3 Sheets—Sheet 1.

S. G. CORNELL.

APPARATUS FOR THE MANUFACTURE OF LEAD PIPES.

No. 5,253. Patented Aug. 21, 1847.

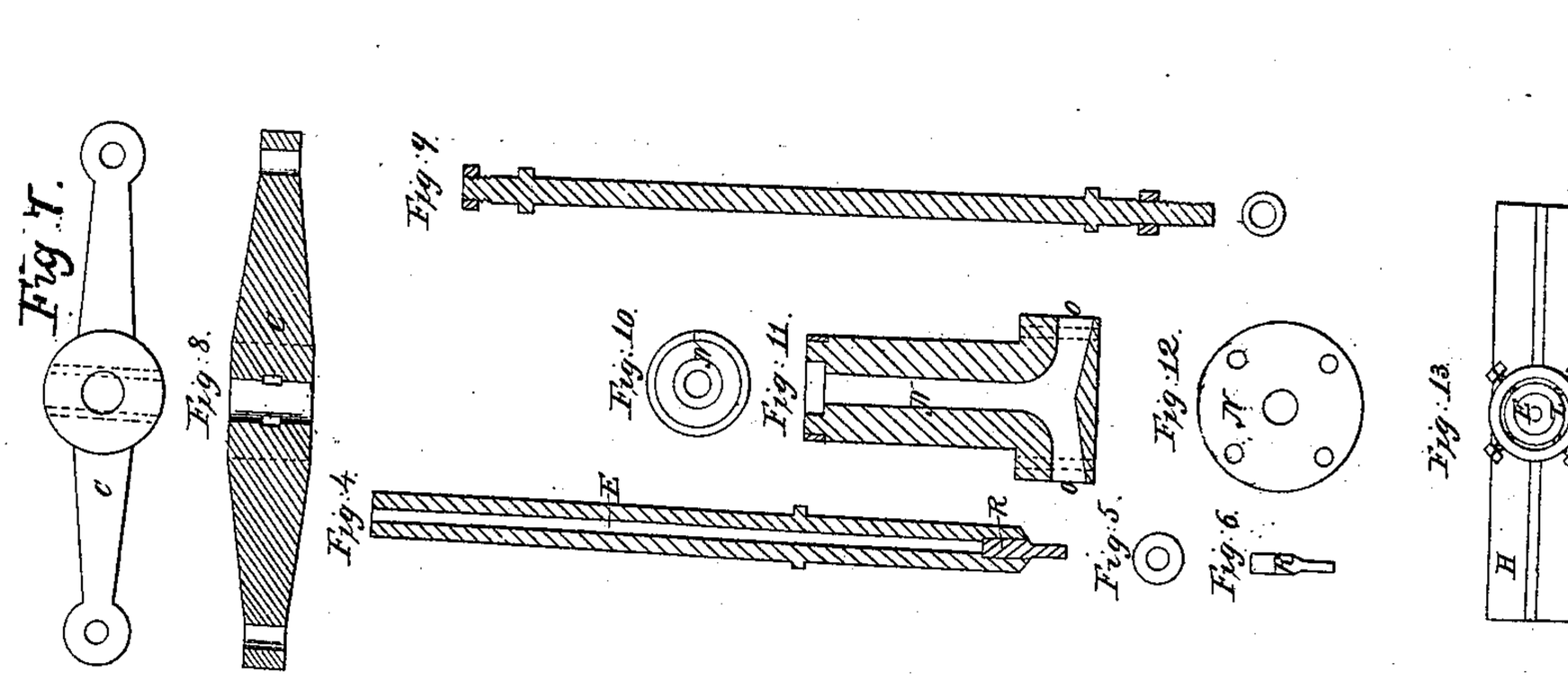

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Fig. 12.

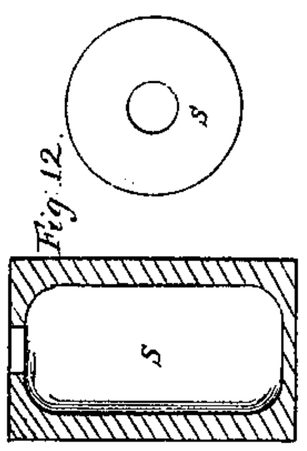


Fig. 10.

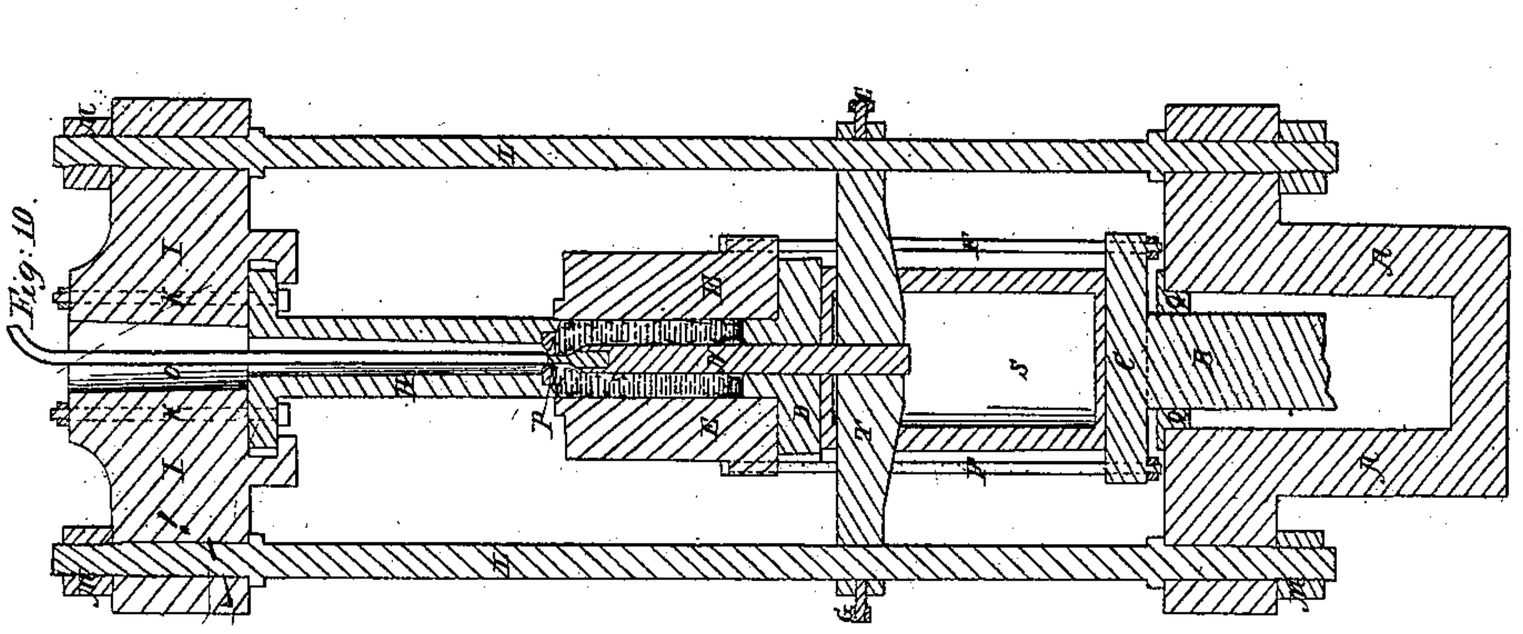


Fig. 11.

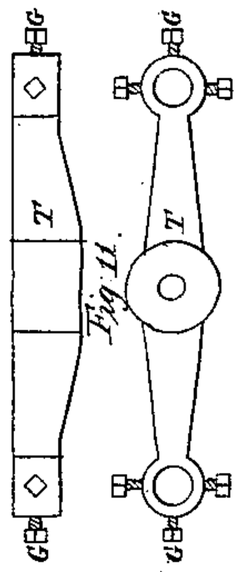


Fig. 9.

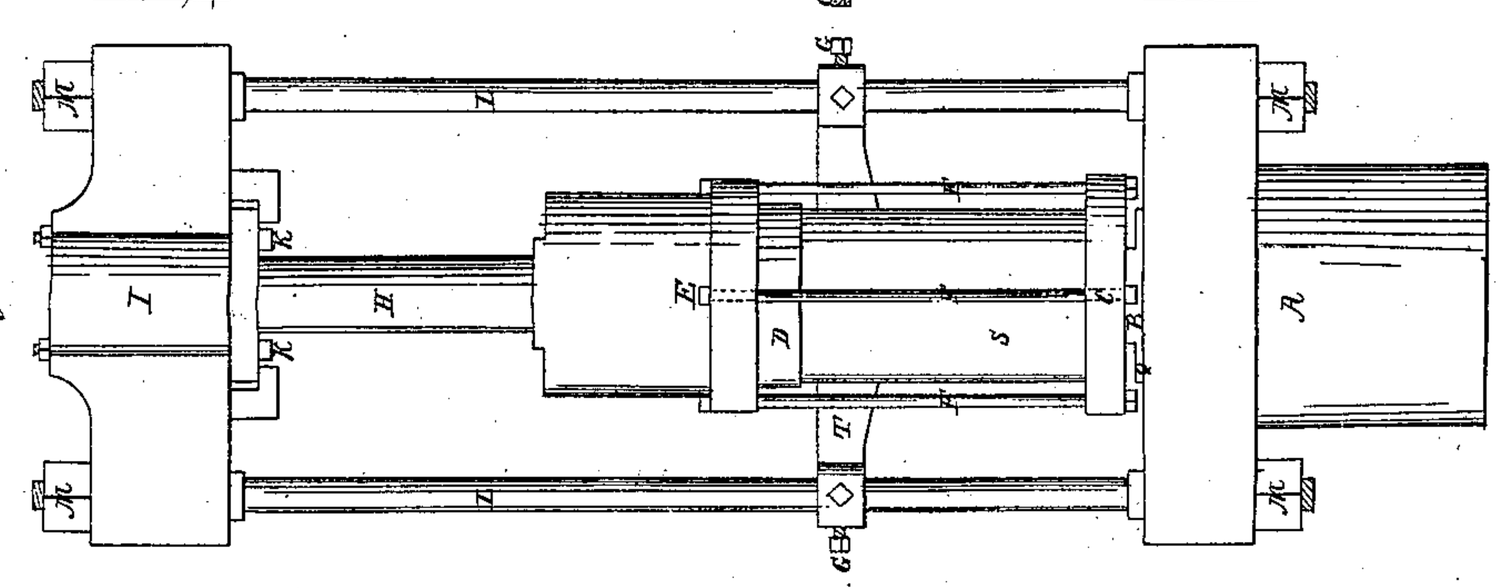


Fig. 7.

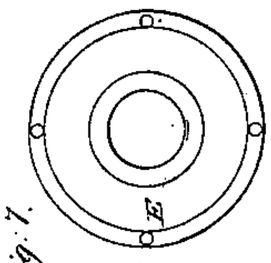


Fig. 8.

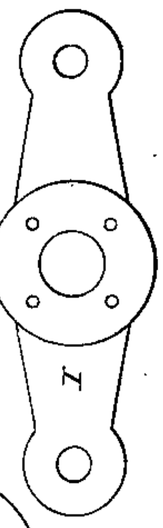


Fig. 2.

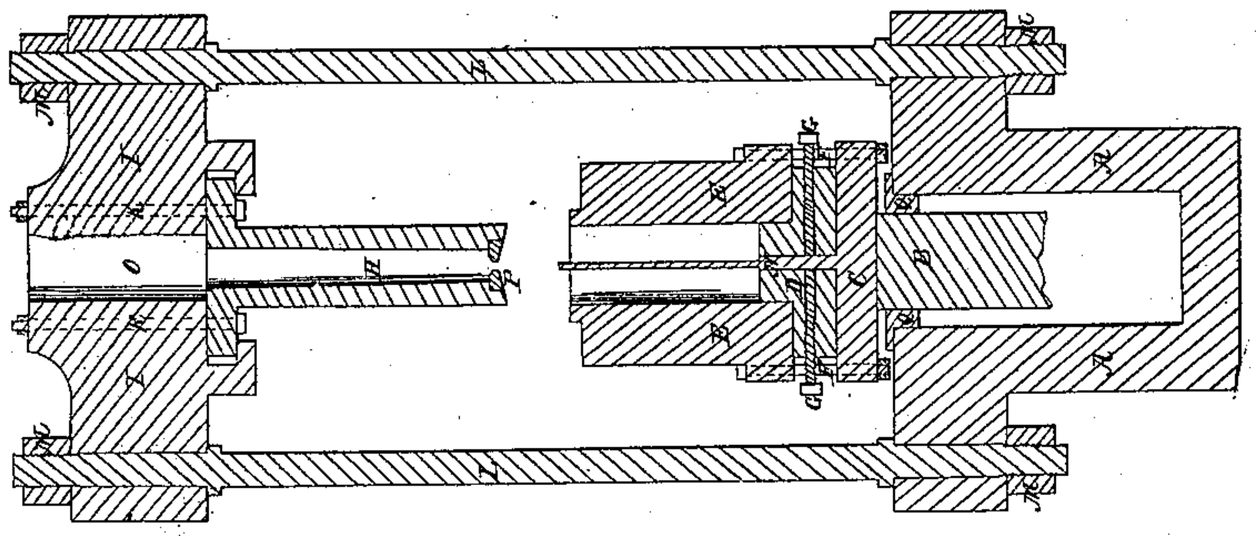


Fig. 6.

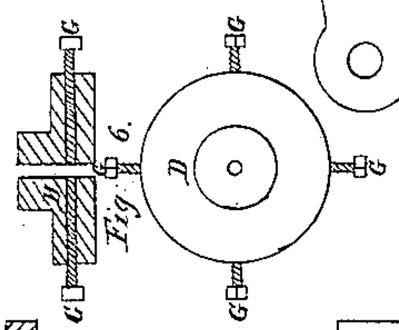


Fig. 5.

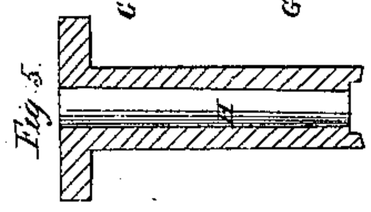


Fig. 4.

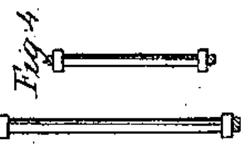


Fig. 3.

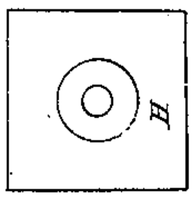
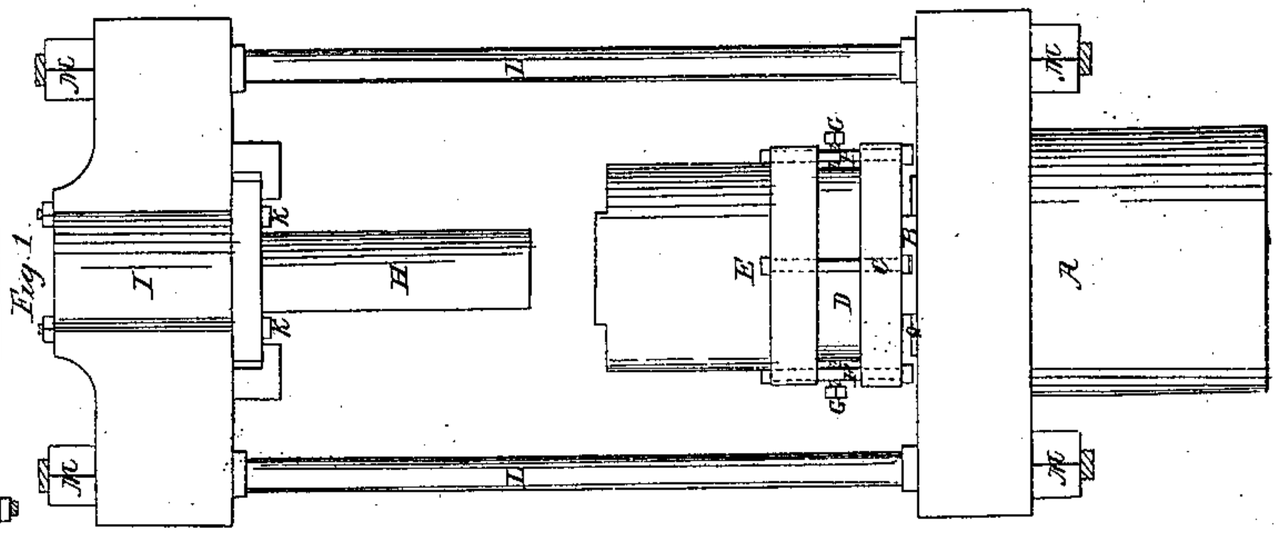


Fig. 1.



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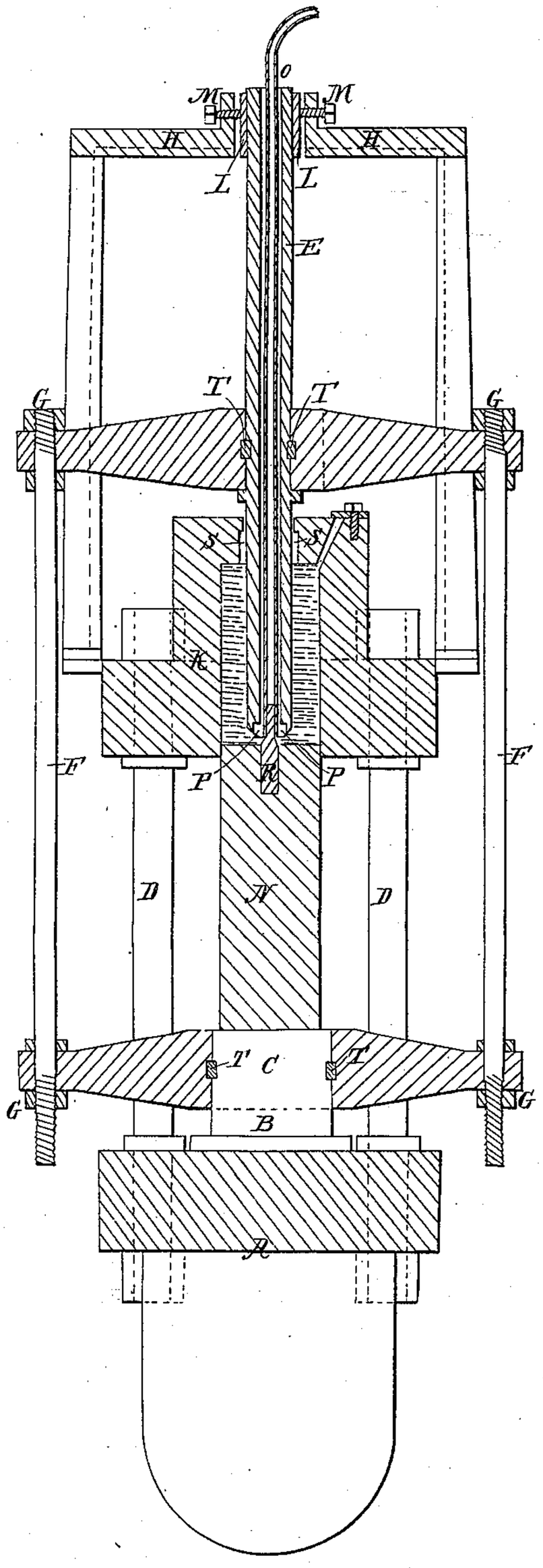

UNITED STATES PATENT OFFICE.

SAMUEL G. CORNELL, OF GREENWICH, CONNECTICUT.

LEAD-PIPE MACHINERY.

Specification of Letters Patent No. 5,253, dated August 21, 1847.

To all whom it may concern:

Be it known that I, SAMUEL G. CORNELL, of the town of Greenwich, county of Fairfield, and State of Connecticut, have invented new and useful Improvements on Machinery and Apparatus for the Manufacture of Pipes and Tubes of Lead, Tin, and other Metals and Their Alloys; and I hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making part of this specification.

My invention consists of certain improvements in the arrangement and combination of the machinery or apparatus heretofore used for similar purposes and in the construction and application of certain additional machinery or apparatus, and the combination thereof with the other apparatus as herein described.

My machine is applicable to the manufacture of pipes and tubes of lead and such other metals and their alloys as are capable of being squeezed or forced by means of great pressure from a cylinder or receiver through or between apertures, dies cores or mandrels when in a solid or semi-fluid state and is mainly referable in its general construction and purposes to the machine patented by Thomas Burr in Great Britain and described in the first volume of the first series of the *London Journal of Arts and Sciences*.

This machine and the published description thereof are well known in this country and any description of the same in this specification is wholly unnecessary.

In my machine I use the hydraulic press, the lead cylinder or receiver, the columns or pillars connecting the hydraulic press with the lead cylinder, the movable ram for pressing the piston upon the lead in the cylinder or receiver, the dies and cores to give the pipes the required form and caliber and dimensions and such other parts of the old machine as may be necessary substantially similar to the machine of the said Thomas Burr now in common use.

In Figure 1 of Plate 1, of the annexed drawing which is a vertical section of one modification of my machine A, is the hydraulic cylinder B, the movable ram rising therefrom, K, is the lead cylinder or receiver, D, D, are the columns or pillars connecting the hydraulic press with the lead cylinder.

In the machine heretofore used, the die is placed in the lead cylinder, at the top thereof when the power is applied at the bottom, and at the bottom thereof when the power is applied at the top, and the core which forms the inner surface of the pipe and determines its caliber is either attached to the piston advancing before it through the lead, according to the method of Thomas Burr, or attached to a long stationary core holder passing through the platform of the press, through the piston or ram, and through the center of the lead cylinder to its discharging end, and the core being attached to the upper end thereof and passing through the center of the die adjusted and secured so as to remain stationary in its proper position, and the pipe is formed by pressing the whole mass of the lead upward by means of the piston, forcing it through the aperture between the die and the core. This long core holder is secured to the platform of the press and lead receiver so as to remain stationary the one to the other and the piston slides over it. This is the method of George N. and Benjamin Tatham as described in their patent granted October 11th, 1841. In these methods the core and the core holder or other apparatus used for like purposes are liable to be broken, or twisted or bent, or otherwise displaced by the upward or the lateral pressure caused by the piston pressing against the metal which may be of unequal density, or from any other cause, so that the pipes will imperfect and often useless, and the machinery often injured or broken. To obviate these difficulties a bridge, cross bar or guide piece, has been placed in the upper part of the lead cylinder, near the die, closely fitting the core holder which passes through it and firmly secured to the interior of the cylinder by means of arms extending from the bridge to the inner surface of the cylinder, and there secured. This apparatus is to support the short or stationary core, or to guide the long core and prevent its being displaced, or the core from being broken or bent. But it will be seen that, in this method, the mass of the lead in the cylinder on being pressed upward

through the same, is divided by the arms into as many parts as there are arms, and after passing the arms, is united and pressed together, so as to adhere, in its passage through the die. It is obvious, however, that the adhesion of these divisions will be more or less imperfect, and that the pipe formed in this way will be liable to burst under any considerable pressure. In all these methods the great pressure required to lift the whole mass of the lead contained in the cylinder and force it through the die, will besides displacing or breaking the cores or the mandrels, often burst the lead cylinder and destroy the machine. The object, attained by my improvement, is the forming of pipe, in all cases at the point of contact of the piston and the lead, where the pressure is applied without moving forward the whole mass of lead in the cylinder. This is the leading feature of my invention, and the various apparatus and the different arrangements and combinations thereof hereinafter described, are all subsidiary to the accomplishment of this object, being the different methods by which it is accomplished.

In my machine, instead of fixing the die in the upper or lower end of the lead cylinder, and there forming the pipe, in the manner above mentioned, I usually place and secure the die in the end of the piston which is to enter the lead cylinder and press against the lead as shown at P, P, Fig. 1, Plate 1. Around the die proper packing is placed to make it fit the lower orifice of the lead cylinder into which it is to pass. The piston is hollow with an opening or openings O, O, near the bottom to permit the passage of the formed pipe downward through it, and thence out at one of the openings.

In a right line with the center of the piston, I place a long movable core holder extending from the top of the piston upward as shown at E, Fig. 1, through the middle of the lead cylinder and beyond it to the top of the frame H. This core holder is of sufficient size and strength to sustain any pressure required without being broken or bent, or otherwise displaced: and is connected with the ram by means of the cross heads C, C, Fig. 1, one of which is secured to the piston, and the other to the movable core holder by the keys T, T, T, T. And the cross heads are connected together, and kept in their proper relative position by the connecting rods F, F, which are secured to the cross heads by the nuts G, G, G, G. The die holder or piston and the core holder being thus relatively stationary the one to the other.

The upper cross head moves in and is guided by a strong cast iron frame H, secured to the lead cylinder by bolts or otherwise. The frame extends above the lead cylinder to which it is secured as shown in Fig. 1. In the top of the frame is placed an iron collar or bush L, L, through which the movable core holder passes and is adjusted and kept in its place by means of the set screws M, M, M, M. The upper cross head, in the working of the machine, slides up and down in the frame, by means of which arrangement the movable core holder is always kept in its proper position, that is, in right line with the center of the piston. To the lower end of the movable core holder I attach and properly secure the short core which is to form the interior surface of the pipe, and determine its caliber, as shown at R, Fig. 1, which is not required to be more than an inch or an inch and a half long in the working machine.

The nuts G, G, at the lower ends of the connecting rods F, F may be turned off to permit the cross heads to be moved farther apart, thus separating the piston from the core holder to allow the die and core to be replaced or changed, at pleasure. This being done the core at the end of the core holder may be inserted in the center of the die P, P, and properly adjusted. The nuts are then screwed on bringing the operating parts of the machine into their proper relative position, and there firmly securing them.

The machine is thus made ready for operation. The piston, by means of the hydraulic ram, being moved up to the lower orifice of the lead cylinder as shown in Fig. 3, the machine is charged with the metal in the ordinary way, and when the metal is sufficiently set and cooled, the power is applied to the ram in the usual manner, causing it to press the piston upward against the metal, which immediately flows downward from the point where the pressure is applied, through the die and over the core, thus forming the pipe. The pipe, as it is formed, passes downward through the hollow piston and out at the aperture O, and is reeled in the ordinary way. When the metal in the cylinder is thus pressed out, the ram descends to the proper point, the cylinder is recharged, and the process repeated in the usual manner.

In my method much less power is required than in the methods heretofore employed, as the pipe is formed at the head of the piston by the pressure upon the lower portion of the metal instead of being formed at the top of the cylinder by forcing the whole mass of the lead upward through the die there placed. By reason of this greatly diminished pressure, and the peculiar construction and arrangement of the parts in my machine, neither the core nor core holder is liable to be broken or bent, or otherwise injured or displaced; nor is the cylinder liable to burst by the lateral pressure. There being no division of the metal, in the cylinder, into parts by the bridge or guide,

before mentioned, as used in Hanson's plan, the pipe is much stronger, and every way more perfect.

Another great advantage of my method is the facility with which the dies and cores may be changed; it being only necessary for that purpose to drop the piston a little below the lead cylinder, and loosen the nuts at the lower ends of the connecting rods, thereby separating the die and the core, which are then readily renewed, and different ones substituted, and the nuts again screwed up, and the parts adjusted as before.

By placing the die in the movable core holder or mandrel, as it may in this case be called, and fixing the short core to the piston, and adjusting the parts as before, the pipe will be formed in the movable mandrel, which may be made hollow for that purpose, instead of being formed in the piston, and will in that case pass upward through the hollow mandred and out at the top. This modification of the machine is represented by the sectional drawing Plate 3. But the machinery employed, and the principles upon which I form the pipe will be substantially the same in both methods, and the advantages over the old method equally important.

Fig. 2, is a front view of the machine, with all the parts attached, as shown in the sectional drawing Fig. 1. Figs. 4, 5, and 6 are sectional views of the movable core holder E, hollow or solid, and the short core R. Figs. 7 and 8, are sectional drawings of the cross heads C, C. Fig. 9, is a sectional drawing of the connecting rod F. Figs. 10, 11, 12, are sectional drawings and views of the hollow piston N. Fig. 13, is a plan of the upper part of the cast iron frame H, and the rush or collar L, with the adjusting screws M, M, M, M.

Plate 2, represents modifications of the same invention, showing how, by different arrangements of the machinery, the power may be applied to the lead cylinder, which in this case is movable, while the piston is stationary. The long movable bore described by the said Thomas Burr, as the long stationary core holder with the short core, as hereinbefore described, may be used. By these arrangements, a portion of the machinery above described may be dispensed with.

In Plate 2, Fig. 1, is a front view of the hydraulic press and pipe machinery in which the long movable core is used, and Fig. 2, is a sectional view of the same machine. In these figures A, is the hydraulic cylinder, and B the ram rising therefrom. A cross head is attached to the hydraulic cylinder in the usual manner, and is connected with the upper cross head I by means of the rods L, L, which are secured at the top and bottom by the nuts M, M, M, M, turned on the screws at the ends of the rods. On the top of the ram, a head block C, is placed and there secured. A foot block D, is attached to the bottom of the lead cylinder E, and the head block, the foot block and the lead cylinder are secured firmly together by the bolts F, F. By this arrangement the lead cylinder will be moved upward and downward by the ram of the hydraulic press. To the upper cross head I, the hollow piston H is attached and secured by means of the bolts K, K, having screws and nuts at the ends. The die P, Fig. 2, is placed in the lower end of the piston, which is hollowed throughout and communicates with the aperture O, made through the upper cross head. The long movable core N, which is used in this case is firmly secured to the head block of the ram, extending upward through the center of the lead cylinder and a short distance above it, to be inserted through the die in the end of the piston. The position of the core is regulated by means of the set screws G, G, four in number, which move the core laterally and set it centrally in the die. The machine, in Figs. 1 and 2, is represented with the cylinder and piston a short distance from each other, in the position for changing the dies. When all the parts are thus arranged, the lead cylinder is raised up to the tower end of the piston, the end of the core passing through the die, and being there adjusted centrally by the set screws, the lead cylinder is charged, and the power of the press applied. The ram is forced upward, carrying the lead cylinder before it, which passes over the piston. The pipe is formed at the point of pressure, as before, passing through the hollow piston, through the aperture O, and out at the top of the machine. The core, in this arrangement, moves upward with the lead cylinder through the die and the hollow piston in the same manner as described by the said Thomas Burr. A strong metallic ring Q is placed and firmly secured on the lower cross head, encircling the ram B, to act as a guide for the ram, keeping it steady and giving it the precise direction. Figs. 3, 4, 5, 6, 7, and 8 are detailed views of the apparatus used in this arrangement. Fig. 3, being the screw bolt K, which secures the piston to the upper cross head. Fig. 4 the screw bolt F, which secures the head block, the foot block and the lead cylinder together. Fig. 5, H, H, sectional and end views of the hollow piston. Fig. 6 D, D, sectional and end views of the foot block with the set screws G &c. which regulate the position of the core. Fig. 7, E, E, sectional and end views of the lead cylinder. Fig. 8, a view of the cross head I, with the aperture through it for the passage of the pipe. In this arrangement it will be seen that the cross heads and connecting rods, for holding the piston and core in their

proper relative position to each other, are dispensed with.

Figs. 9 and 10 in Plate 2, represent another modification of the same improvement, in which the long stationary core holder and short core are used, the piston being stationary, and the lead cylinder movable, as in the modification last above described. These figures represent the machine at the commencement of its operation when the pipe is beginning to be formed. Fig. 9 is a front view, and Fig. 10 is a vertical section of the machine in this modification. A, is the hydraulic cylinder, B, the ram rising therefrom. C, the head block of the ram, D, the foot block of the lead cylinder, E, the lead cylinder, H the hollow piston, I the upper cross head, L, L, the columns or rods connecting the upper and lower cross heads of the press, M, M, &c. the nuts at the ends of the rods, K, K, the bolts attaching the piston to the upper cross head, and Q the metallic ring or guide for the ram, all similar to those represented on Figs. 1 and 2, in Plate 2.

N, is the core holder with the short core fixed in the upper end of it, and the lower passing through and secured to a cross head between the head block and the foot block, as shown at T in the figures. This cross head extends across from one to the other of the rods L, L, to which it is securely fastened at the ends by the screws G, G, so as to remain stationary and support the core holder, and keep it in its proper position. The core holder extends upward from the cross head T which supports it, through the center of the lead cylinder and foot block (which slides over it, when the machine is in operation) nearly to the lower end of the piston, and the core is fixed in its upper end, and inserted through the die P in the lower end of the piston, where it is adjusted centrally by the set screws. The piston, core and core holder are thus kept in their relative position the one to the other, and are always stationary when the machine is in operation.

Between the head block of the ram and the foot block of the lead cylinder, is a column shown at S, Figs. 9 and 10, of a diameter nearly equal to that of the lead cylinder and considerably longer than the cylinder, the lower end resting on the head block of the ram, and the upper end supporting the foot block of the cylinder, and the cylinder placed thereon. The screw bolts F, F extend through the head block of the ram, outside the column S, and through the flange of the lead cylinder, and the nuts being screwed down, secure the head block, the column, the foot block and the lead cylinder firmly together, so that they all ascend or descend with the ram of the press.

Through the middle of the column S, a long slot is made, extending nearly the whole length of the column, and wide enough to permit the cross head T, to pass through it without touching on either side. The use of this arrangement of the column or long block S, with the long slot through it, is to form a connection between the head block and the cylinder, so that the whole may freely ascend and descend together without moving the cross head T, which passes through this slot in the column, and supports the core holder. Instead of this long hollow column three or four solid columns may be used. But the column as described is preferable for strength and uniformity of bearing.

The set screws G, G, for regulating the position of the core holder and core may be placed in each end of the cross head T, and pressing against the rods L, L, and one on each side of the cross head passing through slots in the column S, as shown in Figs. 9, and 10, or they may be placed in the foot block of the lead cylinder, extending from the circumference toward the center, as represented in Figs. 1 and 2, or in both these places as may be found necessary. The parts having been brought into their proper position for operating, and the cylinder charged, the power is applied to the ram, causing it to ascend, and carrying before it the column S, and the lead cylinder. The column passes over and along the cross head T, extending through its slot, and the lead cylinder over the core holder, and over the hollow piston which enters the mouth of the cylinder. In this arrangement also, the pipe is formed at the point of pressure, as before, and passes through the hollow piston and out through the aperture O, as represented in Fig. 10. The cylinder, piston and core are separated for the purpose of changing the dies and cores in the same manner as before described.

Figs. 11, 12, 13, 14, and 15 are detailed views of parts of the machine represented in Fig. 10. Fig. 11 being sectional and side views of the cross head T, with the set screws G, G. Fig. 12, S, S, sectional and end views of the column S, placed between the head block of the ram, and the foot block of the lead cylinder. Fig. 13, sectional and end views of the guide Q for the hydraulic ram. Fig. 14 a sectional view of the core holder and core. Fig. 15 P, P, sectional and end views of the die.

What I claim as my invention, and desire to secure by Letters Patent, is—

Placing the die for forming the exterior surface of the pipe in the piston, or the hollow mandrel, as the case may be, substantially as described, instead of placing it in the head of the lead cylinder, as has been heretofore done; so that, as the piston is

forced into the cylinder, or the cylinder forced over the piston, the pipe will be formed at the point of pressure without moving the mass of lead relatively to the cylinder; and in combination therewith, I claim the cores for forming the interior surface of the pipe; the die and core being adjusted and held in their proper relative positions by any of the known methods.

SAMUEL G. CORNELL.

Witnesses:
FRANCIS H. UPTON,
LOUIS F. WADSWORTH.