N. K. TURNBULL.

MACHINE FOR REMAKING WIRE DRAWING DIES.

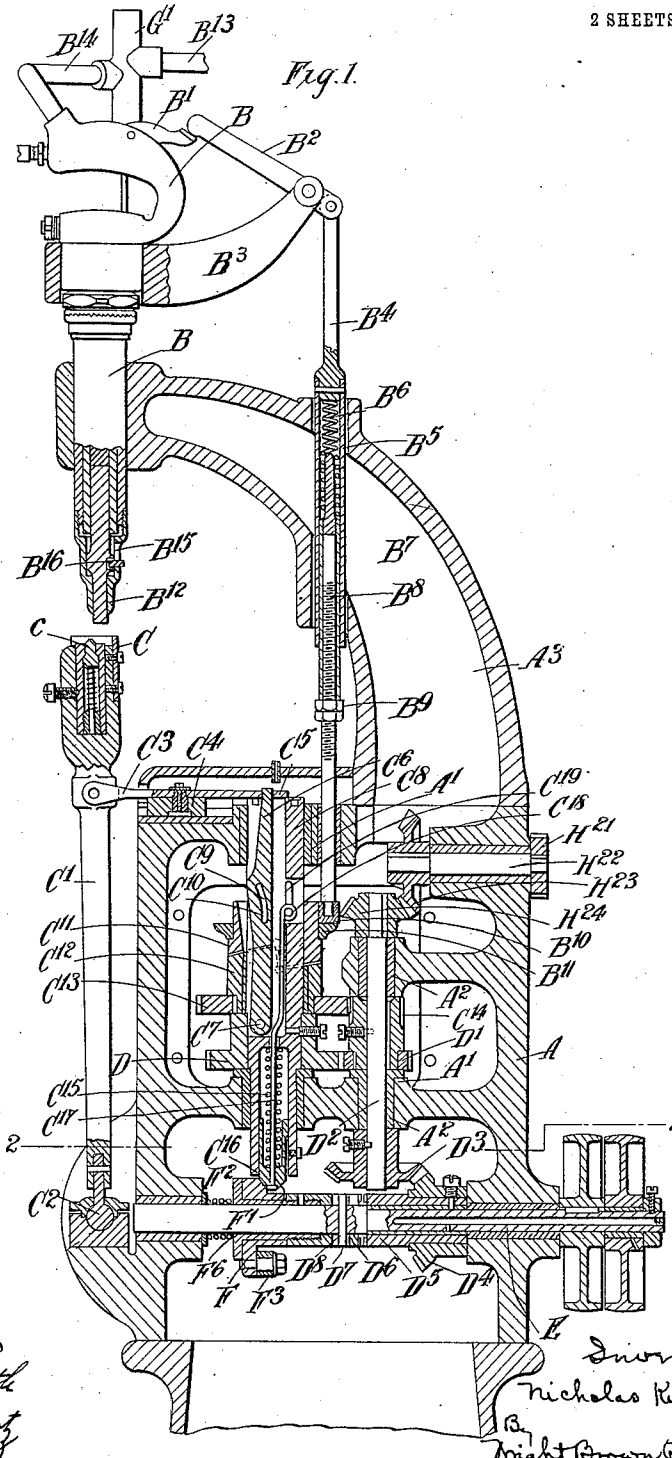
APPLICATION FILED OCT. 4, 1910.

1,041,200.

Patented Oct. 15, 1912.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 1a.

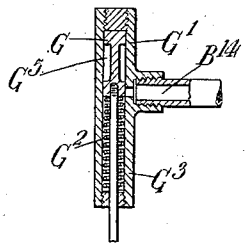


Fig. 4.

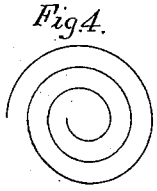


Fig. 2.

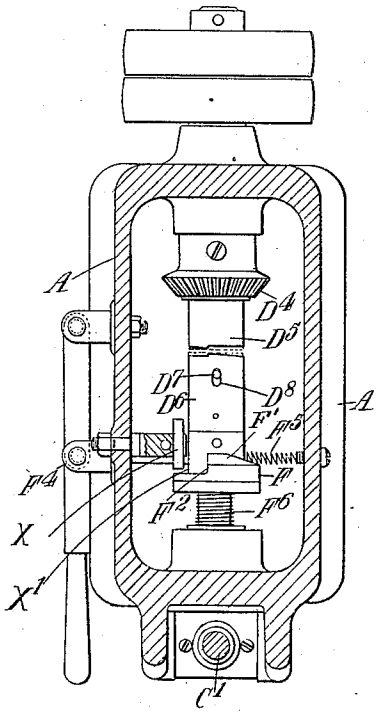
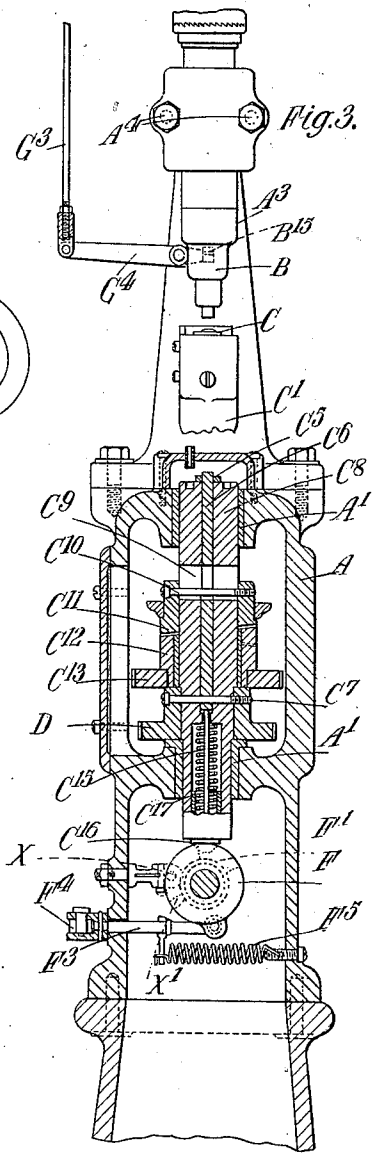


Fig. 3.



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UNITED STATES PATENT OFFICE.

NICHOLAS KING TURNBULL, OF MANCHESTER, ENGLAND.

MACHINE FOR REMAKING WIRE-DRAWING DIES.

1,041,200. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed October 4, 1910. Serial No. 585,182.

To all whom it may concern:

Be it known that I, NICHOLAS KING TURNBULL, a subject of the King of Great Britain, residing at Wire Works, Trafford Park, Manchester, in the county of Lancaster, England, have invented certain new and useful Improvements in Machines for Remaking Wire-Drawing Dies, of which the following is a specification.

This invention relates to a machine for re-making wire drawing dies after the same have become worn by the passage of the wire therethrough. This operation has usually been accomplished by heating the dies in a suitable furnace to the required temperature after which the hammering has been effected by hand while the die has been held in a pair of tongs. This hammering process requires great skill on the part of the operator in order to deliver the blows around the eye of the die without striking the edge of the eye.

According to this invention the machine is so devised that the entire series of blows required for remaking the die are effected at each cycle of operations performed by the machine and an important feature of the invention consists in causing the die to describe a predetermined path in relation to the hammering point of a pneumatic or other appropriate hammer capable of completing the hammering process at each cycle of operations performed by the machine, and to effect this movement in such a manner that the hammering operation is commenced at some distance away from the eye and terminates in proximity thereto with the result that the metal is caused to flow from the outer portion of the die toward the eye and thereby to effect the closing in process of the latter more efficiently. Previous to the hammering operation the dies are caused to pass through any suitable furnace where they are heated to the required temperature and are fed one by one on to an anvil where the hammering is effected, the feed being preferably so arranged that when one die has been hammered another die is fed automatically on to the anvil from the furnace thereby displacing the preceding die which is allowed to fall into a suitable receptacle to cool gradually.

A further important feature of the invention consists in providing means whereby the hammering mechanism is rendered inoperative unless a die is placed between the hammer head and the anvil thereby avoiding damage to the machine.

In order that the said invention may be clearly understood and readily carried into effect the same is described more fully with reference to the accompanying drawings which illustrate a die hammering machine of which the hammering portion is so arranged that the anvil describes a spiral path in relation to the hammering point.

Figure 1 is a vertical section of the hammering portion of the machine. Fig. 1[A] is a detached view of a valve arrangement for rendering the hammer inoperative until a die has been placed in position between the hammer and the anvil. Fig. 2 is a horizontal section taken approximately on line 2—2 of Fig. 1. Fig. 3 is an end elevation partly in section of the die hammering portion of the machine. Fig. 4 is a diagram showing the line of beatings produced upon a die.

The machine comprises an upright frame A which carries a pneumatic hammer B, the anvil C, the mechanism for controlling the movement of the latter and the mechanism for actuating the pneumatic hammer and for preventing the latter from being brought into operation until a die has been inserted between the anvil and the hammer.

The anvil C is conveniently made in the form of a short tube that is detachably secured within the end of an upright shaft C′ and carries a spring controlled centering device *c* adapted to engage with the larger portion of the aperture on the back of the die and to retain the latter in position upon the anvil during the hammering process. The lower end of the shaft C′ terminates in a ball C^2 that is inclosed within a suitable spherical bearing supported by the frame A, this arrangement being provided to permit of the shaft C′ moving freely in every direction around the center of the ball C^2. The mechanism for causing the shaft C′ to describe a spiral path in relation to the hammering point comprises a forked lever C^3 pivoted to the shaft C′ and also to a block C^4 that is slidably mounted in the frame A. The opposite end of the lever is formed with an aperture C^5 through which passes the end of an upright lever C^6 which is pivoted at C^7 in a recess formed in an upright shaft C^8 rotatably mounted in bearings A′ carried by the machine frame A.

The shaft C^8 derives its rotary motion from a toothed wheel D that is fixed to such shaft and gears with a toothed wheel D′ fixed to a shaft D^2 rotatably mounted in bearings A^2 carried by the machine frame. The lower end of the shaft D^2 carries a bevel wheel D^3 which gears with a bevel wheel D^4 secured to a clutch member D^5 that is rotatably mounted upon a main driving shaft E. The shaft C^8 is arranged to make three revolutions for each hammering operation and during these three revolutions the lever C^6 is gradually moved from the position shown in Fig. 1 to a position in which the end of the lever will become approximately concentric with the center line of the shaft C^8. This is effected by forming the lever C^6 with an inclined slot C^9 for a pin C^{10} which passes through slots formed longitudinally in the shaft C^8 and terminates in the opposite sides of a cam C^{11} that is slidably mounted upon the shaft C^8 but is compelled to rotate therewith by reason of the aforesaid pin C^{10}. Situated below the cam C^{11} is a similar cam C^{12} that is rotatably mounted upon the shaft C^8 and carries a toothed wheel C^{13} that gears with a toothed wheel C^{14} fixed upon the shaft D^2. Each cam C^{11}, C^{12} is formed with an inclined stepped surface and the ratio of the gear wheels C^{13} and C^{14} in relation to the gear wheels D and D′ is such that during three revolutions of the shaft C^8 the cams C^{11}, C^{12} make one complete revolution relatively to each other whereby the cam C^{11} is raised the full depth of the stepped surface. This motion of the cam C^{11} causes the pin C^{10} to travel up the inclined slot C^9 in the lever C^6 as the spindle C^8 is making its three revolutions and thereby to move the lever C^6 to its innermost position. The said lever is thus caused to describe a spiral path and its motion is transferred to the anvil C through the pivoted and sliding lever C^3 connecting the shaft C′ and the lever C^6. As soon as the spindle C^8 has made its three revolutions the stepped portions of the cams C^{11}, C^{12} become linable with each other and the cam C^{11} is returned to its lowermost position upon the cam C^{12} by a spring C^{15}. The latter exerts pressure upon a plunger C^{16} that is cone-shaped at its outer end and is slidably mounted in the spindle C^8 and connected by a rod C^{17} and transverse pin C^{18} to the cam C^{11} the said pin passing through a slot C^{19} formed longitudinally in the spindle C^8. Slidably mounted upon the driving shaft E is a clutch member D^6 that is prevented from rotating upon such shaft by a pin D^7 which passes transversely therethrough and through slots D^8 formed in the said clutch member. Rotatably mounted upon a continuation of the clutch member D^6 is a cam F hereinafter referred to as the starting cam. This cam is formed with an inclined surface F′ and with a stepped portion F^2 and is connected by a link F^3 to a starting handle F^4. A spring F^5 is connected to the said link and normally retains the starting handle and cam in the position indicated in the drawings. In this position the inclined surface F′ of the cam is caused by the spring F^6 to engage with the conical surface of the plunger C^{16} and so maintains the driving clutch member D^6 out of engagement with the clutch member D^5.

The pneumatic hammer B is clamped in a curved arm A^3 of the machine frame by the screws A^4 so as to permit of vertical adjustment of the hammer to compensate for dies of different thicknesses.

B′ represents the lever of an air inlet valve which normally remains closed when the machine is not in operation. This valve is adapted to be actuated by a lever B^2 pivoted to an arm B^3 carried by the hammer and such lever is connected to a rod B^4 that is capable of longitudinal adjustment and is provided with a spring escapement which will permit of the contraction of the rod in an endwise direction. In the arrangement shown the rod B^4 is connected with an outer tubular portion B^5 within which is situated a spring B^6 adapted to exert pressure against the inner end of the rod B^4 and a tubular member B^7 that is slidably mounted within the tubular portion B^5. Passing through the tubular member B^7 is a screwed rod B^8 which engages with a screwed portion of such member and is provided with lock nuts B^9 for securing the rod B^8 in any adjusted position in relation to the member B^7. The outer end of the rod B^8 is provided with a detachable shoe B^{10} which rests upon a collar B^{11} that is supported by a shoulder on the cam C^{11}. This arrangement is designed to open fully the air inlet valve at the commencement of the upward movement of the cam C^{11}, the remaining upward movement of the latter compressing the spring B^6 without imparting any further movement to the valve. In order to prevent the hammer being put into operation in the event of the machine being started when there is no die upon the anvil C the hammer is so arranged in relation to the anvil that before a die can be inserted between the hammer head B^{12} and the anvil, it is necessary to raise such head slightly. This motion is utilized to open a supplementary valve which normally closes the communication between the air inlet pipe B^{13} and a passage B^{14} leading to the air inlet valve. In the arrangement shown the supplementary valve comprises a piston valve G, (Fig. 1A,) that is normally retained at the top of a cylinder G′ by a spring G^2. In this position the valve blocks the com-

munication between the air inlet pipe B^{13} and the passage B^{14} leading to the air inlet valve. The valve G is connected by a rod G^3 to a lever G^4 (Fig. 3) pivoted to the casing of the hammer B and the inner end of this lever passes through a slot B^{15} formed in such casing and enters an aperture B^{16}, (Fig. 1) formed in the side of the hammer head. When the latter is raised by the insertion of a die, the piston valve G is lowered until an annular recess G^5 extending around the same puts the air inlet pipe into communication with the passage leading to the air inlet valve. If the starting handle F^4 (Fig. 2) is now moved to its starting position, the stepped portion F^2 of the starting cam is brought into line with the plunger C^{16} with the result that the spring F^6 imparts an endwise movement to the cam F and causes the driving clutch D^6 to gear with the clutch member D^5. Motion is now transmitted to the shaft D^2 from the bevel wheels D^4, D^3 thereby rotating the spindle C^8 and cam C^{11} through the toothed wheels D′, D and the cam C^{12} through the toothed wheels C^{14}, C^{13}. The difference in the speed at which the cams C^{11}, C^{12} revolve causes the cam C^{11} to rise and to incline the lever C^6 toward the axis of the spindle C^8. This motion together with the rotary motion of the spindle is transmitted through the lever C^3 to the anvil C with the result that the latter is caused to describe a spiral path under the point of the hammer head B, and as the hammer is put into operation as soon as the cam C^{11} begins its upward movement, the hammering process is commenced at some distance from the eye of the die and is continued around the same at a gradually decreasing distance. When the spindle C^8 has completed three revolutions the lever C^6 has arrived at its innermost position, the cam C^{11} is in its highest position and is about to return to its lowest position in relation to the cam C^{12}. In this position the plunger C^{16} clears the stepped portion F^2 of the starting cam F whereupon the spring F^5 returns the latter together with the starting lever to their original positions so that when the cam C^{11} is returned to its lowest position by the spring C^{15} the plunger C^{16} comes into contact with the inclined portion F′ of the starting cam and withdraws the driving clutch D^6 out of engagement with the clutch member D^5 and thereby stops the machine. To enable the machine to be instantly stopped at any period of its cycle an adjustable stop X is situated in proximity to the starting cam F, and the latter is formed with an inclined portion X′ that is adapted to be brought into engagement with the aforesaid stop by moving the lever F^4 from its starting position to its extreme out position. This movement causes the driving clutch D^6 to be disengaged from the clutch D^5 whereupon the machine stops. This result is effected by simply rotating the cam F by means of the handle and link connection, as far as said cam can be shifted in the direction to carry the inclined portion X′ into contact with and slightly beyond the stop X.

Owing to the fact that the hammer is mounted in a fixed guide, as shown in Fig. 1, so that said hammer always reciprocates in the same line, it is entirely feasible to operate the hammer pneumatically and control such operation as described. To affect the results on the work, there is a relative movement, but the movement is confined entirely to the anvil and the work, said movement being not only around a point coincident with the axis of the hammer or its line of operation, but also toward that point, whereby the described effect of causing the metal to be worked from the outer portion of the die toward the eye is obtained. The machine having the movement that is necessary to cause the lateral working of the metal confined entirely to the anvil or work support is simpler and easier to operate and control than where both the anvil and the hammer have lateral movements imparted to them.

What I claim and desire to secure by Letters Patent of the United States is:—

1. In a machine for remaking wire drawing dies, a hammer, a fixed guide therefor, a die support movable in any required direction, a rotating member effecting a rotary movement of the die support around the stationary axis of the hammer, and a member adapted gradually to move the die support toward the said hammer axis during its rotary movement around the axis.

2. In a machine for re-making wire drawing dies, a hammer that is capable of delivering a series of blows in rapid succession, a die support that is movable in any required direction, a rotating shaft having a space within it, a lever mounted in said space, means for advancing the lever toward the center of the shaft during the rotation of the latter, and a slidable fulcrum block between the lever and the die support.

3. In a machine for re-making wire drawing dies, a hammer capable of delivering a series of blows in rapid succession, a movable hammer member, a die support, a device for preventing the hammer from being operated, and an operative connection from the said device to the movable hammer member, adapted to release the hammer for operation on the insertion of a die between the die support and the hammer.

4. In a machine for re-making wire drawing dies, a pneumatic hammer capable of delivering a series of blows in rapid succession, a die support and means for simultaneously moving the same around and to-

ward the hammer, an air inlet valve for controlling the supply of air to the hammer, and a supplementary valve that normally excludes the passage of air to the air inlet valve, a lever operatively connected with the hammer and with the supplementary air valve and operated by the movement of the hammer to open such valve when a die is inserted between the hammer and the die support.

5. In a machine for re-making wire drawing dies, a hammer capable of delivering a series of blows in rapid succession, a die support, means for moving the die support around and toward a point coincident with the axis of the hammer, a device for automatically stopping the machine, and controlling means for the said device adapted to actuate it when the die support has reached its predetermined innermost position with regard to the axis.

6. In a machine for re-making wire drawing dies, a hammer that is capable of delivering a series of blows in rapid succession, a die support, that is movable in any required direction, means for causing the die support to travel around the hammer a predetermined number of times and simultaneously to advance toward the hammer, a rotating shaft operatively connected with the die support, a stepped face cam slidably and non-rotatably mounted upon such shaft, a similar cam rotatably mounted upon such shaft and having its stepped surface arranged to rotate in contact with the stepped surface of the first mentioned cam, means for driving the rotatably mounted cam at a quicker speed than the sliding cam, a plunger connected with the sliding cam, a spring that tends to move the plunger and sliding cam in the same direction, a clutch member slidably and non-rotatably mounted upon a driving shaft, a clutch member rotatably mounted upon such driving shaft and operatively connected with the mechanism for driving the aforesaid cams, the slidably mounted clutch member being moved out of contact with the rotatably mounted clutch member by the action of the aforesaid plunger under the influence of the spring and sliding cam.

7. In a machine for re-making wire drawing dies, a pneumatic hammer, a fixed guide therefor, a die support, means for automatically moving the die support simultaneously around and toward a point coincident with the stationary axis of the hammer, an air inlet valve for controlling the supply of air to the hammer, a device for opening the air inlet valve, and an operative connection from the said device to the means for moving the die support.

8. In a machine for re-making wire drawing dies, a pneumatic hammer, a die support, means for automatically moving the die support around and toward the hammer, an air inlet valve for controlling the supply of air to the hammer, a supplementary air valve that normally excludes the passage of air to the air inlet valve, means for opening the supplementary air valve by movement of the hammer, means for automatically opening the air inlet valve, and means for automatically closing such valve.

9. In a machine for re-making wire drawing dies, a pneumatic hammer, a fixed guide therefor, a die support, means for automatically moving the die support around and toward a point coincident with the axis of the hammer, means for automatically stopping the machine at any part of its cycle of operations and means for simultaneously cutting off the supply of air to the hammer.

10. In a machine for re-making wire drawing dies, a pneumatic hammer, a die support, means for automatically moving the die support around and toward the hammer, a clutch member slidably and non-rotatably mounted upon a driving shaft, a cam rotatably mounted upon the clutch member, a starting handle operatively connected with the cam, and an adjustable stop arranged to be engaged by an inclined portion of the cam to move the clutch member in an endwise direction upon the driving shaft.

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

NICHOLAS KING TURNBULL.

Witnesses:
JAS. STEWART BROADFOOT,
PERCY WM. HOLT.