(No Model.) 3 Sheets—Sheet 1.

J. BERRY.

METAL SWAGING MACHINE.

No. 435,351. Patented Aug. 26, 1890.

Fig. 1.

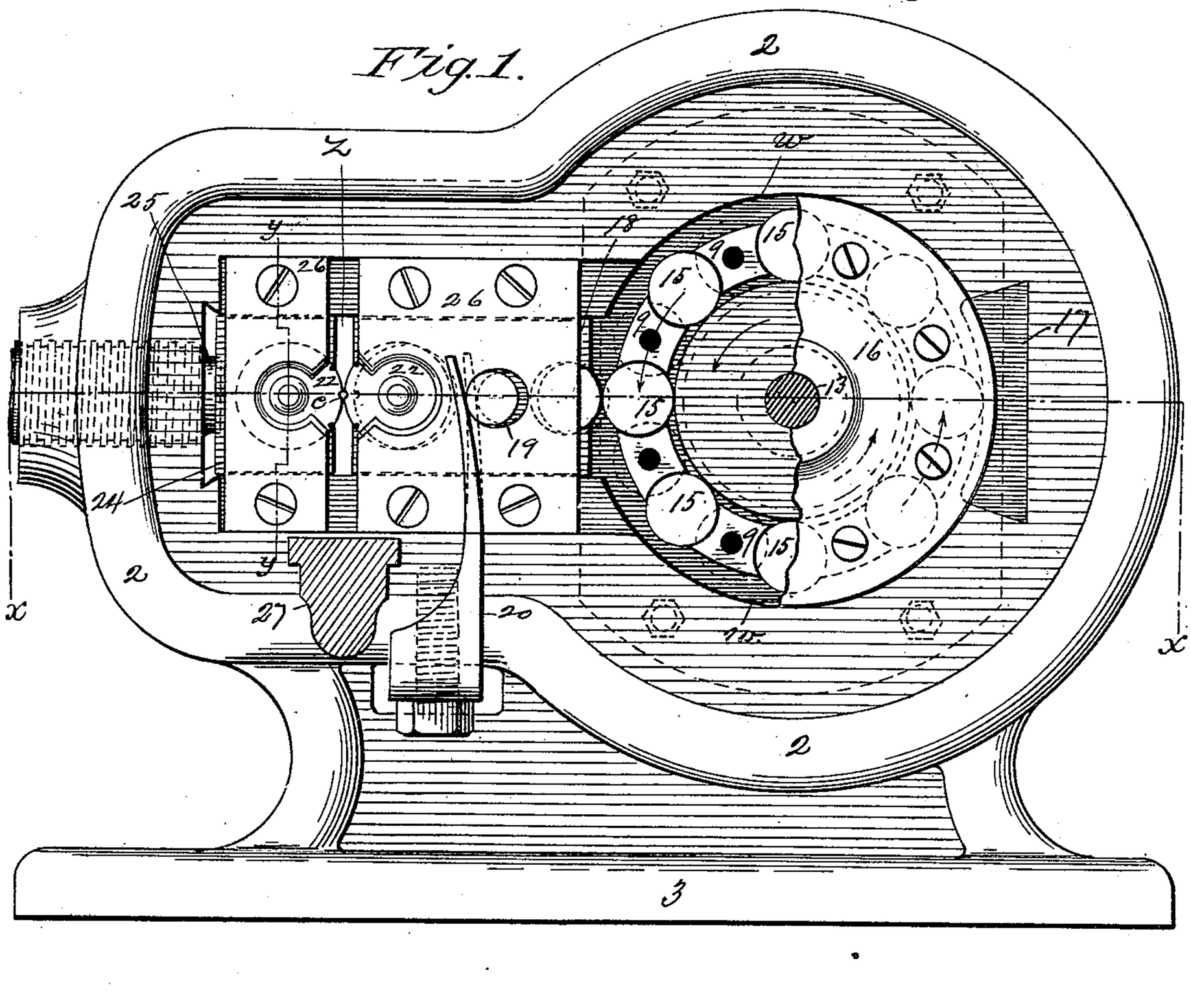
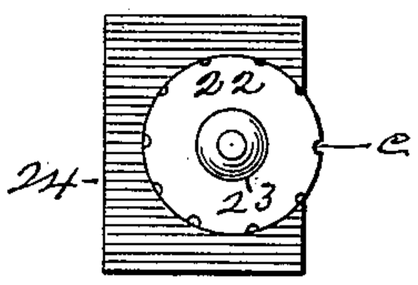


Fig. 4

Fig. 5



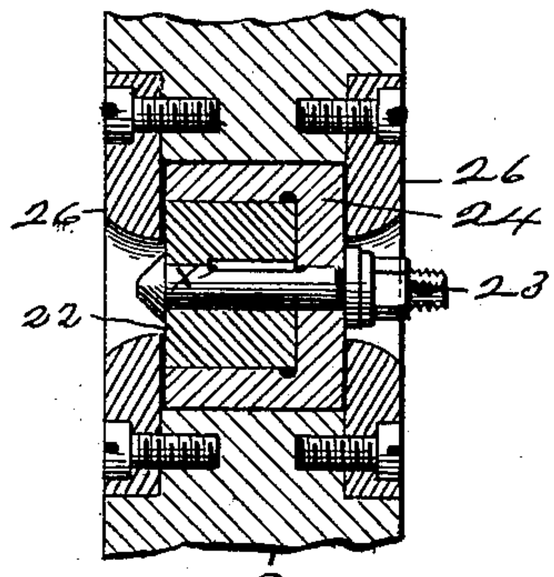
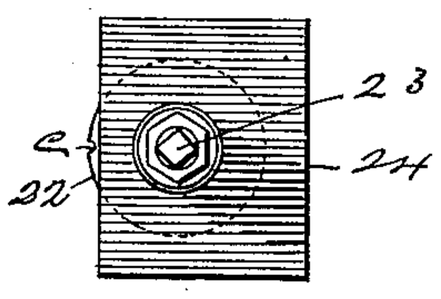


Fig. 6.



2

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(No Model.)

3 Sheets—Sheet 2.

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METAL SWAGING MACHINE.

No. 435,351. Patented Aug. 26, 1890.

Fig. 2.

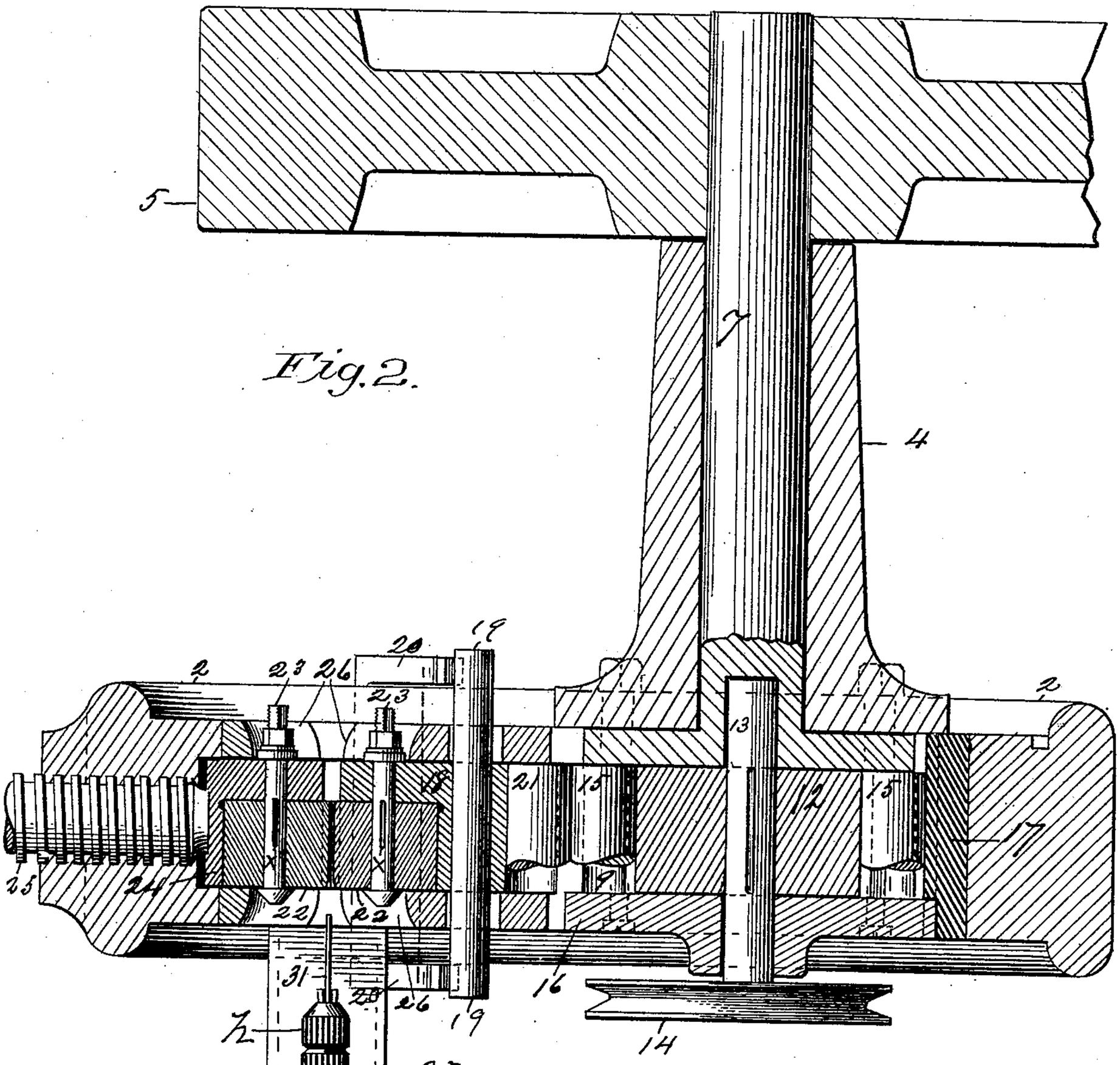
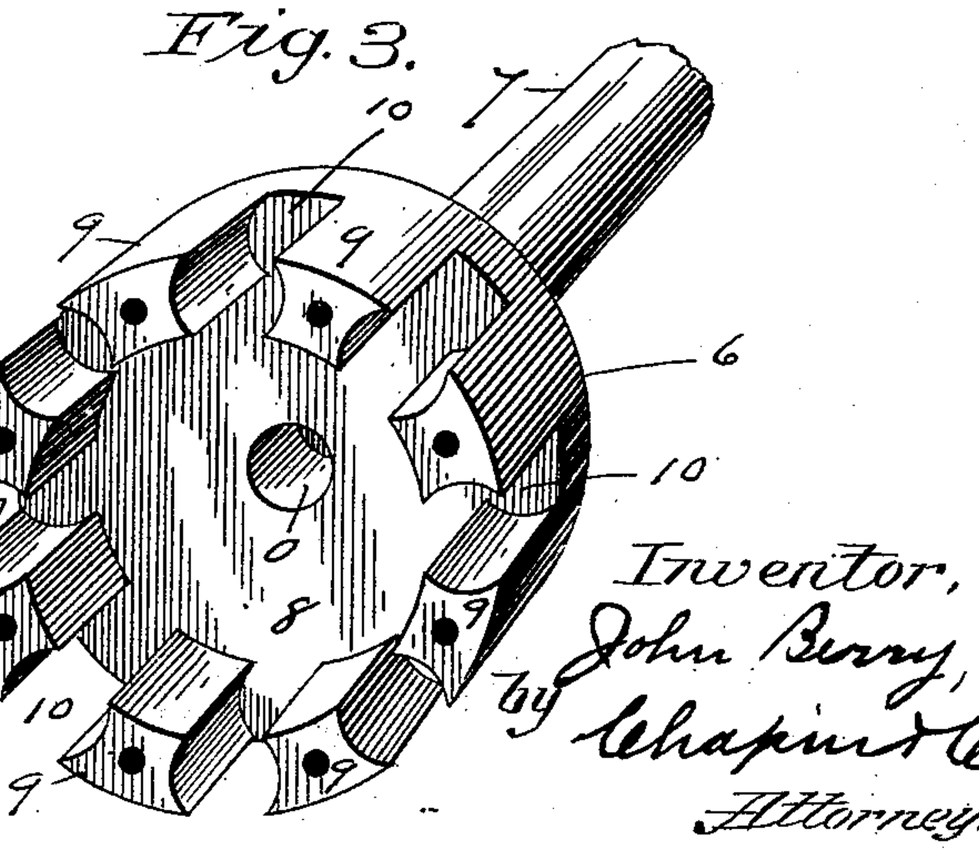


Fig. 3.



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3 Sheets—Sheet 3.

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METAL SWAGING MACHINE.

No. 435,351. Patented Aug. 26, 1890.

Fig. 7.

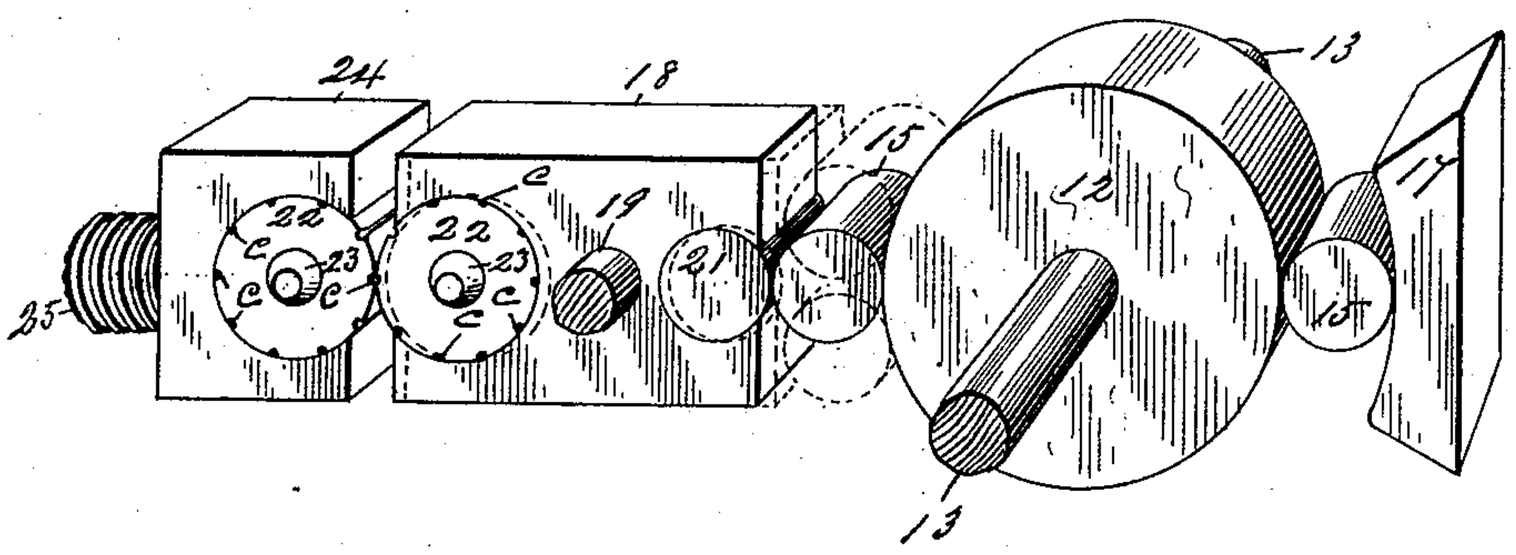


Fig. 8.

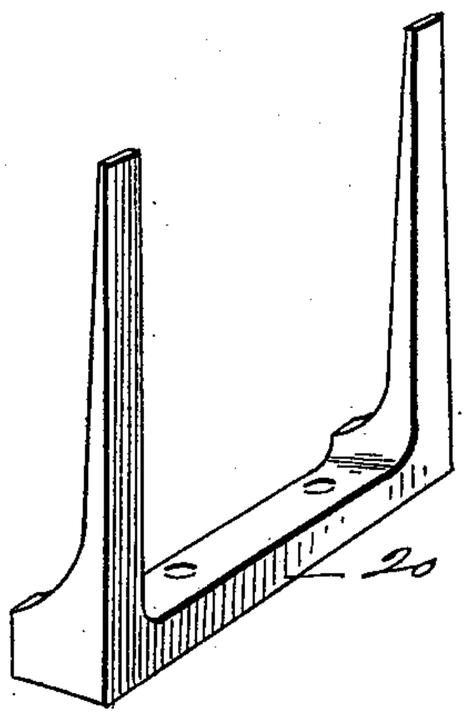
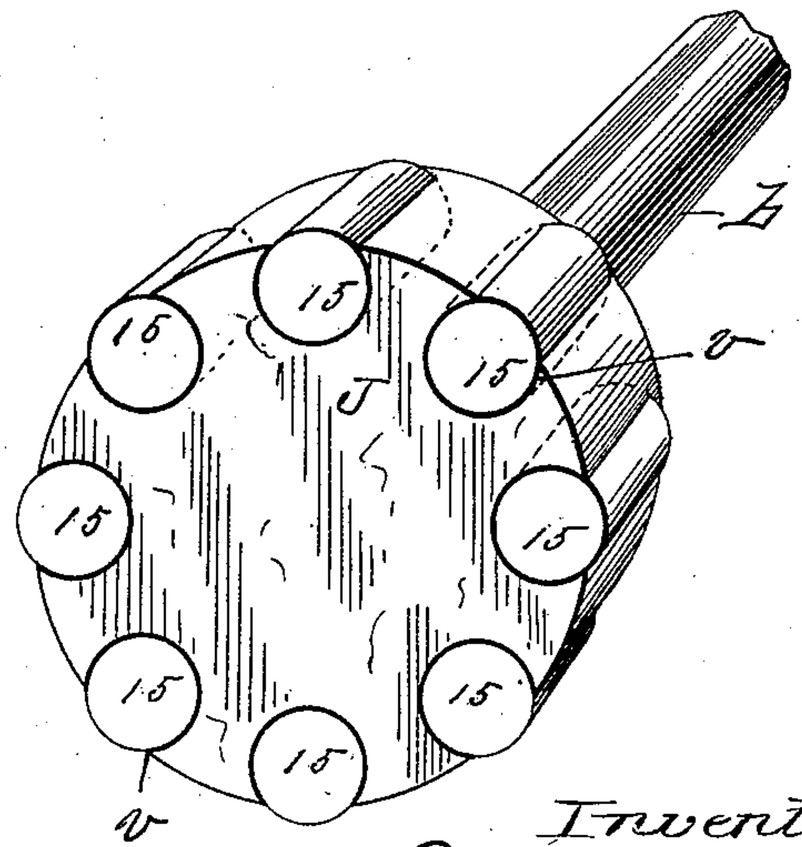


Fig. 9.



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UNITED STATES PATENT OFFICE.

JOHN BERRY, OF SPRINGFIELD, MASSACHUSETTS, ASSIGNOR TO THE NATIONAL NEEDLE COMPANY, OF SAME PLACE.

METAL-SWAGING MACHINE.

SPECIFICATION forming part of Letters Patent No. 435,351, dated August 26, 1890.

Application filed December 23, 1889. Serial No. 334,776. (No model.)

To all whom it may concern:

Be it known that I, JOHN BERRY, a citizen of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented new and useful Improvements in Metal-Swaging Machines, of which the following is a specification.

This invention relates to metal swaging or reducing machines, the object being to provide a machine of improved construction for compressing or reducing cylindrically pieces of metal from a greater to a lesser diameter by blows applied thereto in rapid succession, such machines being adapted to be used in the manufacture of needles, spindles, and other similar metallic articles, the said compressing or reducing operations thereon being performed upon the metal either in a hot or cold state, as may be preferred or as the work may require; and the invention consists in the peculiar construction and arrangement of the various parts of the machine, all as hereinafter fully described, and pointed out in the claims.

In the drawings, forming part of this specification, Figure 1 is a side elevation, partly in section, of a metal swaging and reducing machine constructed according to my invention, said figure showing a portion of a side plate on said machine broken away to expose certain parts thereunder, as hereinafter described. Fig. 2 is a longitudinal sectional view of the machine about on line *x x*, Fig. 1. Fig. 3 is a perspective view of a detail part of the machine hereinafter fully described. Fig. 4 is a sectional view on the line *y y*, Fig. 1. Figs. 5 and 6 are, respectively, front and rear elevations of one of the die-holders and the die attached thereto. Fig. 7 is a perspective view of detail parts of the machine arranged in operative order, all as hereinafter fully described. Fig. 8 is a perspective view of a detail part of the machine below described. Fig. 9 is a perspective view of a modified construction of a part of the machine below described.

The improvements in metal compressing or reducing machines herein shown and described provide for such a construction thereof as greatly multiplies the number of swaging-blows to a single revolution of the main shaft of the machine as compared with machines heretofore made, thereby largely increasing the efficacy thereof as to the production of swaged parts, and the machine is of such compact and simple construction as to insure increased durability in use and economy of manufacture.

In the drawings, 2 indicates the main frame of the machine, whose form in side elevation is shown in Fig. 1, and in plan view, partially, in Fig. 2, said frame being provided with a suitable base 3, which is preferably formed integral with the frame by casting the latter and the base in one piece. The said frame 2 has formed therein and extending transversely thereof a circular opening or chamber within the line *w w*, Fig. 1, and from said circular opening and at one side thereof there extends horizontally a slot *z*, having parallel sides and constituting an open passage therefrom. On the rear side of said frame 2 and covering one side of said circular chamber therein is bolted a long hollow driving-shaft hub 4, which extends, as shown, at right angles to the side of said frame. A cylindrical roller-wheel 6 (see Fig. 3) is fitted within said circular chamber in the frame 2, and is provided with a driving-shaft 7 extending therefrom at right angles to its base 8 into and through the said shaft-hub 4, and to its outer extremity is secured a driving-pulley 5, to which a suitable driving-belt may be applied for imparting a rotary motion to said roller-wheel within the frame of the machine. If preferred, other means may be adopted—such as suitable gearing and connection therewith of requisite driving mechanism or motor—for imparting the necessary rotary motion to the said roller-wheel. The said roller-wheel 6 is constructed preferably from steel, and has projecting at right angles from the front side of said base 8 thereof a series of arms 9, between which are formed a series of roller-chambers 10, the sides of said chambers in said arms being curved and constituting in effect segments of circles corresponding in form to the surfaces of a series of cylindrical hammer-rolls 15, which are fitted to turn more or less loosely in said chambers 10 and to be

carried around by the rotation of said roller-wheel, the axes of said hammer-rolls being substantially parallel with the axis of the said driving-shaft 7. The said hammer-rolls 15 are prevented from moving endwise within their chambers in the roller-wheel by a side plate 16, which is secured to the ends of the said roller-wheel arms 9 by screws, as shown in Fig. 1, or by other suitable means, and said hammer-rolls are made thicker than said arms 9, so that they shall have a clear bearing-surface beyond the outer and inner planes of said arms. The said rolls 15 are designated as "hammer-rolls" because they, one after the other as the said roller-wheel revolves, strike the swaging-blows which drive one die against another, as below described.

An anvil-disk 12 is placed within the circular group of hammer-rolls 15 in the said roller-wheel, and the surfaces of said rolls bear more or less against the periphery of said disk when the machine is running, and with great force when swaging work is being done with the machine, as below described. The said anvil-disk 12 has a spindle 13 rigidly fixed therein, one end of which spindle enters a socket *o* in the base of the roller-wheel 6, and the opposite end of said spindle projects through the said plate 16, (see Fig. 2,) which is secured to the ends of the said arms 9, as above described. On the outer end of said spindle 13 is secured a pulley 14, to which may be applied a suitable driving-band, for the purpose, if desired, of imparting a regular rotary motion to said disk 12 in the direction indicated by the arrow in Fig. 1. Said "anvil-disk" (so designated because it receives on its periphery the force of the said swaging-blows given by the hammer-rolls) in the absence of the above-described means for rotating it would be turned with an irregular or intermittent motion by the slight rotary motion given to said hammer-rolls when they strike said blows, but the anvil-disk is preferably given such independent rotary motion as may be imparted thereto by a belt or band applied to the said pulley 14, for thereby much of the frictional action of the hammer-rolls 15 thereagainst is obviated, as will be more clearly understood by the following description of the operation of the machine, and unnecessary wear of parts is obviated by rotating said anvil-disk.

Fig. 9 illustrates a modified construction of the said roller-wheel, which may be substituted for that shown in Fig. 3, wherein the said anvil-disk is dispensed with, the said wheel proper consisting of a thick disk J, having a shaft *b* projecting from its side, shaft *b* being adapted to enter the hub 4 for the same purpose as does shaft 7 of the construction shown in Fig. 3. The roller-chambers *v* shown in Fig. 9 are substantially the same as those in Fig. 3, except that they are open only on one side, and thus the hammer-rolls have a bearing when striking a swaging-blow, as above described, on the opposite side of the chambers to the open one, instead of against a rotatable anvil-disk. Said modified roller-wheel construction is less advantageous to use than that having the anvil-disk in it, on account of the increased friction of the hammer-rolls when they turn in their chambers as a result of a swaging-blow given by them, whereas when bearing against said rotatable anvil-disk there is little or no friction, for the disk yields to the motion of the rolls.

Within the horizontally-extending slot *z* and at the end thereof farthest from the roller-wheel 6 is placed a fixed "die-holder" 24, (so called in contradistinction to a second die-holder below referred to, which has a reciprocating movement, see Figs. 4, 5, and 6,) which die-holder is provided with a cylindrically-formed die-chamber open at one end and through one side thereof, as shown in Figs. 5 and 6, which show, respectively, the front and rear sides of said die-holder and the die 22 therein. Said die is entered endwise into said die-chamber and there secured by a bolt 23, which has a keyed connection (see keys *x*, Fig. 2) with said die 22, said bolt extending through and beyond the rear side of the die-holder 24, and having its end squared, as shown, for the purpose of placing thereon a suitable socket or other wrench to turn the die in its holder after loosening the nut on the bolt and bring any one of the forming-grooves *c* in said die into operative position beyond the open side of the die-holder, as shown in Figs. 1 and 5. The said fixed die-holder 24 is held in place in said slot by two side plates 26, which are secured by suitable screws, as shown, against the opposite sides of the frame 2 of the machine. (See Fig. 4.) A screw 25 (the outer end of which is shown broken off) is placed through the end of the frame 2 and is screwed against the side of said die-holder 24 to serve as an abutment for the latter and to adjust said die-holder horizontally to a proper operative position. The said side plates 26 are provided with suitable openings therein around and near the ends of said bolt 23 to provide for operating the latter, as aforesaid. In some instances the said block 18 may constitute the die itself; but when the die is made separate from the block it is more easily removed and repaired.

The above-mentioned reciprocating die-holder 18 is, like said die-holder 24, placed in the said slot *z* of the frame of the machine, between the said roller-wheel and said fixed die-holder, and is held in proper operative position therein by a second pair of side plates 26, applied and secured to the opposite sides of the frame 2, as before described. The said reciprocating die-block (see Fig. 7) 18 is fitted to receive a second cylindrical die 22, which is thereto attached in substantially the same manner as above described relative to the fixed die-holder 24, and said die-holder 18 has formed in the end thereof adjoining said roller-wheel a roller-chamber, in which is placed, with capabilities of more or less of a free ro-

tary movement therein, a frictional roll 21, which, when the roller-wheel 6 rotates, receives in rapid succession the blows of the hammer-rolls 15, carried by said roller-wheel, the effect of which blows is to impart a rapid succession of movements of said die-holder 18 and the die carried thereby toward the die-holder 24 and its die.

The reciprocating die-holder 18 has a bolt 19 passing horizontally therethrough, as shown, and through the side plates 26, (the holes in the latter through which said bolt passes being somewhat enlarged, see Fig. 2,) against the ends of which bolt the flexible arms of a yoke-shaped spring 20, which is secured to the under side of frame 2, as shown, bear to force said die-holder 18 and its die away from the adjoining fixed die-holder and die when neither of the hammer-rolls 15 carried by the wheel 6 is in contact with the frictional roller 21 in the die-holder 18. The movement of said reciprocating die-holder toward the roller-wheel 6 is arrested by the contact of the ends of the bolt 19 with the edges of the said enlarged holes in the side plates 26.

A resistance-block 17, preferably of hard steel, is rigidly fixed in frame 2 at the side of the roller-wheel opposite to that which adjoins the end of the reciprocating die-block 18, said resistance-block having a curved face opposite said roller-wheel, which curve corresponds with the circle described by the outer surfaces of the hammer-rolls 15 as they rotate with the roller-wheel.

Fig. 7 illustrates the above-referred-to die-blocks and their dies, two of the hammer-rolls 15 and the anvil-disk 12 in their operative positions between said screw 25 and the abutment-block 17 as when a swaging-blow is struck against the roll 21 in the end of the die-block 18. The friction-roll 21 may, if preferred, be omitted from the die-block 18 and the hammer-rolls be permitted to strike the end of said block.

For machines of the class herein shown and described it is customary to provide some means for holding, rotating, and moving longitudinally pieces of metal which are to be inserted between the reducing-dies of the machine while performing the act of swaging or compressing the same, and to this end a bracket 27, Fig. 2, may be attached to one side of the frame 2 opposite the dies 22, and on said bracket may be mounted a head 28, in which is carried a spindle 29, on which is a hand-wheel 30. Said spindle, by grasping said hand-wheel or the handle thereof, may be rotated and moved longitudinally in said head. The end of said spindle adjoining said dies is provided with any suitable chuck *h*, in which is held a needle-blank 31, of annealed-steel wire or other similar piece of metal whose diameter is to be reduced by the swaging-dies, and the machine being in operation the operator pushes the end of said blank slowly between said dies, and its compression or reduction having been accomplished (the spindle 29 meanwhile having been continuously rotated) the blank is withdrawn, removed from said chuck, and another blank inserted in its place and the operation is repeated.

In practice, when machines of this class are used for swaging-needles, the blanks are automatically fed to and from the dies by feeding devices which are well known.

The operation of the herein-described improvements in swaging or compressing metal bars is as follows: The machine being set in motion—that is to say, the roller-wheel being caused to rotate as above set forth—the hammer-rolls 15 are brought around in rapid succession, and each is made to strike a blow against the friction-roll 21 in the end of the die-block 18, the effect of each of said blows being to drive said block and its die sharply toward the opposite fixed die. The blank 31 is now carried between said dies, as above described, and receives against it the rapid blows of the die in the block 18 until it shall have been reduced to the diameter determined by the grooves *c* of the dies, and it is then withdrawn and taken from the chuck *h*. During said compressing or swaging operation it will be seen by reference to Fig. 7 that the direct line of resistance when a blow is struck by one of the hammer-rolls is horizontally through the die-block 18, transversely through the axes of the rolls 21 and 15 and the anvil-disk 12, and that the points of resistance against which the metal-compressing strain is brought are the end of screw 25 and the face of the resistance-block 17 about centrally between its ends, for each time that a swaging-blow is struck, as aforesaid, by one of said hammer-rolls one of the latter on the opposite side of the roller-wheel is in forced contact with the face of said resistance-block, and the anvil-disk 12, being between said two oppositely-disposed hammer-rolls, receives the entire compressing force of each blow so struck.

What I claim as my invention is—

1. In a metal-swaging machine, the combination, with a movable die, substantially as described, of a rotatable roller-wheel having a series of arms projecting in a circle from the base thereof, having therebetween a series of roller-chambers, substantially as described, a rotatable anvil-disk within said series of arms, and a series of hammer-rolls carried in said chambers, having one side bearing on the periphery of said disk and the opposite side projecting beyond the periphery of said case and imparting movements to said die, substantially as set forth.

2. In a metal-swaging machine, the combination, with a movable die, substantially as described, of a rotatable roller-wheel having a series of arms projecting in a circle from the base thereof, having therebetween a series of roller-chambers, substantially as described, a rotatable anvil-disk within said series of arms, a series of hammer-rolls carried

in said chambers, having one side bearing on the periphery of said disk and the opposite side projecting beyond the periphery of said wheel and imparting movements to said die, and a resistance-block fixed in the machine opposite the periphery of said wheel, against which said hammer-rolls are carried, substantially as set forth.

3. In a metal-swaging machine, a movable die-holder having a roller-chamber in one end thereof, a friction-roller loosely fitted in said chamber, combined with a rotatable roller-wheel, a series of hammer-rolls carried by said wheel and projecting beyond the periphery thereof and having impact with said friction-roller, substantially as set forth.

4. In a metal-swaging machine, the combination, with a movable die-holder, of a spring having an engagement with said die-holder to slide it in one direction, a rotatable roller-wheel having a series of roller-chambers therein, and a series of hammer-rolls carried in said chambers and projecting through openings therein beyond the periphery of said wheel, and having an engagement with said die-holder to impart thereto intermittent movements against the action of said spring, substantially as set forth.

5. In a metal-swaging machine, the combination, with a movable die, substantially as described, of a rotatable roller-wheel having a series of arms projecting in a circle from the base thereof, having therebetween a series of roller-chambers, substantially as described, a rotatable anvil-disk within said series of arms, a spindle fixed in said disk, having bearings in said wheel and in a cover-plate thereon, a driving-pulley fixed on said spindle, a series of hammer-rolls carried in said chambers, having one side bearing on the periphery of said disk and the opposite side projecting beyond the periphery of said wheel and imparting movements to said die, and a resistance-block fixed in the machine opposite the periphery of said wheel, against which said hammer-rolls are carried, substantially as set forth.

6. A swaging-machine frame substantially as described, having a circular chamber therein, a horizontal parallel-sided die-holder slot extending laterally from said circular chamber, and a hollow driving-shaft hub thereon extending at right angles to the side of said frame, combined with a movable die-holder, a die attached to said holder, a resistance-block fixed in said frame opposite the end of said die-holder, a rotatable roller-wheel turning in said chamber, having a driving-shaft entering said hub, and having a series of roller-chambers therein, a series of hammer-rolls carried in said chambers and projecting through openings therein beyond the periphery of said wheel, and having during the rotation of said wheel engagement successively with said die-holder and with said resistance-block, and a plate secured to and covering the end of said roller-wheel, substantially as set forth.

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