No. 824,866. PATENTED JULY 3, 1906.

J. A. HORTON.

MACHINE FOR FORMING WIRE DRAWING DIES.

APPLICATION FILED JULY 3, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

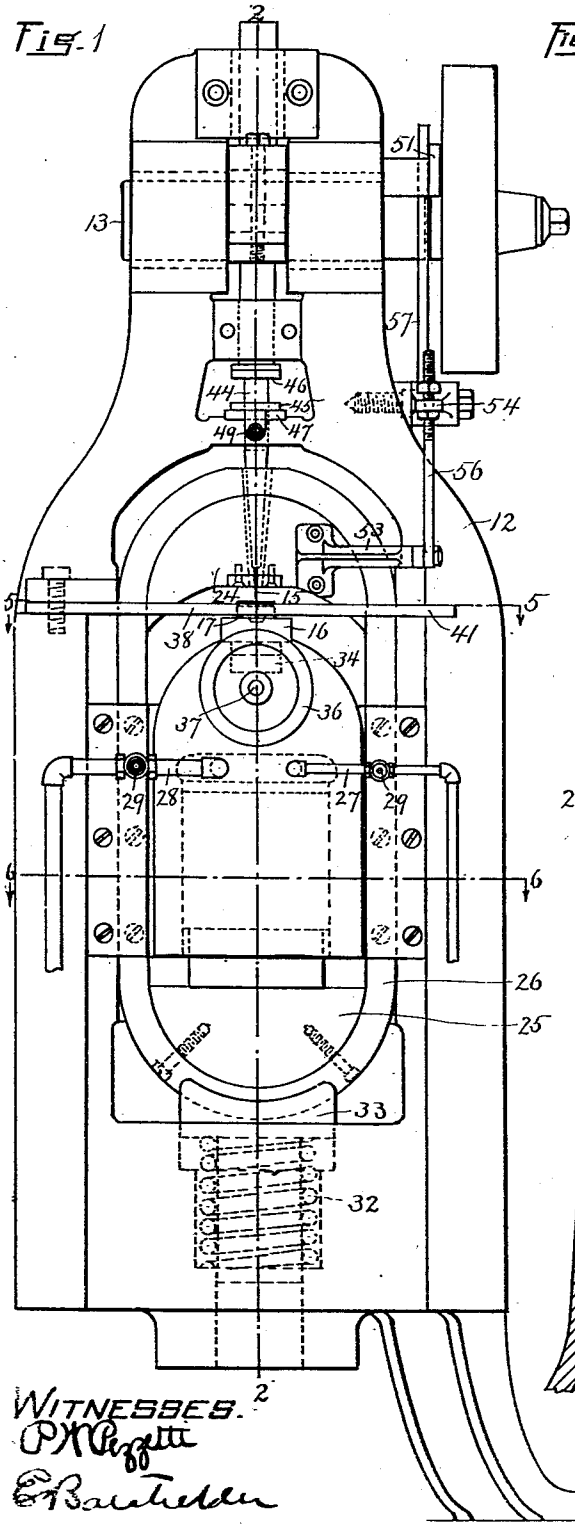
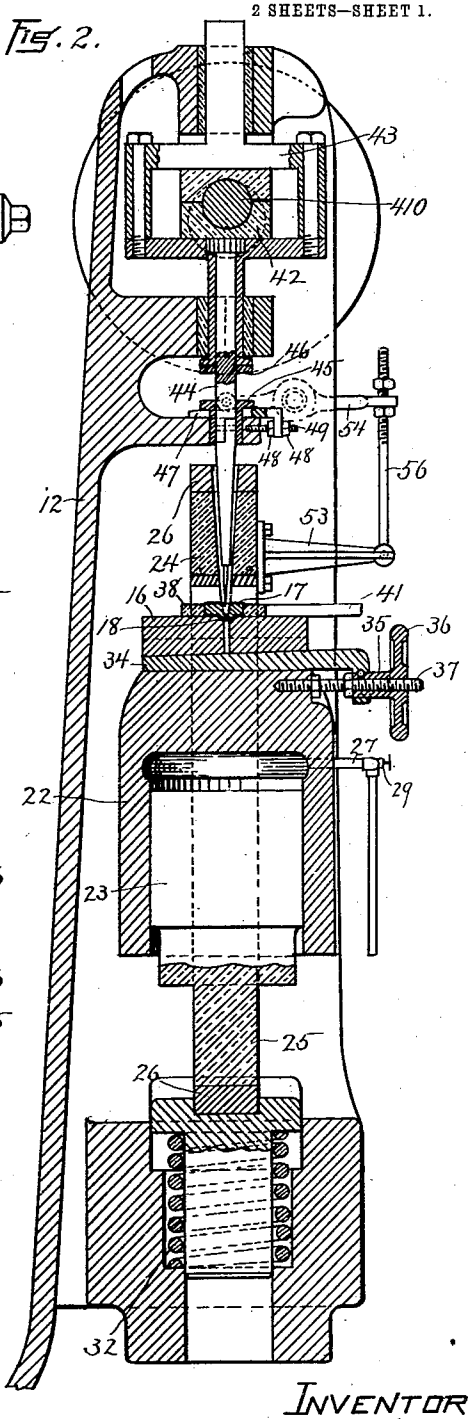


Fig. 2.



WITNESSES.

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2 SHEETS—SHEET 2.

Fig. 3.

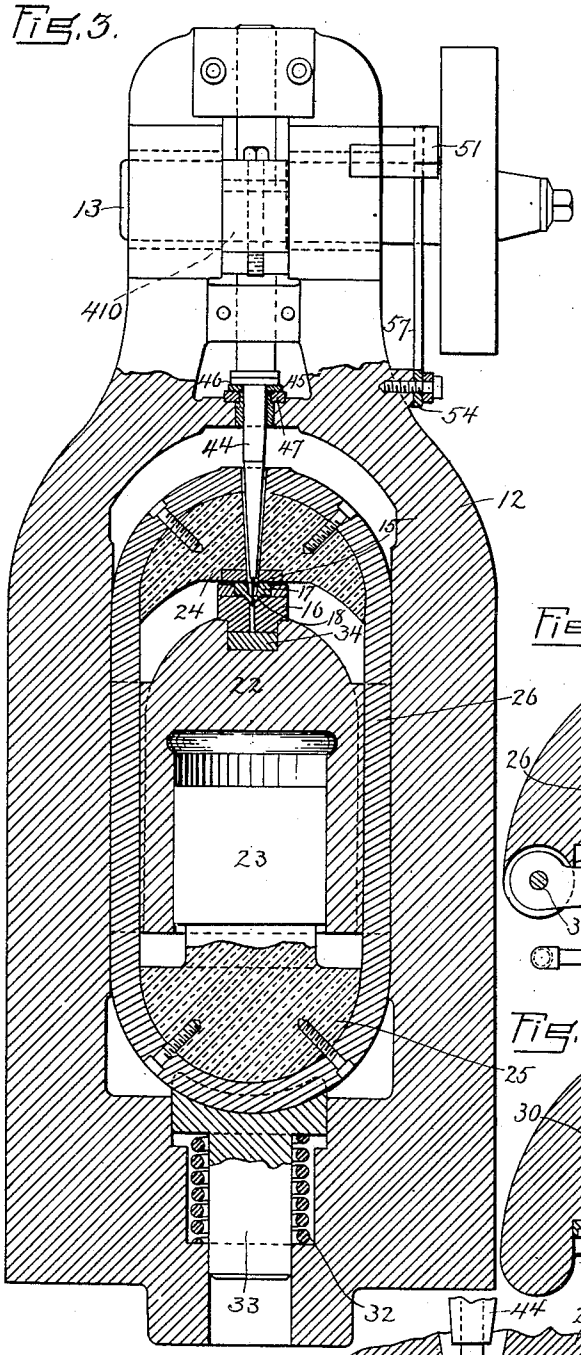


Fig. 4.

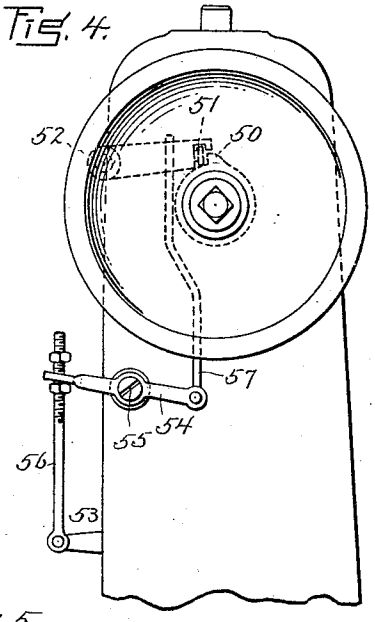


Fig. 5.

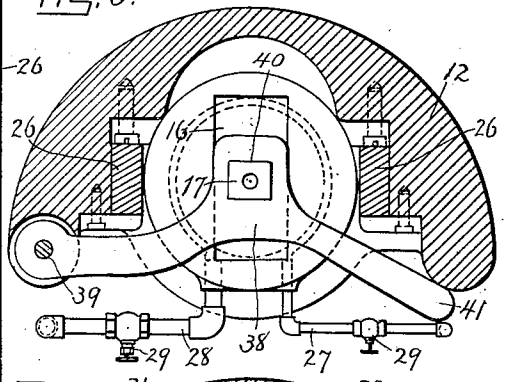


Fig. 6.

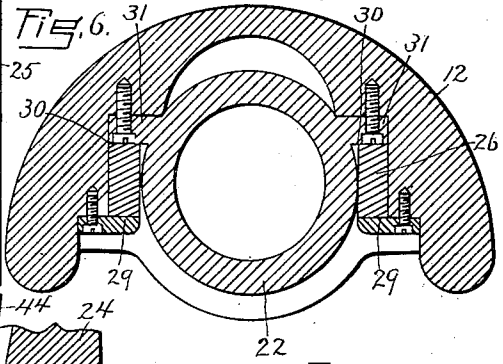
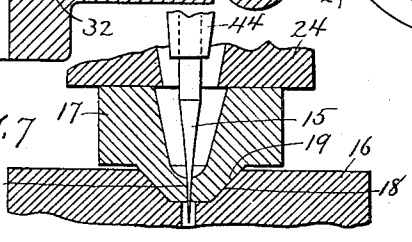


Fig. 7



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UNITED STATES PATENT OFFICE.

JAMES A. HORTON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO IROQUOIS MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MACHINE FOR FORMING WIRE-DRAWING DIES.

No. 824,866. Specification of Letters Patent. Patented July 3, 1906.

Application filed July 3, 1905. Serial No. 268,158.

To all whom it may concern:

Be it known that I, JAMES A. HORTON, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Machines for Forming Wire-Drawing Dies, of which the following is a specification.

This invention relates to the formation in a block or body of steel or other suitable metal of a tapering or conical orifice, the smaller end of which constitutes the throat or acting portion of a wire-drawing die. The wire to be drawn or reduced is passed through said orifice, the wire on entering the die being of larger diameter than the orifice, and emerging from the die reduced to the exact diameter of the orifice. The friction of the wire against the wall of the orifice, particularly in drawing iron and steel wire, causes a gradual enlargement of the orifice, so that it is necessary to re-form the orifice after the drawing of every coil of wire to restore the orifice to the exact diameter desired. This re-forming operation has heretofore been performed practically as follows: The orifice of the die is first scraped by a reamer to remove grit and dirt. The face of the die is then hammered to condense the metal, and thus contract the orifice at its smaller end, the orifice being thus partly closed and its symmetry destroyed. The orifice is then swaged to give it the exact circular form and diameter required by inserting in it a tapered swaging-tool or driving-punch and reciprocating said tool until the orifice is sufficiently enlarged and properly formed.

Heretofore the operation of hammering the die to contract the die-orifice has been performed separately from the swaging operation, the two operations being performed by independent means. That is to say, it has been customary to first hammer the die either by hand or by a special hammering-machine for the purpose of contracting the die-orifice and then to subject the die to a reciprocating swaging-tool operated either by a hand-controlled hammer or by special mechanism provided for that purpose, as shown in Letters Patent of the United States No. 796,726, granted to me August 8, 1905.

The present invention has for its object, first, to facilitate the operation of remaking the wire-drawing die by performing simultaneously, or practically so, the operations of contracting the die-orifice and of forming the same to give it a predetermined size and shape.

The invention also has for its object to provide improved means for contracting the worn orifice of a wire-drawing die.

To this end the invention consists, first, in an improved machine for remaking wire-drawing dies, comprising means for compressing the metal of the die inwardly toward the die-orifice, and thus contracting the latter, and means operating simultaneously with the said compressing means for enlarging and re-forming the contracted orifice.

The invention consists, secondly, in an improved die-compressing means adapted to compress the metal of a die wholly in an inward direction toward the die-orifice, said device being capable of use either independently or as an element of a machine which includes a die-forming tool operating within the die-orifice.

Of the accompanying drawings, forming part of this specification, Figure 1 represents a front elevation of a machine embodying my invention. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents a partial vertical section and partial front elevation of the machine. Fig. 4 represents a side elevation of the upper portion of the machine. Fig. 5 represents a section on line 5 5 of Fig. 1. Fig. 6 represents a section on line 6 6 of Fig. 1. Fig. 7 represents an enlargement of a portion of Fig. 3.

The same reference characters indicate the same parts in all the figures.

In the drawings, 12 represents the supporting-frame of the machine, having in its upper portion bearings for an operating-shaft 13, from which a reciprocating motion is imparted to the die-forming tool or driving-punch 15, shown in Fig. 7.

16 represents a die-support which is rigidly although preferably adjustably sustained and is provided with means for compressing the acting portion of a wire-drawing die 17, said means comprising in this embodiment of my invention a cavity 18, formed in the upper surface of the support 16, said cavity having inclined walls constituting a seat

adapted to fit correspondingly-inclined faces 19, formed on the die and surrounding the die-orifice 20. When the die is forced, under extremely heavy pressure, against the die-support, the seat in the latter will exert inward pressure on the die, thus compressing the metal of the die inwardly toward the die-orifice 20 and contracting the latter sufficiently to compensate for previous wear of said orifice and to enable the forming-tool 15 to act percussively on the orifice and give the latter the desired predetermined size and shape. The two operations of compressing the die to contract the die-orifice and hammering the contracted orifice to impart to it the predetermined form are performed practically simultaneously, the tool 15 being rapidly reciprocated while the compressing pressure is being applied to the die, so that when the pressure is completed the die-orifice has been swaged or hammered to the desired form and size.

The means here shown for applying the die-compressing pressure comprise a hydraulic press having an inverted cylinder 22, affixed rigidly to the frame of the machine, a piston 23, which is movable downwardly in the cylinder by hydraulic pressure introduced into the cylinder above the piston, a die-presser 24, arranged to bear upon the upper surface of the die, and connections between the said presser and piston whereby the downward movement of the piston causes a downward pressure of the presser upon the die. The said connections, as here shown, include an extension 25 of the piston 23 and a yoke 26, engaged at one end with the extension 25 and at the other end with the presser 24, as shown in Fig. 3.

27 represents an inlet-pipe for the impelling fluid, and 28 represents the outlet or exhaust pipe, said pipes connecting with the upper portion of the cylinder and being provided with suitable controlling-valves 29.

The supporting-frame 12 is provided with suitable guides 30, Fig. 6, for the side portions of the yoke 26.

The cylinder 22 is preferably provided with flanges 31, Fig. 6, which are bolted to the supporting-frame.

Means are employed for raising the piston 23 and the presser 24 after their depression by the impelling fluid to permit the removal of the die from between the presser and the die-support and the insertion of another die between said parts. For this purpose I prefer to employ a stout helical spring 32, located in a recess in the lower portion of the supporting-frame and exerting upward pressure on the yoke 26 through a sliding plunger 33.

The die-support 16 is sustained by the fixed cylinder 22, although it may be sustained by any other fixed support, means being preferably employed for adjusting the die-support vertically to determine the distance to which the forming-tool 15 will enter the die-orifice, the size imparted to the die-orifice by the tool 15 being determined by the depth of entrance of the tool into the orifice. The preferred adjusting means comprise a wedge-shaped slide 34, interposed between the head of cylinder 22 and the die-support, the latter having an inclined bottom surface fitting the correspondingly-inclined top surface of the slide 34, as shown in Fig. 2. The slide 34 is movable endwise by means of a nut 35, rotatively engaged with its outer end and provided with a hand-wheel 36, the said nut engaging a screw-threaded stud 37, affixed to the cylinder 23.

38 represents a swinging die-carrier which is pivoted at 39 to the frame of the machine and has a cavity 40, adapted to receive the die, and a handle 41, whereby it may be moved inwardly to locate the die over the die-support and outwardly to withdraw the die from said support. The operator places the die loosely in the cavity 40 when the latter is over the outer portion of the die-support, so that the latter forms a bottom for the cavity, preventing the die from dropping through. When the carrier is swung inwardly sufficiently to bring the tapered portion of the die into coincidence with the tapered seat in the die-support, the die drops in the carrier sufficiently to come to a bearing on the tapered seat.

The operating-shaft 13 has an eccentric portion or crank 41 engaging a slide 42 in a yoke 43, which yoke is reciprocated by the rotation of the shaft 13 and imparts a reciprocating motion to a rod or stem 44, which is movable in suitable guides in the supporting-frame and serves as a carrier for the forming-tool 15, the latter being inserted in a socket formed for its reception in the lower portion of said carrier.

It is very important that the downward stroke of the forming-tool be arrested at an exactly predetermined point. To prevent any indefiniteness or uncertainty in the limit of the downward stroke of the tool, such as would be due to backlash and lost motion in the mechanism which imparts motion from the operating-shaft to the tool, I provide a stop or abutment 45, rigidly supported by the frame of the machine and adapted to cooperate with a shoulder or enlargement 46, rigidly attached to the rod or tool-carrier 44, in arresting the downward movement of the tool-carrier. The abutment 45 is adjusted with great nicety, so that the enlargement 46 comes in contact with it when the forming-tool has descended to a predetermined position. Means are preferably employed for adjusting the abutment 45, said means comprising a wedge-shaped slide 47, interposed between the abutment and a part of the sup-

porting-frame, and adjusting-nuts 48 48, bearing on opposite sides of an ear formed on one end of the slide 47, said nuts engaging a fixed screw-threaded stud 49. The adjustment of the abutment allows it to be so positioned that the enlargement 46 may contact with it just at the end of the predetermined downward stroke of the tool under the influence of the reciprocating mechanism. The abutment prevents the tool from entering the die beyond the distance effected by the normal stroke—a condition which might result from factors of uncertainty—such as the elasticity of the frame, flexure of moving parts, and backlash, as well as from the initial diameter of the die-orifice prior to the compressing operation, it being a fact that some dies are enlarged by wear to a greater extent than others. In some cases the die is stopped up or clogged by material removed from the wire, so that the initial diameter of its orifice is less than when the orifice has been cut out without being clogged or stopped up. The stop or abutment and the shoulder or member on the die-carrier coöperating therewith compensate for the said factors of uncertainty and insure the enlargement of the die-orifice to a uniform predetermined size by the die-forming movement of the tool in all cases.

The operating-shaft 13 is provided with a clutch or stop member 50, Fig. 4, which cooperates with a swinging stop or clutch member 51, pivoted at 52 to the frame of the machine in arresting rotation of the shaft and the movement of the forming-tool. The clutch member 51 is raised automatically out of the path of the clutch member 50 by the descent of the piston 43 through suitable connections, comprising an arm 53, affixed to the yoke 26, a lever 54, pivoted at 55 to the supporting-frame, one end of said lever being connected by a rod 56 with the arm 53, and a rod 57, connecting the other end of the lever 54 with the swinging clutch member 51. The said connecting parts are so arranged that a downward movement of the piston 23 will raise the clutch member 51 and disengage it from the clutch member 50, thus permitting the rotation of the shaft. When the piston is raised by the action of the spring 32, the clutch member 51 is lowered into position to engage the clutch member 50, and thus stop the rotation of the shaft.

It will be seen that the metal of the die is displaced by the compressing means wholly inwardly toward the die-orifice, the direction of the compressing pressure being inward and approximately horizontal or at right angles with the length of the die-orifice. Heretofore the displacement of the metal has been effected vertically or in a direction substantially parallel with the length of the die-orifice by a hammer applied to the face of the die, the result being an outward as well as an inward displacement of the metal. The outward displacement of the metal gives no useful result and is, on the contrary, objectionable, because it involves waste of time and energy and decreases the durability of the die. By eliminating all outward displacement of the metal I obviate these objections.

Important advantages resulting from the employment of a hydraulic press as a means for applying compressing pressure to a die are as follows: First, no adjustment of the mechanism is required to dies of different sizes, the presser 24 being adapted to stand at any distance from the die-support at the commencement of the operation that may be required by the thickness of the die; secondly, no strain is exerted on the frame of the machine by the compression of the die, because the pressure of the impelling fluid on the head of the cylinder and on the piston are balanced, so that there is no tendency of the pressure to strain the frame or the connections between the cylinder and the frame, the said pressure being sustained wholly by the cylinder-head which is under compression, due to the pressure of the impelling fluid in one direction against the cylinder-head and in the opposite direction against the piston. There is therefore no liability of a strain on the frame causing derangement of the predetermined relation between the die and the die-forming tool.

The die-support and die-presser constitute members of a die compressing or contracting machine which may be used independently of the forming-tool 15 for preparing dies for the action of a hand-operated forming-tool or for a die-forming machine, such as that shown in my above-mentioned application. While a hydraulic press is the best means known to me for applying the compressing pressure, I do not limit myself thereto and may use any other means suitable for the purpose.

It will be seen that the parts 16 and 24 constitute opposed pressing members adapted to exert compressive pressure in opposite directions on opposite ends of a die and that the inclined or tapered cavity 18 constitutes means on one of said members for translating the compressive pressure and directing it radially inward toward the center of the die-orifice. The forming-tool 15 and the mechanism for reciprocating it constitute means operating simultaneously with the said pressing members and within the cavity 18 to enlarge and re-form the die-orifice and properly harden and condense its wall.

I claim—

1. A machine for remaking wire-drawing dies, comprising compressing means adapted to act on the exterior of the die to compress the metal of the die inwardly, toward the die-orifice, and thus contract the latter, expand-

ing means, and means for causing said expanding means to act simultaneously with the compressing means and within the die, to enlarge and re-form the die-orifice.

2. A machine for remaking wire-drawing dies, comprising compressing means adapted to act on the exterior of the die to compress the metal of the die inwardly, toward the die-orifice, and thus contract the latter, a reciprocable forming-tool movable within the die to enlarge and re-form the die-orifice, and means for operating simultaneously with said pressing means for reciprocating said forming-tool.

3. A machine for remaking wire-drawing dies, comprising relatively movable opposed pressing members adapted to exert compressive pressure in opposite directions on opposite ends of a die, one of said members having means for translating or directing the compressive pressure radially inward, toward the center of the die-orifice, and means for operating simultaneously with the said pressing members and within the pressure-directing means, to enlarge and re-form the die-orifice.

4. A machine for remaking wire-drawing dies, comprising a fixed die-support formed to contract the die-orifice, a press having a movable member opposed to said die-support, a reciprocable forming-tool adapted to act within the die-support to enlarge and re-form the die-orifice, and means for causing the simultaneous action of said press and forming-tool.

5. A machine for remaking wire-drawing dies, comprising a die-support having a tapered die-seat adapted to receive the orifice-containing portion of the die, a member for applying pressure to a die on said support to cause the compression of the said portion by the said seat, a forming-tool adapted to act within the die-seat to enlarge and re-form the die-orifice, and means for causing the simultaneous action of said parts.

6. In a machine for remaking wire-drawing dies, a die-support having a tapered die-seat adapted to receive the orifice-containing portion of the die, means for applying pressure to the die, a reciprocable forming-tool adapted to act within the die-seat, and means for adjusting said support longitudinally of the forming-tool to determine the size of the die-orifice.

7. In a machine for remaking wire-drawing dies, a die-support having a tapered die-seat formed to contract the die-orifice, a die-presser opposed to the die-support and having a central opening, means for decreasing the distance between the presser and the die-support, and a die-forming tool extending through the opening in the presser and adapted to act within the die-contracting means of the die-support, and means for operating the die-forming tool independently of the presser.

8. A machine for remaking wire-drawing dies, comprising a die-support formed to contract the die-orifice, a die-presser opposed to the support, a press having a fixed inverted cylinder, and a piston movable outwardly therein, said piston having an extension, a yoke engaged with the said extension and presser, and having a tool-receiving opening, and a forming-tool movable through the said opening and acting within the die-contracting means of the die-support.

9. A machine for remaking wire-drawing dies, comprising a die-support formed to contract the die-orifice, a die-presser opposed to the support, a press having a cylinder, and a piston movable therein, connections between the said piston and presser, a die-forming tool adapted to act within the die-contracting means of the die-support, a crank-shaft for reciprocating the tool, a clutch for arresting and releasing the shaft, and connections between the piston and the clutch, whereby outward movement of the piston makes the clutch operative, while inward movement of the piston makes the clutch inoperative.

10. In a machine for remaking wire-drawing dies, a die-forming tool, a holder for the same, means for reciprocating the holder, and means for positively limiting the die-forming movement of the holder at a predetermined point, to compensate for factors of uncertainty.

11. In a machine for remaking wire-drawing dies, a forming-tool carrier having a shoulder or enlargement, means for reciprocating said carrier, and a rigidly-supported stop or abutment adapted to arrest the die-forming movement of the said shoulder and tool.

12. In a machine for remaking wire-drawing dies, a forming-tool carrier having a shoulder or enlargement, means for reciprocating said carrier, an adjustable rigidly-supported stop or abutment adapted to arrest the outward movement of said shoulder and tool, and means for adjusting said stop.

13. A machine for remaking wire-drawing dies, comprising a fixed die-support having a die-compressing seat, a movable die-presser opposed to the support, a press including a fixed cylinder having a closed end sustaining the die-support, and a piston movable in said cylinder, a yoke connecting said piston with the die-presser and extending across the latter, said yoke having an opening coinciding with the orifice of a die supported by the die-support, a longitudinally-movable die-forming tool movable in said opening to act on the orifice of the die, and means for reciprocating said tool.

14. A die-compressing machine comprising

two relatively movable opposed members, one having a die-compressing seat adapted to displace the metal of the die wholly toward the die-orifice when the distance between the members is decreased, the said members having openings in alinement with each other and with the said seat, means for decreasing the distance between the members, a longitudinally-movable tapered die-forming tool movable in said openings, and means for reciprocating said tool.

In testimony whereof I have affixed my signature in presence of two witnesses.

JAMES A. HORTON.

Witnesses:
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E. BATCHELDER.