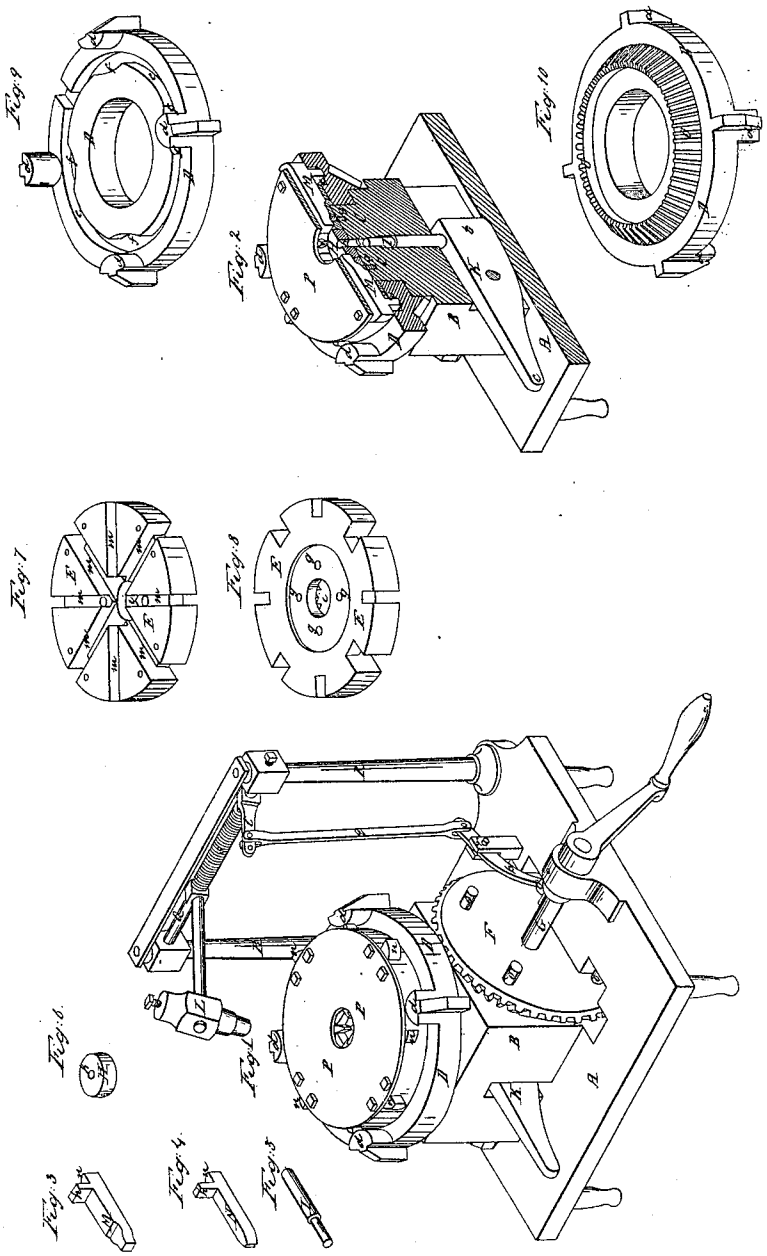
H. CARTER.

BOLT MACHINE.

No. 19,485. Patented Mar. 2, 1858.



UNITED STATES PATENT OFFICE.

HENRY CARTER, OF PITTSBURGH, PENNSYLVANIA.

BOLT-MACHINE.

Specification of Letters Patent No. 19,485, dated March 2, 1858.

To all whom it may concern:

Be it known that I, HENRY CARTER, of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Machines for Forming the Heads of Screw-Bolts and Rivets; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the annexed drawing, forming part of this specification, in which—

Figure 1, is a perspective view of my machine. Fig. 2 is a sectional perspective view through the center of my machine. Fig. 3, represents one of the side dies, turned bottom upward to show the heel piece and tongue. Fig. 4, is one of the corner dies turned bottom upward. Fig. 5, represents the piston which supports the bolt, while the head is being formed and raises it for the purpose of discharge. Fig. 6, is a perspective view of the heading tool. Fig. 7 is a perspective view of the disk which carries the side dies, and corner dies, and heading tool, with those parts removed. Fig. 8 represents the disk (Fig. 7) turned bottom upward to show the rabbet for the head of the pivot. Fig. 9, is a perspective view of the tappet ring, showing the tappets, the annular groove with its indentations, opposite the tappets. Fig. 10, represents the tappet ring (Fig. 9) turned bottom upward to show the bevel teeth which gear into the bevel wheel.

In the several drawings like letters of reference designate similar parts of my machine.

I am aware that numerous attempts have been made to manufacture bolts by machinery, but all of them, so far as I know, or can learn, are complicated in their arrangement and more or less deficient in their operation; producing imperfect bolts: so that the old method of forging the head of the bolt on an anvil is still much resorted to as making the best and strongest bolts. But this method is so tedious, that I have endeavored in my improved machine, to overcome the defects in those machines now in use by modifications of construction and arrangement, which are very important in their results.

The chief end to be attained in the manufacture of screw bolts, is to make a strong and well formed head. It is essential that the underside of the head should be perfectly true and level, and at right angles, or (in case a bolt with a skew-head is required) at the exact required angle to the shank, for if this be not the case, the head will be apt to be wrenched or weakened by the nut being screwed tight up, when the bolt is in use. It is also important that the iron of the head should not be weakened in the upsetting process, as this will make it liable to break off, and for the same reason it is essential that there should be no weakness or diminishing of thickness of the neck of the bolt. All these defects are found in bolts made by machinery now in use; but I overcome them by the repeated and alternate action of my upsetting hammers and heading dies. Another defect in this class of machinery is, that the rod out of which the bolt is to be made is grasped by round or V shaped jaws, which hold it in place while the head is being formed, either by pressing between dies, or by being driven against a former or swage. As the iron at the head of the bolt, has to be heated to the welding point, the effect of this is that the gripping jaws gall the neck of the bolt, and diminish its diameter, and even sometimes create an indentation on one side of the neck close under the head, which makes the bolt very apt to break off just at the point of greatest strain and where it should be strongest. Then again the head of a bolt if pressed between dies, or forcibly driven against a former or swage, may be shaped nicely, but the process is injurious to the texture of the iron, breaking its fiber, and impairing its tenacity: which can only be cured satisfactorily by the process of hammering, thus to weld up any imperfections or fractures, caused by the sudden change of the shape of the iron.

It is therefore obvious that the nearer the action of a machine of this class approaches to the mode of making bolts by hand, the better it will accomplish its object: and this is precisely what I have aimed at in my machine and I have succeeded, as I believe, in fully accomplishing my object so that my bolts are equally as strong, and better shaped than those made by hand, the machine doing the work of the blacksmith, substantially in the same manner, but with an accuracy, precision and rapidity only to be obtained by the use of automatic machinery.

To enable others skilled in the art to make and use my improvement, I will proceed to describe the construction and operation of my machine.

A is a strong iron frame or horizontal bed plate, on which is a cubical block B from which rises the stock or pivot C which is a heavy cylindrical block of iron, turned true and smooth, on which, as a journal, the tappet ring D, revolves. The pivot C rises very slightly above the upper face of the tappet ring D so as to fit into a circular rabbet in the under side of the disk E. On the under side of the tappet ring D are teeth, extending from the circumference of the ring to the pivot C. These bevel teeth O gear into a bevel wheel F which is fixed to, and revolves with, the horizontal shaft G. The bevel wheel being situate close to, and having its inner bearing in one side of the cubical block B. In the center of the pivot C, is a perpendicular circular hole, *a* slightly larger in diameter than the bolts to be made by the machine, so that in case long bolts are to be made, the shank may extend down through the heading tool H into the pivot C. In this circular hole *a* is fitted a piston I, the lower end of which rests on the point of the short arm *b* of the treadle or lever K which has its fulcrum in the block B. The piston I being raised slightly by depressing the long arm of the treadle K projecting from the machine. The upper extremity of the pivot C is flat, and serves as the resting point of the end of the piece of iron which is to be made into a bolt; the short arm *b* of the lever K resting firmly against the frame of the machine when the long arm *c* is not depressed so as to give resistance to the blows of the upsetting hammer L.

On the circumference of the tappet ring D, and equidistant from each other, are four tappets *d*, *d*, *d*, *d*, which rise perpendicularly from the face of the ring; the face of each tappet *d* extending to the outer edge of an annular groove *e* cut in the face of the tappet ring D, and concentric with the ring itself. The outer edge of this groove is an unbroken circle, while on the inner edge are four cam like indentations, *f* one of which is opposite to each tappet *d*. This annular groove *e* is designed to receive the heel piece *h* of the side dies M and corner dies N, etc. as hereinafter explained.

E is a circular disk, the diameter of which is such that it will lie on the pivot C over, and parallel to, though not quite in contact with the upper face of the tappet ring D, and inside of the tappets *d*, *d*, &c. It is placed concentric with the pivot C and tappet ring D and has a circular rabbet on its under face, into which the top of the pivot C fits, as before stated. The circular disk E is screwed fast to the top of the pivot C by four screws *g*, *g*, *g*, *g*. The depth or thickness of the disks E, is such, that when in place, the upper face is on a level with the top of the tappets *d*, *d*, &c. In the center of the disk E, is a circular hole *i* into which the heading tool H is placed. The heading tool H is a circular block of steel, with two parallel plane faces, and a hole *k* in the center of the exact diameter of the neck of the bolt to be made by the machine. When in place in the disk E, the hole *k* in the center of the heading tool H is precisely over the center of the pivot C and over the piston I. Radiating from the center of the disk E, are eight grooves *m* equally distant from each other; and deep enough to receive the eight converging dies, four of which M, M, M, M are side dies, and four N, N, N, N are corner dies. Each of these eight dies has a heel piece *h* which projects at right angles from their under side, far enough to enter the annular groove *e* in the tappet ring D; the outer side of the heel piece *h*, when the hammers are in their places and not pressed forward, being in the line of the circumference of the disk E. Each die has a beveled projection *n*, (like the tongue of a latch bolt of a lock) projecting beyond the circumference of the disk, so that as the tappet ring D revolves, the tappets *d*, *d*, &c. one after the other, will come in contact with the beveled tongue *n* of the die; and press it in toward the center of the disk. The under side of the inner extremity of each die M, or N rests on the face of the heading tool H and slides over it toward the center. A face plate P, of the same diameter as the disk E with a circular hole in the center large enough to receive the upsetting hammer L, and allow the exit of the finished bolt, is screwed down over the upper face of the disk E and keeps the converging dies in place.

From the outer side of the bevel wheel F project four studs or pins *o*, *o*, *o*, *o'* at equal distances from each other, and equally distant from the axis of the wheel. These pins act upon a finger *p*, which has its fulcrum at *r* and is pivoted to a connecting rod *q*. This connecting rod is pivoted to the lever arm *t* which projects from the horizontal shaft Q, to which shaft is rigidly attached a swinging hammer L. This hammer is so placed that when it falls, it strikes immediately over the vertical hole *k* in the heading tool H, and hole *a* in the pivot C. The face of the hammer may be of any shape which it is desired to communicate to the head of the bolt, and is furnished with any required stamp or mark. The hammer shaft Q is supported by a suitable frame R placed back of the machine, and connected with the bed plate A. A spiral spring *s* is coiled around the hammer shaft Q, one end being fastened to the hammer frame R, and the other pressing on the arm of the hammer L. Thus whenever one of the studs *o'* on the bevel wheel depresses the finger *p*

it raises the hammer L, and as the stud *o'* passes over the point of the finger *p* the hammer is released and falls by its own weight with the added force of the spiral spring, *s*.

Motion is communicated to the several parts of my machine by power applied to the shaft G.

Having thus described the construction of the several parts of my machine I will proceed to describe its operation.

The iron which is to be made into bolts is first cut into suitable lengths, and one end, which is to be formed into a head, heated to a welding heat. This is done in a furnace, a large number being heated at the same time. The length of each rod of iron to be made into a bolt must be such that a quantity of iron sufficient to form the head of the bolt will project above the top of the heading tool. A piece of iron heated at one end as before stated, is inserted with a pair of tongs into the heading tool H, the cool end resting on the top of the piston I, and the heated end projecting above the top of the heading tool. The machine is then set in motion, and operates as follows. The stud *o'* on the bevel wheel F passing the end of the finger *p*, permits the hammer to fall, which strikes the heated end of the rod and presses it down into a button shaped mass of irregular form on the face of the heading tool H. The tappet ring D being moved around by the action of the bevel wheel F, each of the tappets *d*, passes over the projecting tongue *n* of each of the four corner dies in rotation, pressing them toward the center. Each of these corner dies N, has a rectangular V shaped indentation at its extremity, which pressing against the mass of iron on the top of the heading tool, shapes the angular corners of the head of the bolt; the curved indentation *f* of the groove *e* in the tappet ring D permitting the heel *h* of the die M or N to pass inward, and allows the die to be moved forward by the action of the tappets; but the heel *h* still sliding in the grooves *e* is brought outward again by the groove *e* so soon as the curved indentation *f* is passed, and thus the dies are immediately withdrawn. The four tappets *d*, still passing around the circular disk E, next come in contact with the projecting tongue *n* of the side dies M and in like manner force them in toward the center; the heels *h* of these side dies working in the groove in the tappet ring in the same manner as the heels of the corner dies. These side dies, closing together until they touch each other at their corners, form a square into which the button shaped mass of iron is squeezed. The side dies are then immediately withdrawn by the action of their heel pieces *h* in the annular groove *c*. The hammer then immediately falls, again striking the top of the bolt and shaping the head and welding together any imperfections which may be caused by the squeezing or upsetting processes.

As there are four studs on the bevel wheel F, and four tappets on the tappet ring D, this process is repeated four times for every revolution of the tappet ring. Each bolt is struck by the hammer and then pressed by the corner and side dies as often as may be necessary to shape it completely. The motion of the machine is then stopped by uncoupling the shaft G from the driving shaft, which may be instantaneously done in the usual manner, and the treadle K being depressed raises the piston I, and with it the finished bolt, which is then removed with a pair of tongs and another piece of iron put in its place to go through the same process.

When bolts of ordinary size are to be made, the corner dies may be dispensed with, as the side dies close so exactly, that they form a die box, in which the head of the bolt is formed with sufficient accuracy; but where bolts of unusual size or thickness are made, the corner dies are found necessary to prevent the iron at the corners being squeezed through the point of contact of the side dies, thus making ragged and misshapen corners to the bolt head.

It is manifest, that as the upsetting hammer strikes vertically on the heated head of the rod, it will tend to drive the iron into the heading tool, and as the diameter of the heading tool is slightly larger than the rod or iron, and a little tapering downward, the neck of the bolt which is confined in the heading tool, will be made compact and firm, and instead of being weakened by the heading process, will be strengthened and somewhat enlarged.

As it is sometimes desired to make the neck of bolts square, so as to prevent their turning around when the nut is being screwed on, in use, this may very conveniently be done by making the hole in the heading tool square instead of round, for a part of its depth, and the action of the upsetting hammer on the heated end of the rod will drive the iron into the angles of the square neck of the heading tool, making the bolt of the required shape.

The size of the head of the bolt will be regulated by the length of the side and corner dies, and the width of face of the side dies. These dies may be made adjustable in length, by making them in two parts, united by bolts passing through a slot in each piece:—or other convenient method: or if preferred, various sizes of dies may be kept, all fitting into the same converging grooves *m* in the circular disk E for making the various sizes of bolts. In order that

these side and corner dies may be readily removed and replaced without disturbing the machine or removing the face plate, I make a notch or recess T in the rim of the tappet ring D, of the width of the side dies, and extending down to the bottom of the annular groove *c* so that when any one of the dies is brought opposite to this notch T by turning the tappet ring D, the die may be removed from its groove in the disk E, by taking hold of the projecting tongue *n* of the die and drawing it out, the notch being deep enough to allow the heel piece *h*, to pass the rim of the tappet ring: Thus each die in turn being brought opposite to the notch T may be withdrawn instantaneously, and another substituted in its room. A variety of heading tools suited to the various diameter of bolts to be made, and all fitting in the central hole *i* of the disk, will be kept on hand. The length of bolt to be made will be adjusted by the piston I inserted in the center of the pivot C. The length of the piston must be adjusted to suit the required length of bolt and therefore pistons of various lengths are used, as circumstances require.

The distinguishing features of this machine from others of the same class is the operating of converging dies upon the four sides of the head of a bolt at each stroke, alternating with the strokes of an upsetting hammer, whereby a symmetrically shaped and perfectly square head is made, and by the repeated and alternate action of the dies, all fractures or imperfections in the iron either caused by the change of shape of the iron in forming the head, or by other causes, are welded up, and a perfectly sound head is obtained. If the dies operated alternately on but two opposite sides of the head at each stroke,—each stroke of the dies, would contract the head in the direction of the stroke and elongate it in the other direction, the last stroke, which ever way it were given leaving the head of the bolt more or less oblong and out of the true square; and as the heated iron speedily chills around the neck and the hammers and dies must therefore be worked with rapidity and great force, so as to complete the operation while the iron is yet in a plastic state, this defect is of considerable importance, for the violent action of the hammers on the head when the neck is chilled is very apt to crack or otherwise injuriously affect and weaken the bolt, as before stated, and the hammering of iron when at a red heat, or partially chilled, is well ascertained to be very injurious to it, by crystallizing its fiber, and rendering it brittle.

My mode of operating the swinging hammer is also very important as it is raised away from the machine allowing space for free access to the heading tool to remove the finished bolt and insert the iron making a new one: thus avoiding the necessity of complicated machinery for that purpose.

Having thus described my improved machine, what I claim as my invention and desire to secure by Letters Patent is,

1. The use of a stationary heading tool arranged centrally to the converging dies, in the manner substantially as described.

2. The use of a swinging hammer for upsetting the head in combination with the converging side dies and corner dies, arranged and operating substantially as hereinbefore described.

In testimony whereof I have hereunto set my hand this twenty sixth day of January A. D. 1858.

HENRY CARTER.

Witnesses:

MARTIN G. CUSHING,

L. P. STONE.