L. A. B. Walbach.

Sheet 1. 3 Sheets.

Metal Borer.

No. 9961.

Patented Aug. 23, 1853.

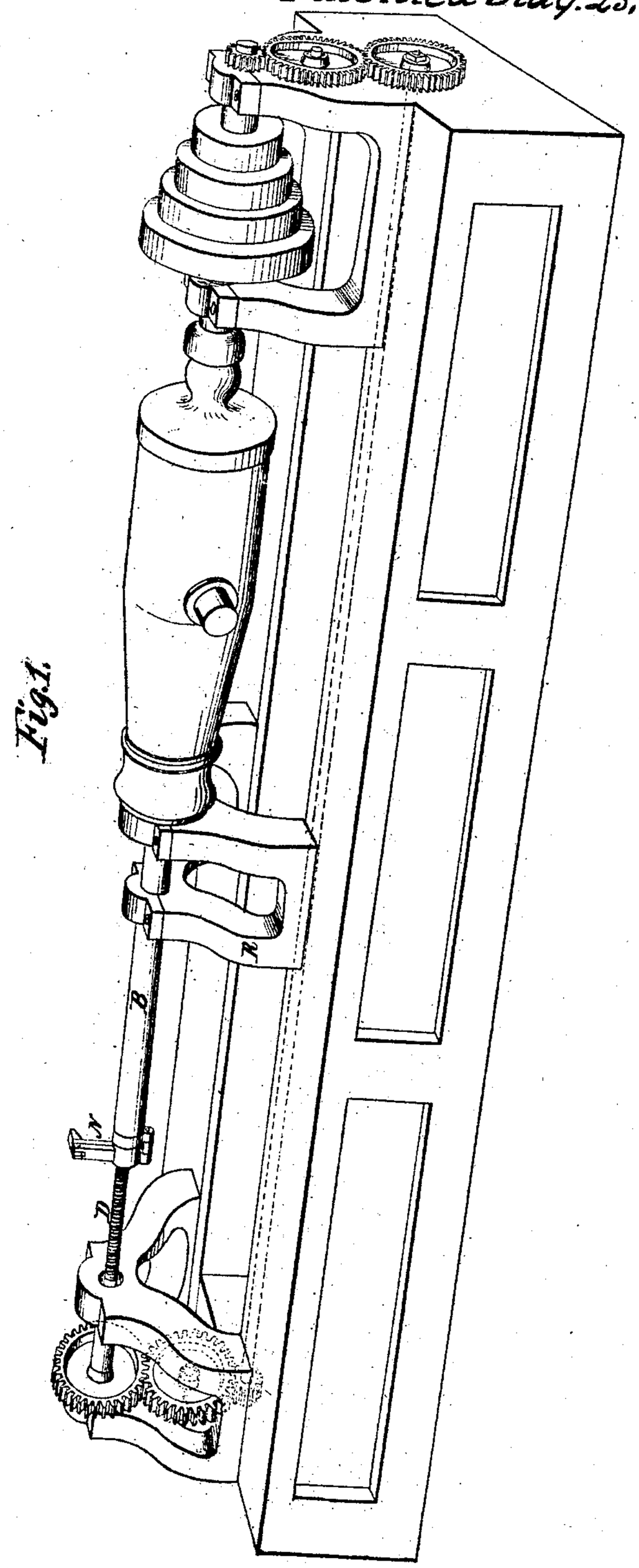

Fig. 1.

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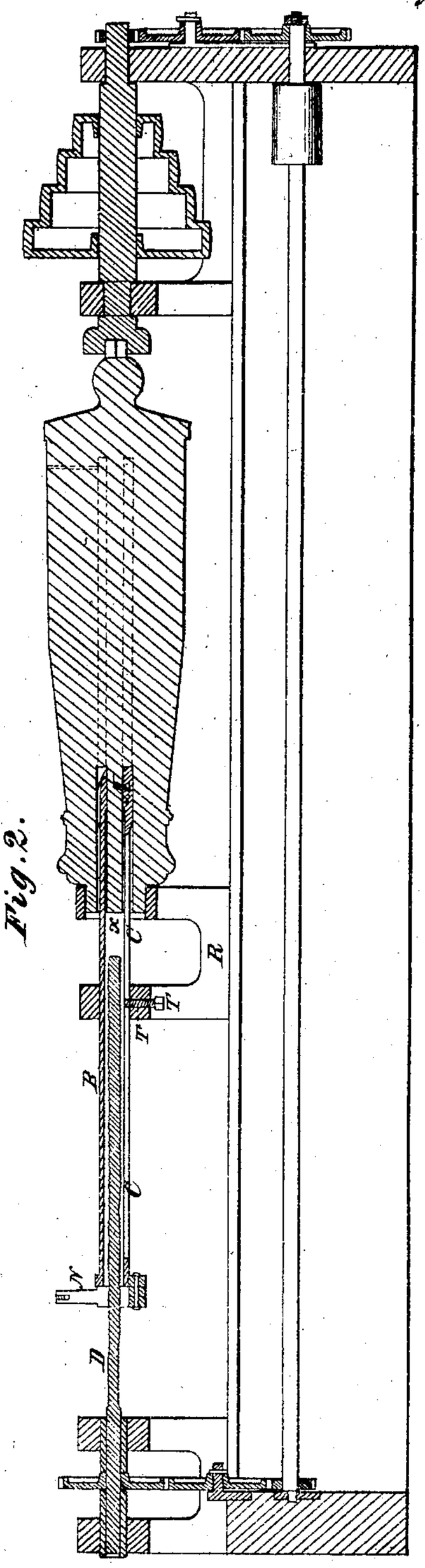

Fig. 2.

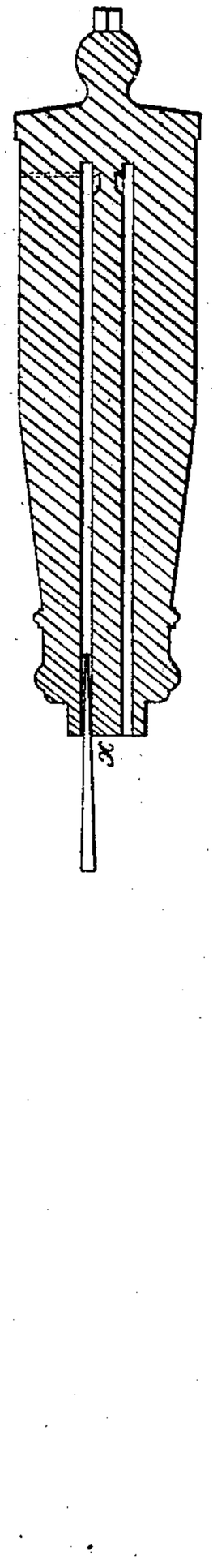

Fig. 1.

Sheet 3. 3 Sheets.

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Fig. 5.

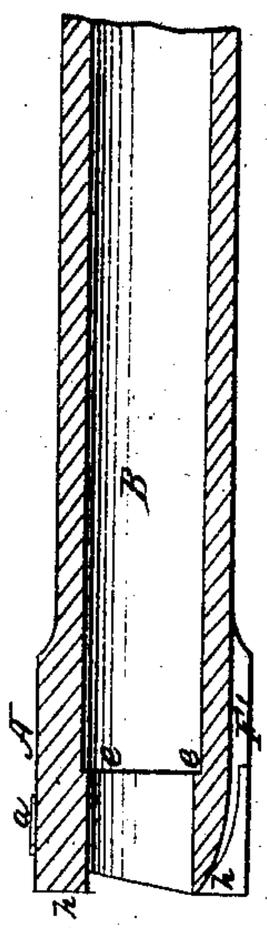


Fig. 6.

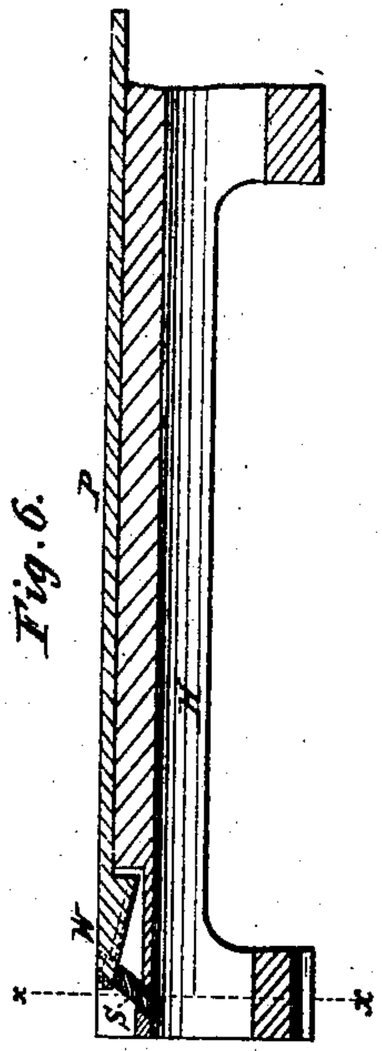


Fig. 7.

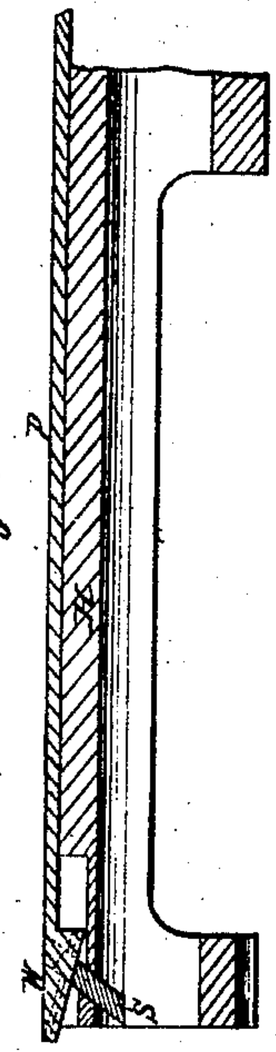


Fig. 8.

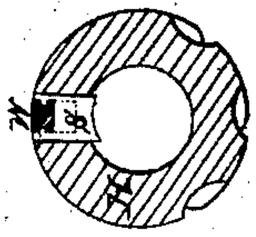


Fig. 3.

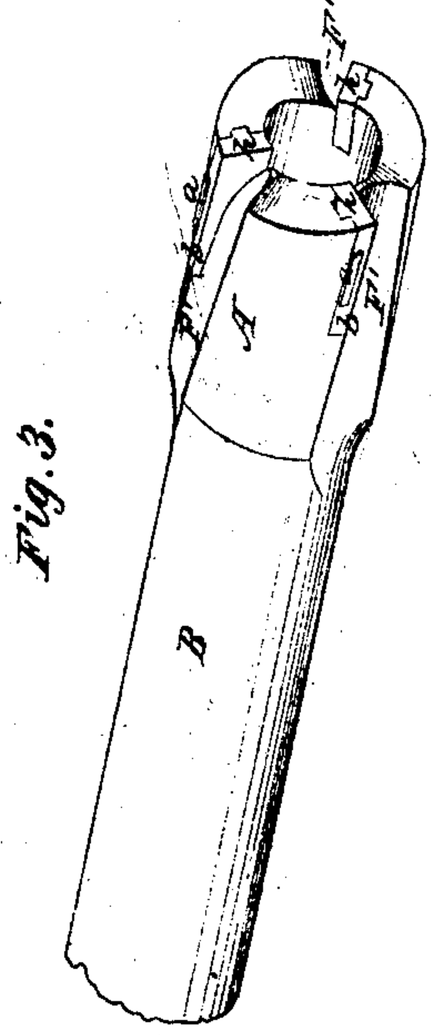
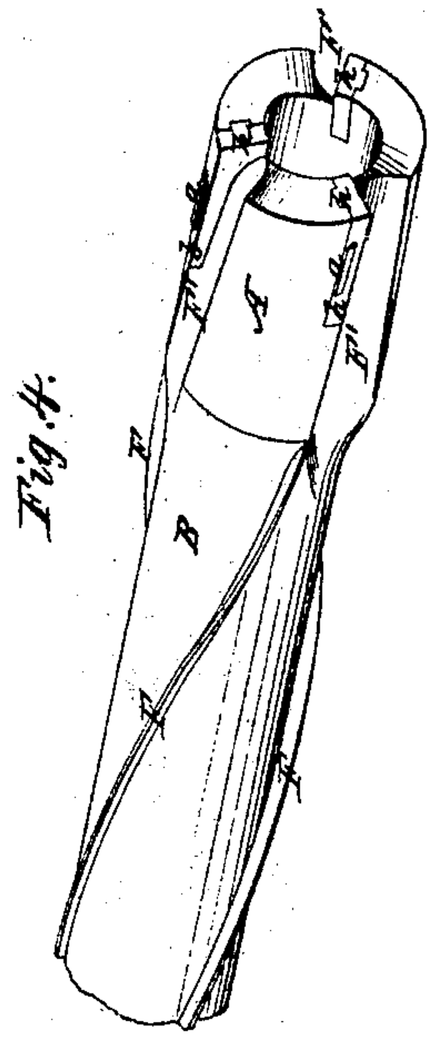


Fig. 4.



UNITED STATES PATENT OFFICE.

L. A. B. WALBACH, DECEASED, LATE OF PIKESVILLE ARSENAL, MARYLAND; WM. F. LUCAS, ADMINISTRATOR.

BORING CANNON.

Specification of Letters Patent No. 9,961, dated August 23, 1853.

To all whom it may concern:

Be it known that I, LOUIS A. B. WALBACH, of the Army of the United States of America, at present stationed at Pikesville Arsenal, in the State of Maryland, have invented a new and useful Method of Boring Cannon and other Ordnance and Firearms, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form part of this specification, and in which—

Figure 1 represents a view in perspective of an engine suitable for boring cannon upon the principle which I have invented; Fig. 2 a vertical longitudinal section of the same; Fig. 3 a view in perspective of the cutter head and sleeve; Fig. 4 a similar view, showing a series of spiral ribs on the sleeve for clearing out the borings as the cutters progress; Fig. 5 a longitudinal section through the cutter head and sleeve shown in Fig. 3; Fig. 6 a longitudinal section of the transverse cutter head and sleeve for nicking the core after the annulus is formed; Fig. 7 a similar view but showing the cutter in a different position; Fig. 8 a transverse section at the line *x x*, of Fig. 6; Fig. 9 a longitudinal section of the cannon with the annulus completed and the core nicked and ready to be broken off and removed.

My invention consists in producing a cylindrical hole in any solid substance suitable for making cannon or small arms by boring out an annulus of the diameter of the required hole, leaving a central core, two thirds more or less of the diameter of the bore, which can be broken off when the annulus is completed to the required depth and removed in a solid mass, instead of being cut into fine chips, or shaving as in the ordinary way of boring whereby much labor and time are saved and the expense of boring is greatly reduced. The core likewise furnishes a sample or test of the nature or quality of the material in the interior of the substance being bored, and this method of sampling the material which is highly important in the boring of cannon, constitutes another branch of my invention.

The means for removing the core after the annulus is bored, constitutes another branch of my invention.

Mechanism suitable for boring cannon might be made that would consist of a tubular cutting instrument, whose cross section would be an annulus corresponding to the annulus required to be bored. This tubular cutter should be armed at one end with cutters so that when it is pressed forward by a regular screw or other feed against the substance to be bored, the muzzle of a solid cannon casting for example, it would penetrate the same faster than the ordinary borer in the same ratio that the area of the annulus is less than the area of the bore. When an annulus has thus been made as deep as the required bore the tubular or circum-axial cutter should be withdrawn and a second or radial or cross-sectional cutter inserted to make a groove round the inner end of the core left by the first named cutter. This weakens the core at its junction with the breech, so that upon its being jarred by the blow of a hammer or otherwise deflected at its outer end, it will readily snap off, when the bottom of the bore may be finished of the required shape by a bur or other tool of the proper form.

This mode of boring cannon differs from all other now practised or known, first, in leaving a solid core formed by the cutting of an annular space around it, while the boring progresses and which core is usually of greater bulk than half of the material to be removed, and second in afterward detaching this core as a solid instead of reducing it to particles in the form of chips and dust as in the usual mode of boring.

The dead center of the ordinary boring tools which is a great impediment to the progress of the work, is entirely avoided by my method of circumaxial boring wherein no such center exists. The center of every common boring bit forms its pivot or axis

of revolution and having little or no circumferential motion cannot possibly cut out a chip, it can therefore only progress through the substance by the force of pressure or crushing alone.

In my method, the cutting edge is reduced in extent to at least one third of that of any other boring tool, by which both time and expense are saved, in proportion to the diminished amount of material to be removed; and being placed at and near the periphery of a hollow cylinder, it works there with greater effect in the ratio of its greater distance from the axis, and by avoiding the dead center of other modes of boring effects a still further saving of time in proportion to the greater facility of cutting, over that of forcing or crushing a tool into the mass to be perforated.

The accompanying drawings illustrate my new method of boring, in which Figure 1 represents the machinery ready for operation.

The gun casting is suspended in the lathe after the usual manner; and as it revolves, a corresponding motion is given to the boring shaft by means of a connecting rod, which passes along the lower part of the lathe and engages in the gearing at its extremities. Upon the boring shaft a screw is cut, which works in a nut at the extremity of the sleeve to which it communicates the motion required. Along the lower side of the sleeve there is a longitudinal slot or groove in which a feather inserted into the lower part of the rest or bearing plays. This prevents the sleeve from revolving, and by the action of the screw and nut at its extremity, a rectilinear motion is given to it in the direction of its axis, and in this way it is fed forward into the gun while boring: It can in like manner be withdrawn when so required, and to save time in so doing, the feed nut opens so as to become detached from the screw, and to allow the sleeve to be run back over the shaft by hand.

In the drawings A is the cutter head, consisting of a hollow cylinder of steel, cast iron, or other proper material, with three or more boring cutters (*h*) fitted to its end. Reamers or side cutters (*a*) are placed at a proper distance from the end on the exterior surface of the head (A), and at a proper distance from the cutting edges (*b*). These reamers may be used to smooth the periphery of the bore, or be dispensed with, as occasion requires.

B is the sleeve which passes over the screw shaft (D) and receives the core (X) as it is cut round by the head (A) in the progress of the boring. The length of the sleeve with its cutting head should be longer than the base of the gun by the distance between the rear end of the sleeve rest (R) and the muzzle of the gun; usually but one rest would be required, and that should be just in rear of the position of the cutting head, at the commencement of the work; but when the depth of boring requires a great length of sleeve, one or more intermediate rests may be used.

N is the hinged nut attached to the extremity of the sleeve (B) and engaging when shut into the thread of the screw shaft (D). C is the horizontal slot, along the bottom of the sleeve for receiving the guide or feather (T) as before described; and which serves also for the escape of any chips or borings that may accumulate within the sleeve.

D is the screw shaft to which the feed motion is given by the machinery, and which engages with the nut (N) at the extremity of the sleeve (B) and passes through to the other extremity or head, where, if necessary it may center upon the muzzle of the gun at the pivot point of its axis of revolution.

The screw thread need not be cut beyond the point where it enters the sleeve rests (R); the remaining portion being made like an ordinary boring shaft.

The bore of the sleeve is enlarged by a recess (*c*) back of the cutter head to prevent it from rubbing on the core and creating friction and also to avoid choking or binding from chips that may accumulate within it.

F are spiral flanges passing around the exterior surface of the sleeve, which, in combination with spiral grooves (F′) extending from the cutting edges back over the outer surface of the head, carry off the chips or borings as they are disengaged by the cutters. The cross sectional cutter represented in Figs. (6 to 8) and used in detaching the core, when the material is of a nature like copper, bronze, wood, or the like, and which cannot be broken off transversely at its base, like cast iron or other brittle substances, by merely driving a wedge into the annular space along its sides. This contrivance I propose to attach to the boring cutter head; but if found more convenient, it may be applied separately, and be passed into the annular space over the core to the point at which it is to be cut off. This transverse cutter consists essentially of a cutting tool (S) inserted in the side of the head of a hood (H) or a sleeve the cutting edge of which, lies even with the inner surface of the head—so that it may be slipped over the core. To feed the tool inward against the core, I use an inclined plane or wedge (W) set also in the cutter head. This wedge or inclined plane, is to be fed forward upon the tool by a screw or otherwise, operating through a rod (P) passing along the side of the sleeve. The tool is drawn back by drawing back the rod and inclined

plane. The edge of the cross section cutter is pressed down against the core, by feeding forward the wedge, while the rotation of the gun causes it to cut a circular groove, around and into the base of the core, which so weakens it as to insure its breaking off, whatever be the material of the core by driving a wedge into the annulus and forcing the core to one side of the bore after the cutter head has been withdrawn.

In the process of manufacturing cannon a solid block of metal corresponding in form and size to the exterior of the gun is first made and then it is perforated in the line of its axis by some instrument that makes a hole of the proper size to form the bore.

As represented in the accompanying drawings the boring shaft does not go entirely through the sleeve, but only far enough to answer the purpose of a feed screw and a directrix for the head. The gun is made to revolve in its own bearings, and the boring sleeve is placed in its own bearings in such position that its axis shall coincide with a prolongation of that of the gun, so that the centering of the cutting head with respect to the face of the muzzle of the gun may be easily adjusted. But as in long borings, it might be required to center the boring shaft in the center of the muzzle before the cutters had become engaged upon its face; in that case the shaft would have to pass through the sleeve and pivot upon the face of the gun, its axis still being in the same line with the axis of the gun. The core corresponding as it does in diameter with the boring shaft becomes thus a prolongation of the same to guide and steady the sleeve as it passes into the gun.

It will be readily seen that if the inner diameter of the sleeve were uniform throughout, the sleeve passing over the boring shaft and the core, both of the same diameter and the one entering on the other, this fit would keep them invariably on the same axis of rotation. But the enlargement of the sleeve within its ends may after the cutters have advanced some feet into the gun, permit a wabbling at the centering; to obviate which I propose when necessary to use three set screws, passing through the sleeve the points of which just touch the boring shaft and passing with the sleeve into the gun, receive and steady the core which revolves, between and in contact with them. There may be as many of these set screws as experience may show to be necessary, the longer the gun the more numerous of course would they be.

Other modes of steadying the boring shaft and core may be used, such as a cylinder smaller than the boring shaft, projecting from the end of it into a hole previously bored for it, by any ordinary tool into the muzzle of the gun or center of the core, or the sleeve may be of such length and so supported as to dispense with all support from the core.

To enable the cutting head and sleeve to free themselves from the chips and dust on their exterior, I reduce the outer diameter of the sleeve, back of the cutting head, and between the reamers, and in connection with the cutters make on the cutting head spiral grooves on its outer surface. By these grooves, the passage of the chips into the bore of the gun is facilitated. I likewise when necessary form a spiral thread on the outside of the sleeve, back of the cutter head whose diameter is equal to that of the cutter head, whose office it is to remove the chips from the bore in the manner of a screw and trough conveyer.

The shaft and sleeve outside of the muzzle may be steadied by any of the rests well known among mechanics to prevent the vibration of a long shaft or rod while in the turning lathe.

When the cutter head has fairly entered the gun an additional support is thereby given and the stability of the system is rendered more perfect and secure.

To bore a 32 pounder gun, the depth of whose bore is 106 inches or near nine feet, I would have the sleeve at least ten feet long; and steadied as it would be, as here described in its passage into the gun, it would complete the bore with mathematical precision.

I do not describe the form of the cutters, and the mode of attaching them to the cutter head, because these are matters admitting of much variation and are well understood by mechanics generally. When the gun or other substance to be bored is long, or where for other reasons it may be preferred to bore it in sections (that is, after boring for some feet to withdraw the tool, break off the core and bore another section, and so on until the bore is completed, and for which purpose the same machine or one with a shorter sleeve may be used), all that would be necessary to do, would be to make a new center on the broken end of the core to support the screw shaft. The method by which I do this is by inserting into the end of the boring shaft a drill which would bore out the center required, and to keep this tool from being diverted from the true axis of rotation by the broken surface of the core it may be passed through a hole in which it fits closely, made in the axis of a collar or short cylinder of hard wood exactly fitting the bore of the gun. This tool may remain as the centering in the boring shaft to which it may be attached; the larger diameter of the shaft forming a shoulder after the tool has penetrated as far as may be desirable.

It may be proper here to remark that the foregoing description of the mode of centering with the boring shaft, instead of using it merely as a guide or directrix for the sleeve cutter, is given only as an additional means of insuring steadiness of boring in cases requiring such extra precaution. My experiments however, in boring with this hollow cutter some 32 pounders, and permitting others to bore with it for experiment, convinces me that the cutting head, if the sleeve be well supported by sufficient rests, will of itself find and keep its own center; and that in ordinary boring I would therefore use the boring shaft simply as a guide or directrix to the sleeve, and as a feed screw for moving it forward into the gun or substance to be bored; and only in certain kind of work which from its nature might so require it, would I use the solid shaft for a centering tool as already described. Several guns in fact have been bored simply by attaching the hollow borer to the end of an ordinary boring shaft, which directed and fed it after the manner in which it usually directs and feeds other boring cutters.

As a matter of course the size of the boring shaft, sleeve and cutter head must be regulated by the caliber of the gun. To bore a 32 pounder whose caliber is six and two tenths inches, I would make the boring shaft three inches in diameter and the thickness of the cutter head one and five-tenths inches, which would of course be the length of the face or cutting edge of the boring chisels, and would leave an annulus of two tenths in thickness to be taken out by the reamers or side chisels.

The exterior diameter of the cutter head would be six inches without the reamers—and the diameter of the sleeve back of the cutter head I would make only five inches which would leave a space between the finished bore and the sleeve, of six tenths of an inch for the discharge of the chip and for the working of the spiral flanges already described to aid in effecting the discharge.

The annulus of metal or other material, having been taken out by the means herein described, the core still remains to be removed from the gun, or other body to be bored. Where the gun is of cast iron, or the material is of a brittle nature, this may be readily done, by driving a wedge into the annular space left around the core and breaking it off transversely at its base. The rough surface so left at the bottom of the bore may be afterward finished off by an ordinary cutter or face reamer to the form required to be given it.

It is well known by those practically conversant with the manufacture of cannon, that the weakest and most defective part of a solid casting for a gun, is along the center or axis hence when a core is taken from that part it is necessarily the very best possible portion of the material which can be selected for inspection, and for mechanical and other tests, since if this comes up to the standard of quality, it is a sure guarantee of the sufficiency of the rest of the gun or material.

In solid castings like those for cannon, the cooling of the metal commences on the outer surface as that in contact with the mold. This produces a traction of the parts of the fluid metal toward the exterior, withdrawing them from the center of the mass which is the last to cool; hence the flaws or fissures which are so frequently met with in large castings or those suddenly cooled and it is therefore in the center portions or about the axis that these flaws or imperfections are most generally found. They would not exist to any considerable extent in a good gun casting, and if found there over a certain size, the quality of the gun should be suspected; lest extending beyond the cylinder of the bore, they may occasion flaws and defects in the solid portion, or body of the gun. The sample of the core by its length and size enables us moreover to ascertain important mechanical properties of the metal, which otherwise could not be determined; for instance, these long samples furnish the means for testing not only the tensile strength and density but also the transverse strength of the metal, its elasticity and its resistance to an impacted force at different points between the breech and muzzle; all of them being essential tests to the durability of a gun, and the three last of which, can be determined by no other sample that can be taken from the gun. This mode of obtaining a sample from the core is therefore a valuable and important part of this invention.

I have described such mechanism for reducing my improved process of boring, and core sampling cannon, &c., to practice, as I deem well suited to the purpose, but there are numerous other forms and arrangements of mechanism which could be advantageously employed yet I deem it unnecessary to describe them, as they are subordinate to the main invention, which is a method of operation, and consequently independent of any special form of machinery or tools.

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

The method herein described of boring cannon, or the barrels of other ordnance or fire-arms by perforating the same with an annular hole which leaves a central core, in combination with a second operation for detaching and removing the core, substantially as specified, whereby the amount of material to be reduced to chips, the time

and labor of boring, and the wear of tools are greatly diminished, and the accuracy of the work increased.

2. I also claim the transverse cutter or the equivalent thereof, for grooving or cutting off, the base of the core, substantially as specified.

3. I likewise claim the method herein described of ascertaining the quality of the gun, by taking out a core, of sufficient diameter and length, from the axis or center of the bore, to be tested mechanically or otherwise.

In testimony whereof, I have hereunto subscribed my name.

L. A. B. WALBACH.

Witnesses:
P. H. WATSON,
PETER HANNAY.