W. Grant,

Bolt-Heading Machine,

No. 5,986. Patented Dec. 26, 1848.

Fig. 1

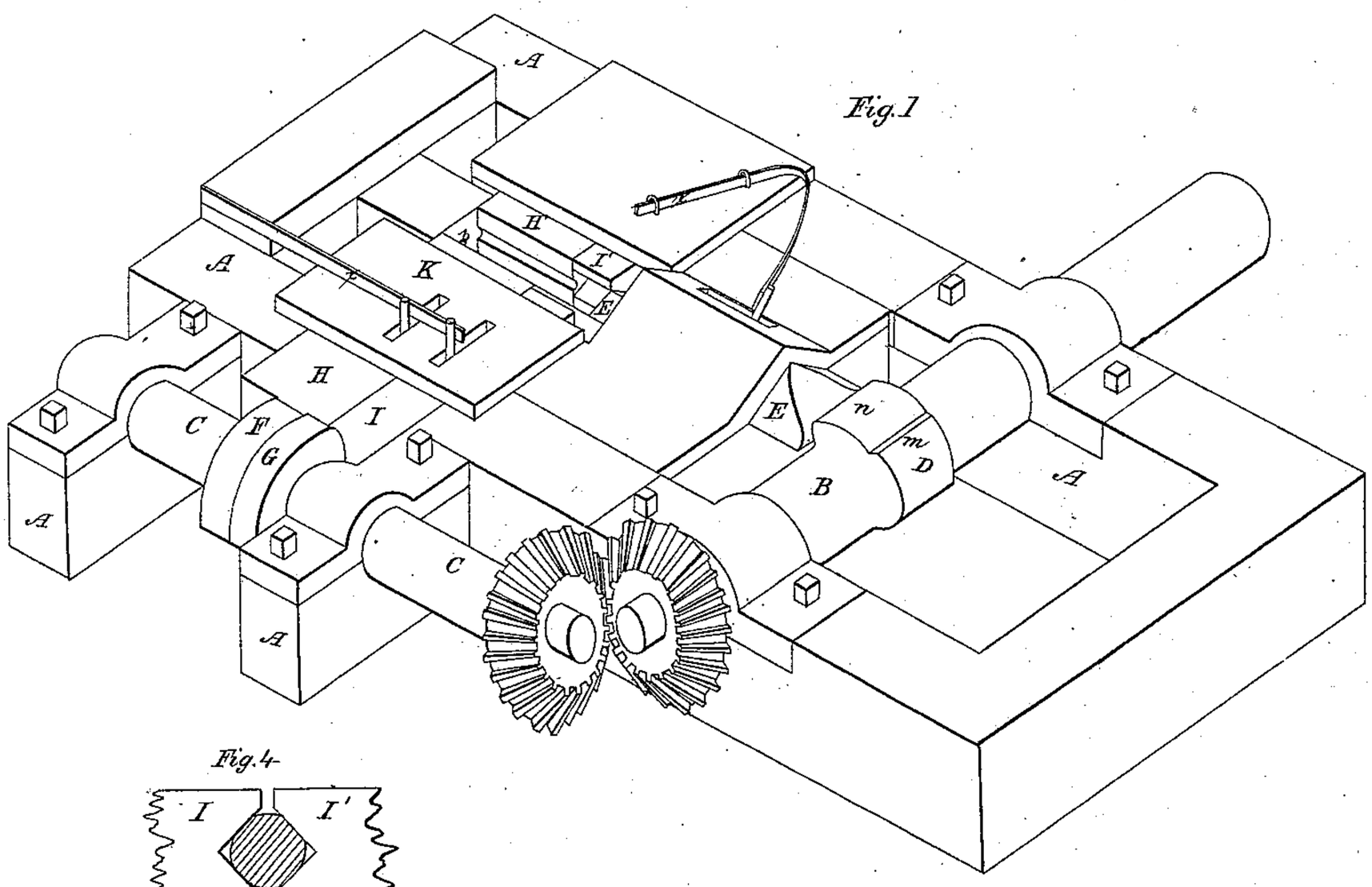


Fig. 4

Fig. 2

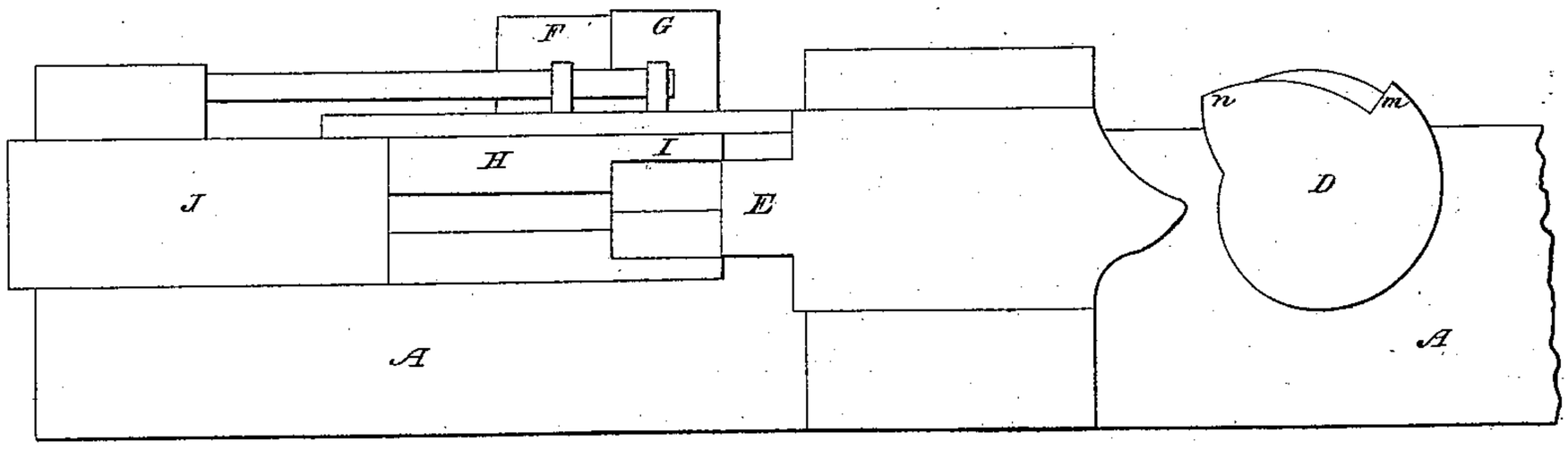
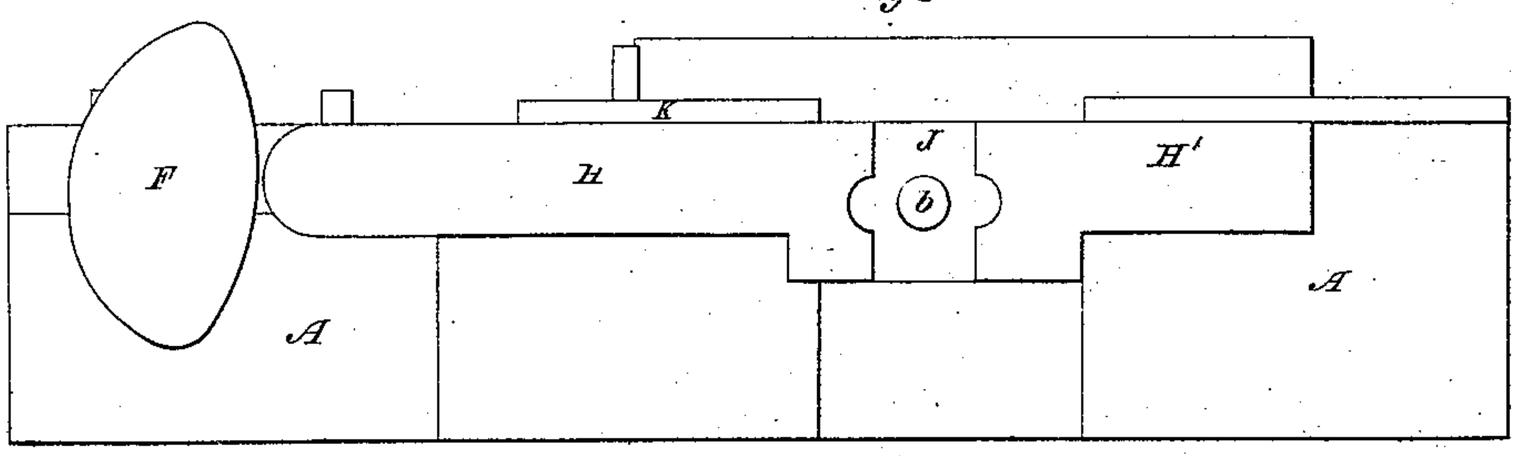


Fig. 3



UNITED STATES PATENT OFFICE.

WM. GRANT, OF BOSTON, MASSACHUSETTS.

BOLT-HEADING MACHINE.

Specification of Letters Patent No. 5,986, dated December 26, 1848.

To all whom it may concern:

Be it known that I, WILLIAM GRANT, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Machine for the Purpose of Forming by Compression Prismatic Heads of Three or More Sides on Metallic Bolts, of which the following is a full and exact description, reference being had to the annexed drawings of the same, making part of this specification, in which—

Figure 1 is an isometrical perspective view of the machine showing the several parts in connection, and ready for operation, Fig. 2 is a vertical longitudinal section through the line 11 of Fig. 1, and Fig. 3 is a vertical transverse section taken through the line 22 of Fig. 1, Fig. 4 is a sectional view, showing the form of the head when flattened by the first stroke of the punch, before being acted upon by the dies or swage.

The same letters indicate the same parts in all the figures.

Numerous attempts have been made to form square and other angular heads on metallic bolts by compressing a portion of the rod to the proper shape by means of automatic machinery, but heretofore with only partial success, none of the machines tried having been found capable of producing heads with uniformly sharp and well-defined angles. The only way in which headed bolts are now made, either upon a large or small scale, is by hand, forging with hammer and swages upon an anvil, in the primitive method. The cause of these repeated failures to make heads on bolts by machinery, is to be found in part in the refractory nature of iron, and its deficiency in the quality of plasticity, even when heated to as high a degree as it will admit of without permanent injury to its strength. Another of the causes which has contributed to these failures is the total want of adaptation in the mode of action, and structure of the machines used, to those methods of operating upon the metal, which manipulation upon the anvil has demonstrated to be essential to the production of angular heads of a definite form and size. They have all been constructed upon the plan of attempting to compress a portion of the end of the bolt into a mold of the required form and size, by the direct action, and at one operation of a piston or punch fitting therein. But the smith always proceeds first to upset the end of the bolt, until it is of the form of a thick disk of considerably larger diameter and proportionately shorter than the required head, and then hammers this disk into the desired number of sides and angles, in doing which it is reduced to the diameter and increased to the length required. Now this is precisely the plan upon which my machine operates, having constructed it solely with a view of imitating as closely as possible the most approved methods of manipulation, from which its action differs only in being capable of working with greater power, velocity, and accuracy, whereby a superior bolt is produced at a diminished cost.

The frame A, represented in the accompanying drawings, is made of a strength equal to at least double the heaviest strain to which it is ever subjected, by the ordinary operations of the machine, so that the several parts may be firmly retained in their respective places, and thus rendered capable of performing at all times their appropriate functions with certainty.

B and C are respectively strong shafts well secured in suitable bearings made in the frame A at right angles to each other, and are connected together with cog wheels, in order that one may drive the other and the motions of both be equal and simultaneous.

The cam D is either cast in one solid piece with the shaft B, or firmly secured thereon, by screws, keys, or otherwise. This cam operates the punch E which upsets the end of the bolt, and is so formed as to give the same, two strokes in quick succession at each revolution.

The cams F and G are respectively cast in one piece with, or firmly secured to the shaft C, the former cam F closing the movable jaw H of the clamp, and the latter G operating the movable half of the die or swage I in which the head is formed.

J is an adjustable sliding block or rest, placed in a mortise made through the end piece of the frame, and held firmly therein in any position in which it may be adjusted by a clamp screw. Longitudinally through this sliding block a hole *b* is made of a diameter just enough larger than the rod being operated on to admit of the same being pushed through it with ease, this hole is made through the block a distance equal to about its own diameter from the center of

the opening between the jaws of the clamp, the movable jaw of the same when open being withdrawn past it, so as not to obstruct the protrusion of the end of the heated rod to be cut off and formed into a headed bolt.

H is the movable, and H′ the fixed jaw of the clamp, they are respectively in the form of flat, rectangular blocks, and are placed in recesses formed in the cross pieces of the frame, the bottom of these recesses being in the same plane. The jaw H′ is firmly fixed in its place by screws or otherwise, and the jaw H is securely held in the recess, but not too tightly to admit of its sliding freely, by the cap K. The adjacent ends of these jaws are of the precise length which it is required to make the shank of the bolt, and have parallel creases made in them, which when the ends meet form a cylindrical or other shaped hole, which in diameter and form corresponds with the bolt being headed. The movable jaw H of the clamp as it closes, slides against the inner end of the adjustable rest J, and clips off the end of the rod which is protruded through the same.

The fixed and movable halves I, I′ of the swage or die in which the head is formed, are placed in the same recesses with the fixed and movable clamp jaws H H′, and being of the same thickness, and of an uniform width throughout, they are secured in place at the same time and by the same means as the jaws. The movable jaw of the clamp and the movable die, are held back against the cams by means of a spring, as is also the punch E. The adjacent ends of the die blocks have each a semi-prismatic recess made in them, of the precise form and size of one half of the head which it is required to make on the bolt, the hole formed by the junction of these recesses when the dies are closed being parallel to and concentric with, that formed by the meeting of the jaws of the clamp in which the shank of the bolt is held.

A series of clamp jaws H H′, dies for the head I I′ and sliding rests J must be provided, as numerous as the different diameters of bolts required to be made, with a further increase of the number of clamp jaws equal to the sum of the different lengths of each size of bolt, as a distinct pair of clamp jaws is required for every variation in any of the dimensions of the bolts. As many sets of head swages or dies must also be provided, as there are different forms of heads. The punch E is placed parallel to and concentric with the die, and rests in, and is guided by a mortise made through the cross bar of the frame which is strengthened by bosses on its upper and under sides to compensate for the weakening occasioned by this mortise.

Upon either of the shafts a pulley or cog wheel may be placed for the purpose of communicating motion to the apparatus from a steam engine, or any other convenient or available source. The rods to be cut up into bolts and headed, are made white hot in a furnace which is placed near the end of the machine, in order that they may be transferred from the former to the latter with the least possible loss of heat.

The motions of the clamp, dies, and punch may be effected by means of cranks, toggle joints and various other devices besides the cams herein described, but as these several devices are well known and understood by machinists generally, I have not deemed a particular description of them here, necessary, and more especially as every constructor will prefer to produce the movements in a manner suited to his own particular views.

Preparatory to commencing operations a quantity of rods must be heated in the furnace to the required temperature. The clamp plates dies and rest must be of the proper size and form, and duly adjusted in their respective places. The machine being then put in motion the attendant seizes with his tongs, one of the hottest rods, and pushes it rapidly through the aperture *b* of the rest until its end strikes the punch E, when it is instantly cut off by the closing of the clamp jaw H, and held with one end against the rest J, the other protruding between the swages a length sufficient to furnish the requisite quantity of metal to form the head, the clamp is then closed, and the rod held in it by the cam F acting against the movable jaw H. Simultaneously with the closing of the clamp by the action of the cam F, the cam G causes the movable swage I to approach within about one eighth of the required diameter of the head of the bolt of its fixed counterpart I′ where it remains stationary for a moment, and in the mean time the cam D by its projection *m* pushes the punch E with great force into the die, compressing or upsetting the end of the bolt therein, into a shape approximating to the form of the dies, but about one eighth greater in diameter, and proprtionately shorter than the finished head is required to be, the punch is then quickly withdrawn by the action of a spring or otherwise, and the cam G by a continuance of its motion, bringing its point of greatest eccentricity to act against the movable swage I forces it up into contact with the fixed part I′ compressing the flattened head to the required diameters in doing which all the angles of theswage are filled, then the punch by th action of the projection *n* of the cam D is a second time forced against the head, which makes the end and every part of the head smooth, even, and of the exact form of the die, parallel to, and concentric with the bolt,

and in all respects as accurate as can be made by any means whatever, or as is required for any purpose. The bolt is now complete, the cams present their sides of least eccentricity to the clamp, swage and punch, which are thus left free to be moved back by the springs (*x x*), the bolt drops down and out, and the machine is again ready to receive the end of the rod from which to make another bolt by a repetition of the process just described.

It is obvious that any number of bolts can thus be made of a uniform size and form, neither using too much nor too little material, an advantage, the importance of which may be inferred from the fact that all hand made bolts have to be trimmed to the proper size after being forged and the loss caused by this operation from the diminished value of the pieces of metal thus cut off and reduced to the form of scrap, amounts where bolts are made upon a large scale, to a very considerable item in the course of the year. In addition to this saving of matrial a great saving of fuel is also effected by the use of my machine, as it is capable of performing the work of at least ten forge fires, and the bolt rods being heated in a furnace it will not consume more fuel than one of these fires. Those ten forge fires would require ten smiths and ten assistants, but my machine to perform the same labor would only require one attendant to feed it with rods and thus the labor of nineteen men, and nine tenths of the fuel consumed by the ordinary hand process, is saved.

The cost of the excess of power required by this machine, over what would be sufficient to blow the forge fires, is of course to be deducted from the above estimated saving, but as three or four bushels of coal per diem would produce it, it is but a small item. These statements are of course only approximative, but it is believed that they will not be found very far from the truth.

The uniformity, accuracy, and truth with which the heads are formed, and the precision with which they are placed concentric with the axis of the rod, and with their ends at right angles thereto, if of great importance from considerations entirely independent of the saving in the cost of manufacture, for when the shoulder of the head is irregular, it bears upon its seat only on one side, and if in bringing it home the nut be turned a little too hard, the head will eihter be broken off, or the neck so much weakened as to render it liable to give way the first time it is subjected to a heavy strain, and thus endangering the stability of whatever is dependent upon it for support.

I do not claim, making the angular heads of bolts by compressing the end of the rod into the required form and size, by itself, as my invention. Nor do I claim to have discovered that chilled cast iron is capable of resisting a higher temperature without being softened than cast steel. Neither do I claim its use in the construction of machinery generally, for the purpose of working heated metals; nor for operating upon metals in a cold state—but

What I do claim as my invention, and desire to secure by Letters Patent, is—

The formation of heads on bolts by machinery by first upsetting or compressing into a partially closed die, a portion of the rod, by means of a punch, into a shape approximating to the form required, but of larger diameter, and proportionately shorter, and then, by entirely closing the dies and again forcing up the punch reducing it to the proper proportions, and completing its form as herein set forth, whether the devices by which the several motions are produced, be such as are herein described, or others capable of effecting the same results.

In testimony whereof I have hereunto signed my name in presence of two witnesses.

WM. GRANT.

Witnesses:
S. N. Wood,
P. H. Watson.