar letters indicate similar parts throughout.

My invention is for certain improvements in seamless tube and pipe making machinery, and the principal novelty or peculiarity thereof consists in the manner of constructing and operating the dies whereby the reduction of the ingot to the finished tube is effected, by a series of motions and in sections, as distinguished from continuous rolling or drawing through dies. My improvement has many advantages over the latter systems in that it enables me to work a variety of metals and alloys, either hot or cold, with a facility not possessed by those systems, while it is believed that a stronger and more perfect pipe is produced. In the old modes a mandrel must be employed which shall be as long as it is intended that the tube or pipe is to be; but in mine only a short one is required reaching merely such distance along the tube as the dies will finish at one vibration, being then withdrawn to feed along the next length or portion. Thus all this difficulty and loss of time in shipping the mandrel is avoided. To get a clear perception of the principle, the dies may be considered as sectors, the edges of which are beveled out with a tapering curve. Four of these may conveniently form a set, the hollows being brought together at the centers, making a hole, and because of the taper, the hole will be of differing sizes in different sections as the edges of the sectors roll together, that is to say, if laid out in a straight line the hole would be conical.

In operation the sectors at starting are in such position that the hole formed within them is at its greatest size, the end of the ingot, on its mandrel, is then thrust in a short distance, when the faces of the sectors are made to roll upon it toward its end, to the full extent of their motion, the central hole gradually contracting all the while, and of course squeezing the end of the ingot down into less size, the metal extending itself, (or rather that portion of it subjected to pressure, for the main body or part of the ingot not yet acted upon remains stationary). The sectors now rock back to their former position, when a feed takes place, and another portion is reduced, and so on. In Figures V, and VI, is represented a portion of the sector dies illustrating this action upon a piece of pipe; at (*a*) is the sector, with its edge curved, and grooved, at (*a'*) the groove is deepest, tapering gradually to the other edge; from the groove on each side the edges of the sectors are beveled off to a right angled miter, if four are to form a set. In a greater or less number the angle would have to be different. The arrangement of the sectors, is seen in their proper position in the frame, in Fig. I, at (*a*).

When the edges of the sectors have rolled over each other so that their ends (*a'*) coincide, their central aperture is at its largest size, and will then receive the end of the ingot of metal to be worked into pipe. This is to be fed in to a certain distance, and then comes to a stand. The sectors now move toward (*a''*), their central hole beginning immediately to diminish in diameter of course crushes down the metal of the ingot (*b*) (the mandrel (*c*) upon the inside supporting and forming the interior) in conformity therewith. A slight ridge or wave forms before the sectors, from the escape of the portion which is thus, as it were squeezed out, and causes it to advance forward thereby rolling out the pipe. The metal is not broken down suddenly but gradually, as shown by the sloping shape of the ingot in the figure. The sectors now return to their former position, during which time the ingot receives two motions, the first being a slight turn on or rather with the mandrel as an axis, and the other a forward motion for a feed of another portion. The mandrel remains however in position the metal being shoved along upon it, as seen at (*b'*) Fig. III, where the finished pipe is shown delivered off the end. The mechanism to effect these operations may be various.

That now to be described, and represented in the drawings, is satisfactory in its performance. The sectors in crushing down

the metal of course meet with a great resistance; these are set therefore in a powerful framework shaped like an X and as shown at A, Fig. I. The sectors are set so that they may vibrate as nearly frictionless as possible, and for that purpose, instead of vibrating upon an axis the opposite edge is curved and rolls upon a vibrating railway (*d*). This edge of the sector-die is cogged, which fits in a proper rack upon the edges of the rail in order to keep it always in position. The inner edges of the sectors are kept in place by means of the rod seen at (*e*) Figs. I, II, III, which extend out and are secured to projecting blocks in front of the frame. These rods are hinged at their ends in order that they may vibrate with the sectors. The railways (*d*) do not slide against the frame but are supported by rollers (*d'*) the whole forming a sort of carriage. Each railway (*d*) is fastened to an X shaped cross head B which plays in guides parallel with the mandrel as at (*f*) Fig. IV, and is made to vibrate by two connecting rods (*f' f'*) terminating in cranks on the main shaft C. In order that the rollers (*d'*) shall not become displaced they are connected to a pinion (*d''*) working between two racks, one of which is stationary, and the other moving with a railway (*d*) arranged as seen in Fig. III.

The operation of the sectors is that of rolling along a surface. Thus the ingot remains stationary while being acted upon as in Fig. V, where the starting point is (*a'*) upon (*b*) terminating with (*a''*) at the point (*b''*) just at the end of the mandrel, the vibrations of the cross-head B causing them to rock back and forth that distance. The mandrel (*c*) is attached to a rod which passes through a cylinder D, and which cylinder has its interior cut with a screw. Upon the mandrel rod a screw follower (*g*) plays, said rod having a feather along it which compels the follower to turn when the mandrel turns and thus a motion through the cylinder D is secured. This feeds the ingot (*b*) along. It will be seen that the mandrel is of less size than the rod, thus the ingot which must fit upon said rod will be larger than the mandrel on which it is formed into pipe. This is found to be advantageous in effecting the operation, affording an easier working of the metal. The rotary motion of the mandrel is given by a ratchet wheel (*h*) into which a pawl (*h'*) is worked by a cam and lever upon the main shaft at (*h''*) Fig. IV, in any common and convenient manner. A lengthwise motion is also given to the mandrel by a lever (*i*) the forked end of which embraces the rod (*c'*) at the end and behind the ratchet wheel. Upon the main shaft there are two cams (*i'*) Figs. II and IV, which strike the levers (*i*) at the proper time and give the motion required to the mandrel. In the machine here represented the cylinder D also revolves and in the same direction as the mandrel. The use of this is to render the feed slower; for this reason the ratchet (*h*) has but eight teeth so that it will revolve the whole mandrel and ingot in as many vibrations of the sectors, the reason for which will be subsequently explained. This speed would cause the feed to be too rapid, therefore turning the cylinder D each time a short distance in the direction of the motion of the mandrel reduces the travel of the nut (*g*) accordingly. This movement is produced by a ratchet wheel (*k*) and pawl made to vibrate from some convenient part of the machine. The same effect would be produced by cutting the screw thread on the interior of D finer or the cylinder might be dispensed with entirely and the follower (*g*) carried along by a rack motion or by long parallel screws, at its sides.

The operation is as follows. The follower (*g*) is to be run back in the feeding cylinder D until room is left between it and the sectors to take on the ingot. This latter may be slipped on at the end through the sectors, those being at such time drawn back so that the edges (*a'*) are together, in which position the central hole is large enough to pass the ingot. The main shaft is now set in revolution when the reciprocating motion of the cross head B, causes the four sectors to rock back and forth, the inner surfaces rolling over each other from (*a'*) to (*a''*). When the sectors are at (*a'*) Figs. II and V the feed of the ingot, and the withdrawal of the mandrel takes place, as also its rotation because at this time the ingot is in the largest part of the rolling hole and consequently free. As the sectors approach this position the cams (*i'*) strike the lever (*i*) which presses against the fixed head or ratchet wheel (*h*) and pulls out the mandrel by its rod (*c'*). Now inasmuch as the follower (*g*) is kept firmly in place by the screw in D, the ingot is held while the mandrel is pulled out to the extent of the throw of the cams (*i'*). A cam on the end of the main shaft, strikes the lever (*h''*) Fig. IV, and through that turns the mandrel rod by one notch of the ratchet (*h*). This effects both the feed and the turning of the ingot. The follower (*g*) being moved by the screw in D pushes the ingot toward the sectors. The object of turning the ingot is to cause that part which came along the joints of the sectors to pass around so that the ribs on the tube formed by the creases would come between or in the smooth part of the concaves of each. It must be understood that the feed is small at each vibration, so that the metal in the time of passing through receives many actions of the sectors, whereby it becomes reduced very gradually and with

great ease and as shown by the tapering shape in the diagram Fig. V. Thus at each throw of the sector dies (after the end of the ingot has worked through) a portion of finished tube is pushed off the mandrel, by the withdrawal of the latter and as shown in Fig. III. As represented in the present machine a complete revolution of the mandrel at eight blows of the cams (i') would make the follower (g) feed too fast. The onward motion is reduced by causing the cylinder to turn a short distance in the same direction and is practically nothing more than cutting the screw in D with a finer pitch. The giving of different speeds to the rotations of the cylinder D also affords the means of varying the feed, and which is required in forming the various sized pipes and in accordance too with the character of the metal used. Thus for a rapid feed the cylinder may be allowed to remain stationary; for a little slower the pawl may engage one notch of the ratchet wheel at a time, and reducing gradually by taking more teeth until finally the cylinder and mandrel may rotate with equal speed at which time the feeding would cease altogether.

I have described the sector dies as vibrating, but there are other positions in which they work advantageously, viz, by placing several on an axis and causing them to revolve. This plan is useful in making short lengths of tubes from hot metal, and I propose to make pistol and gun barrels in this way. Fig. VIII is a diagram of the sectors so arranged, there being three on an axis. When this plan is used the mandrel with its ingot must vibrate a distance sufficient for the sectors to roll from (a') to (a'') so that before the next sector approaches, the mandrel must recede, and rotate to the distance necessary for carrying the bead formed on the surface, by the joints, to the inner part of the hollow, as before described for the other plan; and the feed also must be given in time for the ingot to enter while the sectors are at (a') where the central hole is largest.

I have described the central hole formed by the sectors as being a true circle in whatever position they may be in. In operating upon some kinds of metals it will be advisable to vary the shape of the tube at different positions of the sectors; as for instance, when in the position (a') the hole should approach somewhat a square as shown in the end views Fig. VIII. The ingot which is shown in section within will not be pressed at the commencement upon all its circumference and this renders it easier to break down the metal in the first instance. As the sectors roll on, the hole gradually becomes more nearly round, terminating finally in a circle. The hollows in the sectors may also be so worked out as to have a differently shaped hole at one position than in another, that is to say, a hole of which the sectional figure will vary as the edges roll from one end to the other. The hole may also be made to contract more rapidly in one place than in another all which variations will be dictated by experience and in accordance with the different kinds of metal to be worked.

This machine is also applicable to the purpose of rolling metal into solid rods either round or polygonal as may be preferred, and to some kinds of forging.

I claim—

In forming the groove upon each sector that the breadth and depth thereof shall gradually diminish from one end to the other whereby the size of the central hole formed by a set of the said sectors when arranged for operating shall increase or diminish as the sectors vibrate or rotate, in the manner and for the purpose set forth herein.

WILLIAM S. PLATT.

Witnesses:
I. P. PINSSON,
S. H. MAYNARD.