No. 682,359. Patented Sept. 10, 1901.

H. R. KEITHLEY.

MACHINE FOR MANUFACTURING TUBULAR BODIES.

(Application filed July 1, 1901.)

(No Model.) 2 Sheets—Sheet 1.

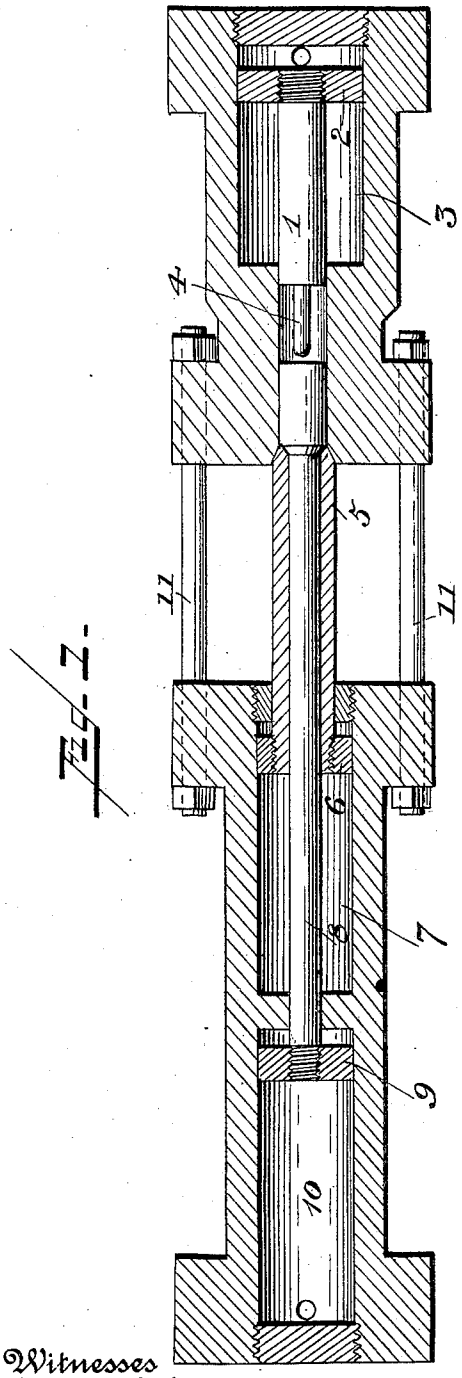

Fig. 1.

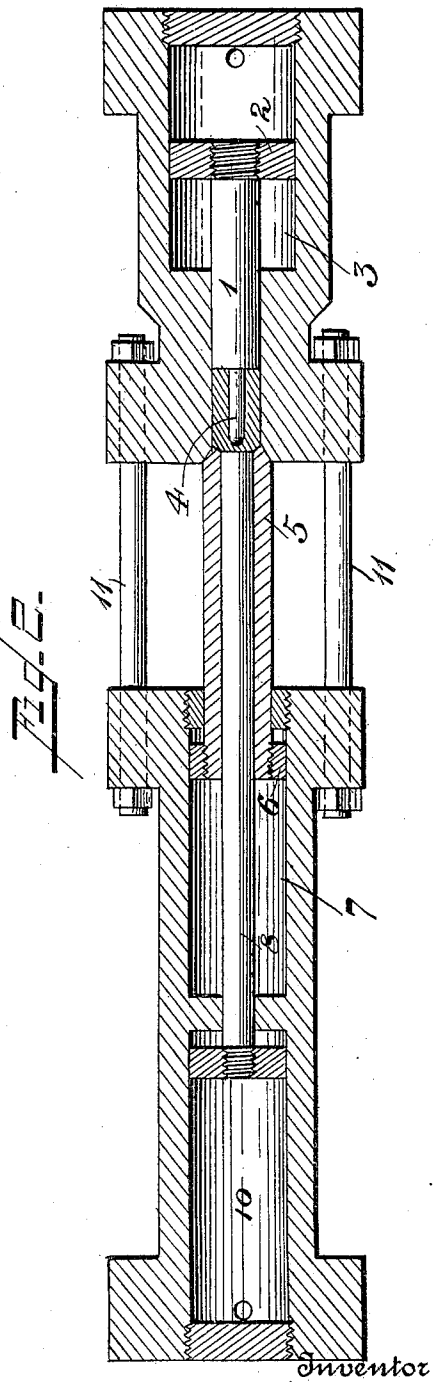

Fig. 2.

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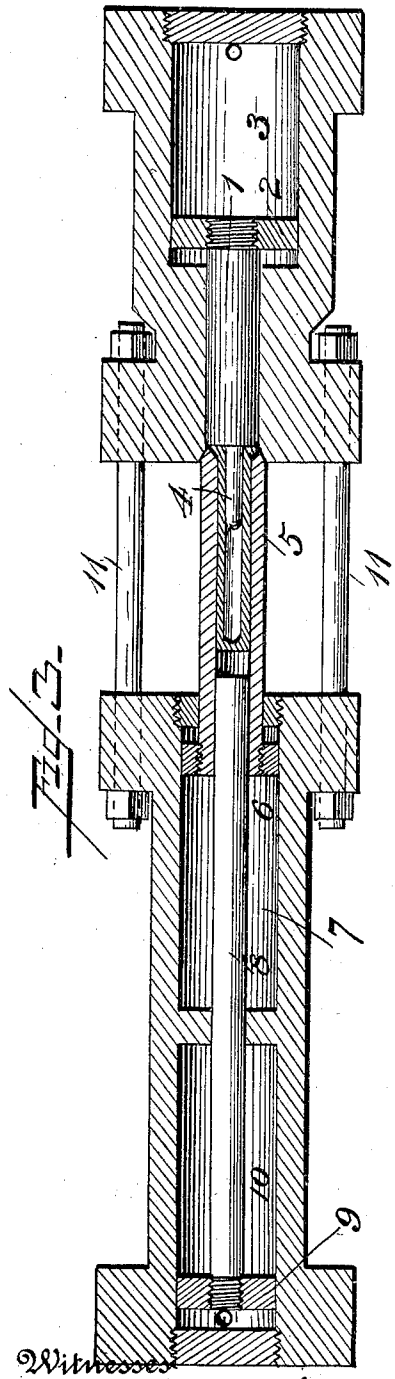

Fig. 2.

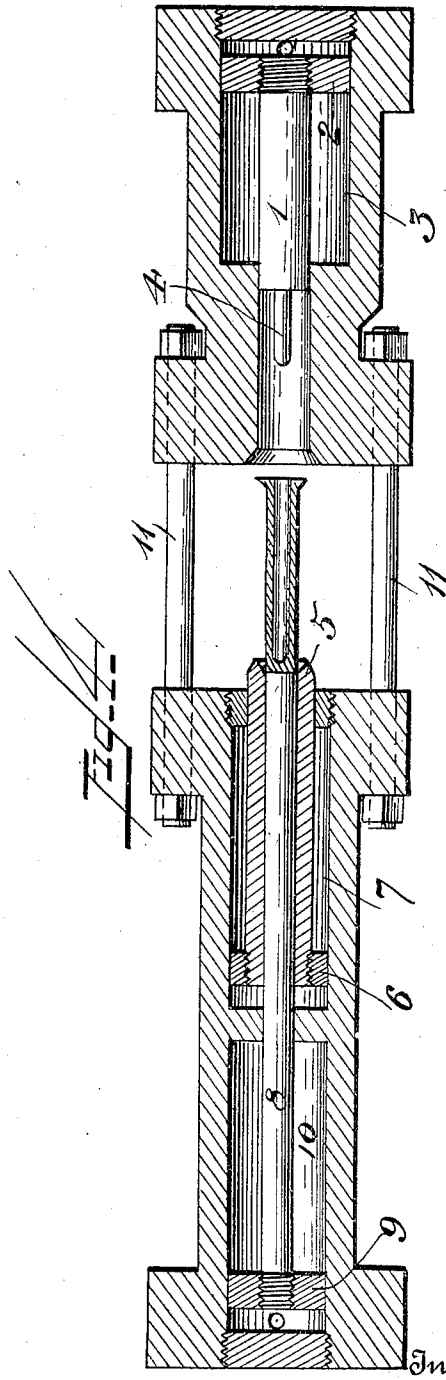

Fig. 1.

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HERBERT R. KEITHLEY, OF WILSON, NEW YORK.

MACHINE FOR MANUFACTURING TUBULAR BODIES.

SPECIFICATION forming part of Letters Patent No. 682,359, dated September 10, 1901.

Application filed July 1, 1901. Serial No. 66,666. (No model.)

To all whom it may concern:

Be it known that I, HERBERT R. KEITHLEY, of Wilson, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Machines for Manufacturing Tubular Bodies; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to machines for manufacturing seamless tubular bodies from solid bodies of metal.

In the present state of the art there are two principal methods or processes of manufacturing seamless tubular bodies. One of these processes consists in confining a solid piece of hot metal in a suitable chamber and forcing a punch into or through the mass to form the tube. In the other process referred to the tubular blank is produced on a mandrel between rolls having differential rotation at high velocity and is called the "disk rolling or piercing" process. The principal difficulty encountered in the first-named process is to produce a tubular blank of the length required to work into the commercially-finished form, which blank shall have a perfectly centered hole or bore, so that the walls are of uniform thickness. Commercial tubing is now made in lengths of about twenty feet, and this requires that the original seamless tubular blank be approximately three feet long. To punch a hole of the required size through a solid mass of metal of such a length (three feet) and to preserve the exact alinement of the punch under the heavy pressures required to penetrate the metal has been found to be so difficult and uncertain that this process has been superseded by the disk rolling or piercing process above referred to. This latter process requires the use of a high grade "open-hearth" steel, which is very expensive. This is necessary, because it has been found that the use of the ordinary grade of open-hearth steel or Bessemer will not produce satisfactory results. It has also been found that even when high-grade steel is employed in this process the effect of the excessive working and manipulation of the metal mass has been such that the product cannot be "machined" and prepared for various mechanical uses with satisfactory results. This disk rolling or piercing process has the disadvantage of requiring very expensive machinery, which in operation requires constant and careful attention in order that the adjustments of the various parts throughout may be properly maintained; otherwise the product will be defective.

The object of my invention is to provide a machine by which seamless tubular bodies may be formed from solid blanks or bodies of the ordinary grades of steel, which machine shall be simple, economical, and efficient.

My improved machine possesses advantages over the machine which is employed in practicing the old process first-above referred to in that although the metal blank is punched at one stage of the process of forming the tube the punching is accomplished by a tool substantially shorter than the length of the finished product. Consequently the said punching-tool will successfully resist deflection from true alinement and will produce a tubular body having a perfectly centered hole and walls of uniform thickness. The machine possesses advantages over the machine employed in practicing the disk-rolling process above referred to in that it may be maintained and operated very much more economically and in that the ordinary grades of steel may be successfully used. It possesses a further advantage over the second-named process in that the productive capacity of the machine is greatly increased.

In the drawings, Figure 1 is a longitudinal sectional view of a machine constructed according to my invention. Figs. 2, 3, and 4 are similar views, the parts being shown in different positions for the purpose of illustrating the successive steps of operation.

1 is a plunger or rod.

2 is a piston by which the plunger 1 may be moved.

3 is a cylinder in which the piston 2 moves.

4 is a punch or mandrel.

In the forward end of the cylinder 3 there is a passage of a size corresponding to the size of the plunger or piston 1. This passage

will hereinafter be termed the "blank-chamber." 5 is a tubular abutment, the passage through which is of less diameter than said blank-chamber, but of larger diameter than said punch. This tubular abutment is movable by means of a piston 6, in turn movable within a cylinder 7.

8 is a piston-rod of a size corresponding to the bore of the tubular abutment 5 and movable therein. This rod 8 may be moved by a piston 9, in turn movable in a cylinder 10.

The casing or casings forming the piston-cylinders may be connected in any desirable way—for example, by rods or bolts 11 11. The pistons may be operated hydraulically or in any other suitable mechanical way.

The preferred form and means by which the plunger 1, the punch 4, the tubular abutment 5, and the piston 8 are operated is shown in the drawings, although it is obvious that the same may be modified in form and arrangement. The entrance to the passage through the tubular abutment is preferably slightly beveled, as shown in the drawings. The end of the abutment 5 is also tapered, by preference, so as to take into a flared opening leading to the blank-chamber. By this construction when the parts are in the positions shown in Figs. 1, 2, and 3 the entrance to the tubular abutment 5 is reinforced, so that the strains due to the passage of the metal through said member 5 will be successfully resisted. This construction is further advantageous in that the perfect fitting of the member 5 into the entrance to the blank-chamber and its alinement therewith is always assured, since it might otherwise be disturbed by the expansion and contraction of the parts.

In operation a solid blank of hot metal is first inserted into the blank-chamber, so that it will assume approximately the position shown in Fig. 1. In this figure the abutment 5 and the piston-rod 8 are in a proper position to hold the blank during the punching process. The plunger 1 and punch 4 are then advanced, and the latter is forced into the solid blank, forming the short heavy tubular body shown in Fig. 2. The next step is to retract the piston-rod 8. The plunger 1 is then advanced, causing the punch 4 to enter the forward end of the tubular abutment 5 and simultaneously causing the metal of the short heavy tubular blank to flow forwardly in advance of the punch and through the tubular pass or die formed by the punch and the inner wall of the tubular abutment. Thus the blank is contracted diametrically and elongated, producing, as shown in Figs. 3 and 4, a blank of substantially greater length than the length of the punch 4.

During the first part of the operation above described the member 4 acts only as a punch, but during the latter part of the operation it ceases to act as a punch and performs the function of a mandrel. While acting as a mandrel the pressure of the metal against this member will not deflect it from true alinement, since the resistance against the end of said member ceases, due to the fact that the metal by displacement is caused to move or flow longitudinally and forwardly beyond the point of the mandrel. When the metal has been substantially displaced from the blank-chamber and has taken the form of the tube shown in Figs. 3 and 4, the plunger and punch may be retracted, and then the tubular abutment 5 may be retracted, exposing the tube, as shown in Fig. 4, whereupon said tube may be removed. In Fig. 4 the abutment 5 is shown as being still slightly in engagement with the tube. It is obvious, however, that it can be entirely freed therefrom by retracting said tubular abutment 5 still farther.

What I claim is—

1. In a machine for manufacturing seamless bodies, a blank-chamber, a punching device projecting therein and means for operating the same, a plunger projecting therein and means for operating the same, a tubular abutment located at the end of said blank-chamber and means for operating the same, a piston-rod coacting with said tubular abutment and means for operating the same, said tubular abutment and said punch coacting to form a die.

2. In a machine for manufacturing seamless bodies, a blank-chamber, a punching device located therein and means for operating the same, a plunger located therein and means for operating the same, a tubular abutment located at the entrance to said blank-chamber and means for operating the same, a piston-rod projecting into said tubular abutment and means for operating the same, said tubular abutment and said punch coacting to form a die.

3. In a machine for manufacturing seamless tubular bodies, in combination, a blank-chamber, a plunger located therein and fitting the same, said blank-chamber having a beveled entrance, a tubular abutment projecting into the beveled entrance to said blank-chamber and means to remove said tubular abutment therefrom, a punch carried by the plunger and coacting with the tubular abutment to form a tubular die.

4. In a machine for manufacturing seamless tubular bodies, in combination, a blank-chamber having a beveled entrance, a plunger located in the blank-chamber and fitting the same, a movable tubular abutment having its forward end tapered to engage with the wall of the beveled entrance to said blank-chamber, a punch independent of said tubular abutment but coacting therewith to form a tubular die of smaller diameter than said blank-chamber.

5. In a machine for manufacturing seamless tubular bodies, in combination, a blank-chamber having a beveled entrance, a movable tubular abutment having its forward

end tapered to engage with the wall of the beveled entrance to said blank-chamber, a beveled entrance to the tubular bore of said abutment, a piston-rod movable in the bore of said tubular abutment, a plunger movable in the blank-chamber, and a device acting as a punch in the blank-chamber and as a mandrel in the passage in the tubular abutment.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HERBERT R. KEITHLEY.

Witnesses:
R. C. MITCHELL,
E. F. CAVERLY.