S. Andrews.

Drop Hammer.

No. 10,720. Patented Apr. 4, 1854.

Fig. 1.

Fig. 2.

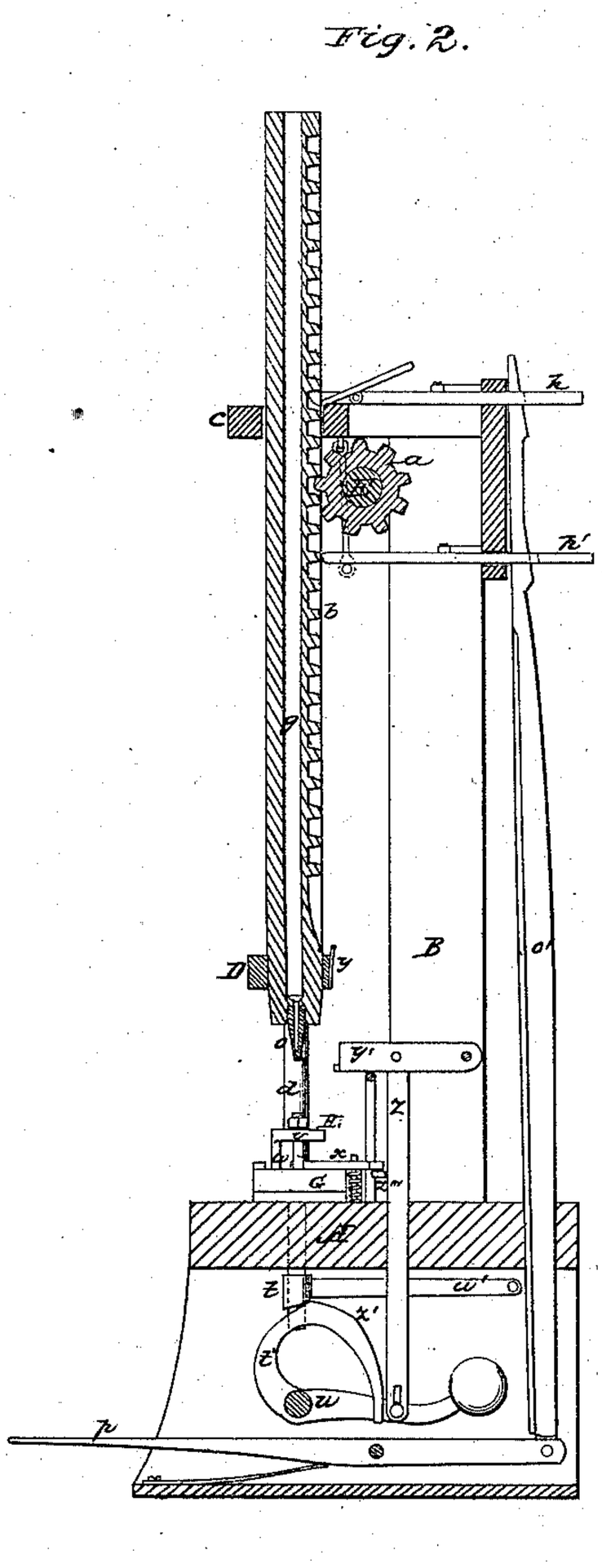


Fig. 3.

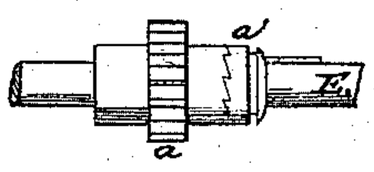


Fig. 4.

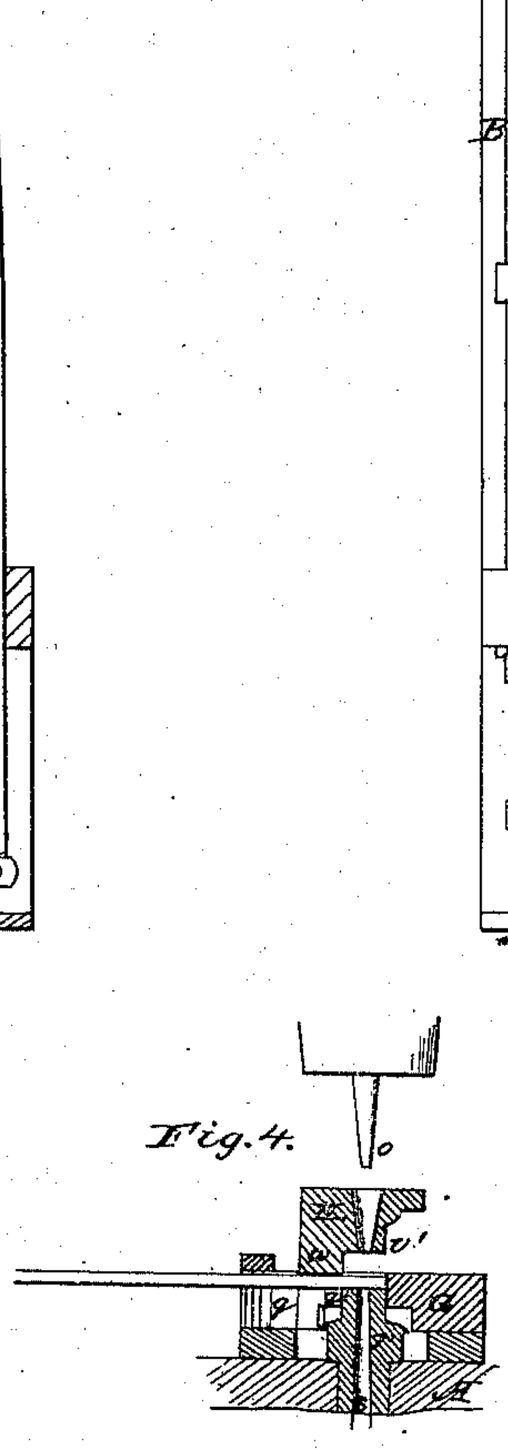
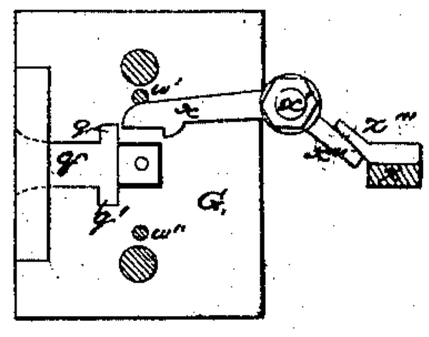


Fig. 5.



UNITED STATES PATENT OFFICE.

SOLOMON ANDREWS, OF PERTH AMBOY, NEW JERSEY.

DROP AND DIE FORGING AND PUNCHING MACHINE.

Specification of Letters Patent No. 10,720, dated April 4, 1854.

To all whom it may concern:

Be it known that I, SOLOMON ANDREWS, of Perth Amboy, county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Machinery for Forging and Punching; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawing, making a part of this specification, in which—

Figure I is a front elevation. Fig. II is a vertical section. Figs. III, IV, and V are of parts in detail and similar letters refer to similar parts throughout.

This invention is principally designed for making what are termed "forged nuts" for screw bolts, &c., but it is also applicable to the making of many other articles from hot metal where the forging and swaging principle is advantageous.

My machine consists of an anvil, a drop or stamp, punch, follower or releaser, dies, discharger or trigger, safety stop, &c.

The anvil is a heavy block of metal properly supported upon a foundation as seen at A. From the two sides near the back strong posts B are erected reaching to a proper height well secured to the anvil by keys and connected together at the top by a cap, which also rests upon and secures the upper ends of two guide rods (*d*, *d*) fitted into the anvil in front. These posts sustain the main shaft. The drop or stamp is a tall column of metal as seen at C, and stands midway between the two guide rods (*d*, *d*) but in front of the posts B and has a clear space all around it. It is not necessary that the guide rods (*d*, *d*) be attached to the anvil for if more room is required around the stamp they may rest upon braces or arms projecting from the posts B. The drop or stamp is kept in place and guided in its movements by a lug or arm on two sides at or near its bottom end fitted to the guide rods (*d*, *d*) and at top by passing through a hole in the cap (*c*). To raise the stamp a rack and pinion motion is employed; the rack being seen at (*b*) and the pinion which plays loosely on the main shaft, at (*a*). The main shaft is seen at E, and when the machine is in operation it is continually revolving, and therefore to raise and let fall the stamp a clutch motion is employed; one half of this clutch is connected with the pinion (*a*) and revolves with it; the other half turns with the main shaft but may slide along it upon a feather as at (*a'*) Fig. III. To raise the stamp the clutch is thrown into gear which sets the pinion revolving and the stamp ascends accordingly. As soon as it reaches the proper height the clutch is disengaged, by an arrangement to be described, when the stamp falls. The rack (*b*) is sunk in the side of the stamp so that the lift is near the central line of gravity of the same, this is an important feature as undue pressure upon the guides is avoided as well as the tendency to cant over, and less power is required. The engaging and disengaging arrangements consist of a lever (*l'*) hinged to the back part of the frame and taking hold of the groove in (*a'*) near its middle; the front being combined with a feather spring (*f*) to throw it into gear and with a wedge or trip-off F to throw it out of gear which works in combination with the stamp C. The trip off has to be done in a peculiar manner in order fully to clear the teeth of the clutch from each other. In the ascent of the stamp as soon as it strikes the wedge F, that begins to cause the half (*a'*) of the clutch to move away, this goes on until the extreme ends of the teeth just clear and at the same moment the stamp falls. The clearance however has not been so complete but that the edges still clash against each other and they would soon become rounded off and their action rendered uncertain. To prevent this, a link connects the top of the wedge F with the top end of the feather spring (*f*) which link as one end of it rises with the wedge throws off the spring from the clutch lever and at the same time presses back the lever and clutch farther from the pinion; at (*e*) is a pin or small block inserted into one of the lugs of the stamp to act against the wedge F when the stamp has been carried up to the proper height and by using a shorter or longer pin the length of the blow is regulated or determined. In ascending, as soon as this pin touches the

bottom of F, that is pushed up through the slot in (C); this brings the inclined plane on the edge at (*i*) against the forward end of the clutch lever (*b'*) and gradually thrusts it back and with it the clutch (*a'*); by the time the wedge has gone up to the point (*i'*) on the inclined plane the clutch is just at the point of disengaging itself and the end of the lever (*b'*) is suddenly thrown off, by the spring acting on the wedge converted into a lever of the first order, so far as fully to clear the teeth of the clutch from each other and the stamp falls without their interfering.

I now return to a further description of the stamp C. In Fig. II the center will be seen to be bored out hollow at (*g*). At the bottom a second piece is shown as secured within the face to meet the hollow chamber as seen at (*o*). This is the punch and in it nearly the whole length a hole is bored also. The chamber (*g*) is to contain water or other fluid to keep the punch cool and is a very important feature of this invention.

In connection with the operation of the stamp is an independent trip-off, to be worked by the attendant at the time of starting and for keeping the stamp going. It consists of a pair of pawls catching in the rack of the stamp; they are thrown into gear by springs and drawn out of gear by a treadle under the anvil.

(*h h'*) are the pawls one resting on the cap over the pinion, and the other, suspended under the pinion by links, their beveled ends working in the rack. These pawls are so spaced that when one enters and catches under a tooth the other is out and pressing against the end of a tooth as shown at (*h'*). These pawls serve to keep the stamp up after the clutch (*a'*) is disengaged and to hold it up until the attendant is ready to operate it. To allow the stamp to fall the foot is pressed upon the treadle (*p*). This throws up the rod (*o'*) and withdraws these pawls from the teeth of the rack, when the stamp will drop. As the stamp falls a pin (*p'*) comes into contact with the top of the wedge (which is then in the position shown by the dotted lines) and strikes it down which of course throws the clutch (*a'*) into gear and causes the raising of the stamp. A peculiar feature is to be noticed here which is of importance. The instant that the stamp has fallen and given its blow upon the hot metal it commences to rise again and thus the punch and dies are relieved from contact with the hot metal in the shortest possible time while the comparatively slower ascent of the stamp affords more time for all to get cool.

I now come to describe the dies and the operation of forming and discharging a nut.

The die consists of three principal pieces viz: an under die, a bolster, and an upper die, which are more clearly seen in Figs. IV and V where IV is a section of the whole and V a top view of the bolster and under die. A massive piece G, the bolster, forms three sides of the die when square nuts are to be made, and lies upon the anvil A in such a position that the center hole will be immediately under the point of the punch (*o*). The part which would form the fourth side is cut away as seen at (*q*) and forms a passage for the entrance of the end of the bar of hot iron out of which nuts are to be made as seen in Fig. IV. Two lateral grooves are also cut out at (*q'*). These are to serve as guides to receive the part which forms the fourth side of the die and which is attached to the follower above, being a strong plate which glides down these grooves and constitutes a shear to cut off the bar and the fourth side of the die.

At (*r*) is the bottom die, a piece of metal which passes vertically from a hole in the anvil A; the top is squared and made to fit accurately within the square in the bolster G though not so tightly but that it can move up and down. The bottom of it rests on the anvil A, being enlarged for that purpose. Through the center is a hole (*s*) by which the punchings are discharged and a strong tube (*t*) continues down through the anvil A to a short distance below, serving the double purpose of guiding the discharge of the punchings and of raising (*r*) at the time of discharging the finished nut.

The raising of the tube and bottom die (*r*) is effected by means of a cam (*t'*) vibrating on an axis at (*u*). To steady the tube and restrain the side pressure caused by the action of the cam there are two cam levers (*u'*) centering at the back of the anvil and suspended on pins attached to each side of the tube. The last piece of the die is that which closes the top. It is shown at (*v'*) Fig. IV and is fitted into the center of the follower or piece H which has holes (*v*) at each end Figs. I and II through which short guide posts pass, nuts being screwed on the top to keep the piece on. This upper die is a square projection made to fit the square hole in the bolster G before referred to, and having a hole directly through it to admit the passage of the puncher (*o*) as clearly seen in Fig. IV. In front of this upper die is fitted the plate or shear (*w*) to form the fourth side of the square in the bolster G as before referred to. The lower inside corner or edge of this plate forms the upper half of the shear to cut the bar off, while the upper front edge or corner of the under die (*r*) forms the lower half of the shear. This plate is thickened out in the middle to increase its strength. Underneath the follower and between the two short guide posts are two small rods (*w' w''*) passing down through the anvil and resting

by collars on spiral springs which surround them below. On the top of these rods the follower H rests, the spiral springs admitting of its descent under the stamp when it falls thereon and supporting the weight of the follower and the upper die and shear attached thereto when the stamp rises up.

I now come to describe the discharging arrangements.

As soon as a nut has been formed the lower die (r) rises so as to come to a level with the top of the bolster G; at this moment a trigger (x) which vibrates upon a post at (x') is disengaged from the position seen in Fig. V and by a force to be more fully described sweeps over the surface of G and across the top of the die (r); hence it comes in contact with the nut standing on the top of (r) striking it with sufficient force to throw it clear of the machine. The operation of the trigger (x) is timed with the raising of the die (r) and the follower H. As the stamp C falls, the projecting piece (y) on the back part of the stamp passes by the end of a lever having its fulcrum between the posts B on the under side of which lever is a latch which recedes and admits the piece (y) to pass and come under it. As the stamp rises the said piece (y) engages the end of the lever (y') which is thus raised and operates the cam (t') (as clearly shown in Fig. II) by a connecting rod (z), and as soon as the lever (y') begins to lift the cam (t') that immediately throws up the lower die (r) to a level with the surface of G and with it the nut. Motion being continued the arc (z') plays along and keeps the die up. At the same time that the arc (z') begins to come under (t) a double beveled pin (z''') attached to the connecting rod (seen enlarged in Fig. V) rises and strikes against the back of a double beveled arm (x'') Fig. V of the trigger and presses the trigger hard against the rod (w'). As soon as (z''') rises above the edge of the arm (x'') the lever (y') is disengaged from (y) and it falls upon a staple set in the anvil A. The pin (z''') in falling strikes upon the front beveled edge of the arm (x'') and violently and suddenly throws the trigger (x) forward, which action discharges the nut as before mentioned. As the dropping of the lever (y') also effects the dropping of the under die (r) the discharge of the nut is effected while the arc z' still holds it up. To make the matter more certain the lower part of the connecting rod (z) is slotted where it takes hold of the cam arm, and if a spring is put upon it it will be thrown down more suddenly than the weighted arm of the cam will fall. A recoil spring on the trigger post (x') will carry the trigger (x) back for a new stroke.

The operation is as follows: The main shaft E being set in motion and the bar of iron brought from the furnace to the attendant standing in front of the machine he pushes one end into the die as seen in Fig. IV. Then pressing his foot on the treadle (p) the stamp C falls, the punch (o) passing through the follower and upper die, the face of the stamp strikes down the follower H. This causes the shear (w) to descend and cut off the bar. The bar is about half cut off before the point of the punch strikes it. The whole, that is, the stamp, punch, follower, upper die and shear (w) descend together and close the die up. The full force of the blow being imparted to the hot metal and thus compressing the mass around the punch effects the forging of the nut more perfectly than if hammered by hand. The metal is also forced into all parts of the die and takes its shape. The instant that the stamp has given its blow the clutch (a') is thrown into gear by the pin (p') and the stamp begins to ascend, the attendant keeping his foot all the time on the treadle. The nut is stripped from the punch by means of the upper die and follower; as soon as this rises so that it is stopped by the nuts on the guide posts the punch is withdrawn, leaving the nut upon (r) and is discharged as before described. The bar is continued to be fed in until it is either used up or requires a further heat. The moment that the attendant takes his foot off the treadle (p) the pawls engage in the rack and prevent the stamp from falling on being disengaged from the clutch.

I claim—

1. Lifting the drop or stamp near its central line of gravity, by means of a pinion or pulley running on a shaft operated by a clutch combined with the driving power, whereby the stamp may be released and dropped at any point of its ascent at the option of the attendant, and without stopping the other moving parts, as described.

2. I claim hollowing out the stamp, and also the punch, for the formation of a reservoir to hold water or other proper fluid for keeping the punch cool, not limiting myself to a punch merely but also as applied to any other tool fitted to or used in combination with a stamp for operating upon hot metals.

3. I claim interposing between the stamp and the die, a secondary stamp or follower so constructed as to effect the cutting off of the blank from the bar, and when combined with the bolster shall form the box or die in which the nut is forged, and which secondary stamp shall also act as a releaser to remove the finished nut from the punch, as described.

4. I claim the combination of the cam-lever (t') and the arc (z') with the stem of the lower or discharging die (r), to be operated by the stamp during its ascent in

order to raise and support the lower die until the nut is thrown off as described.

5. I claim the wedge-lever F in connection with its spring (*f*) and its lever or arm operating as described for effecting the complete disengagement of the clutch teeth so as to prevent those from clashing when the stamp falls, the whole being constructed and operating substantially as set forth herein.

SOLOMON ANDREWS.

Witnesses:

S. H. MAYNARD,

I. P. PIRSSON.