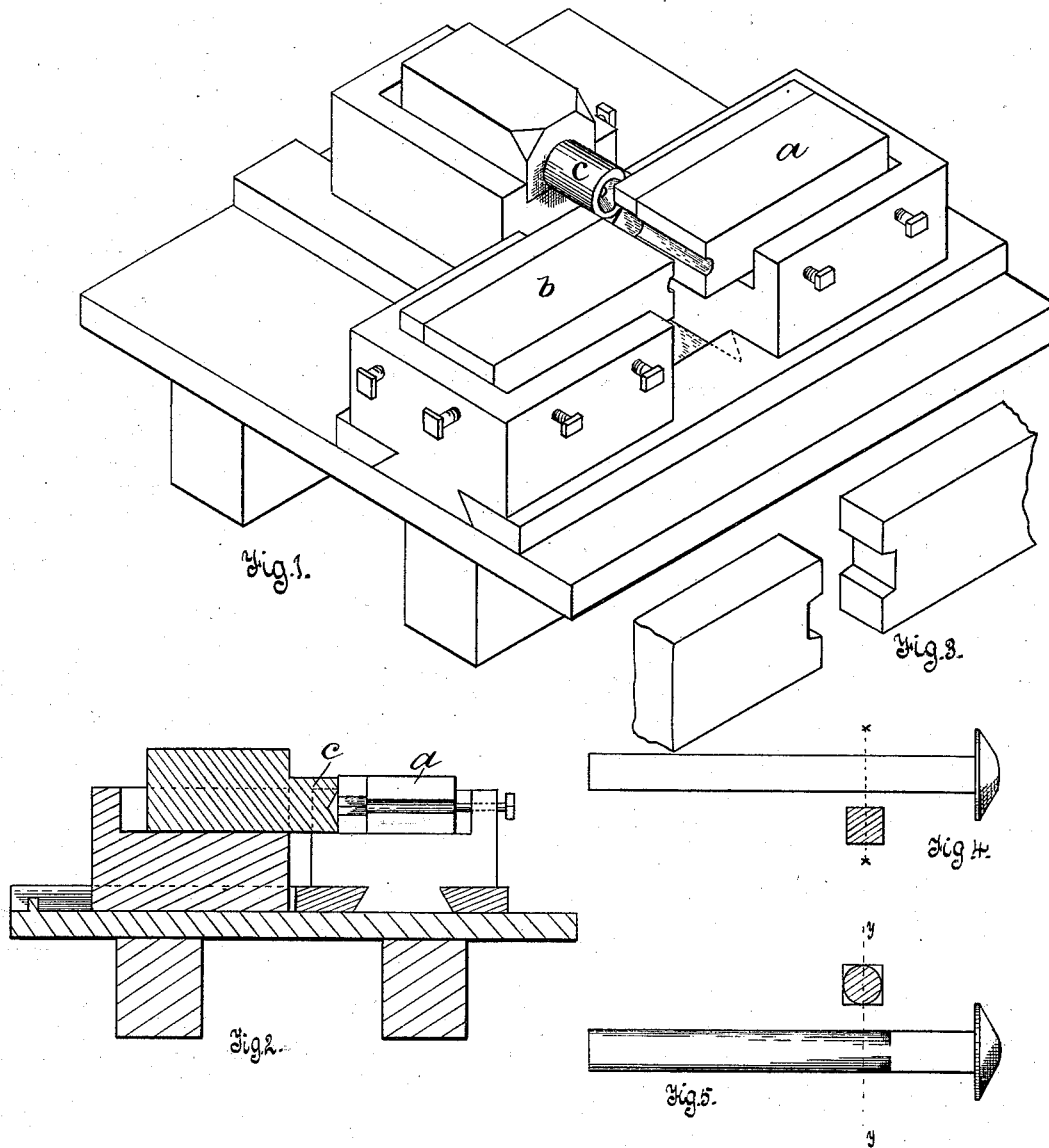


G. M. SMITH.  
Manufacture of Carriage-Bolts.  
No. 219,027. Patented Aug. 26, 1879.



Witnesses.  
Robert M. Hall  
J. C. Smith

Inventor.  
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By Bakewell & Kerr  
Attys

# UNITED STATES PATENT OFFICE.

GEORGE M. SMITH, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO HIMSELF  
AND WILLIAM J. LEWIS, OF SAME PLACE.

## IMPROVEMENT IN THE MANUFACTURE OF CARRIAGE-BOLTS.

Specification forming part of Letters Patent No. **219,027**, dated August 26, 1879; application filed  
February 11, 1879.

*To all whom it may concern:*

Be it known that I, GEORGE M. SMITH, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Manufacture of Polygonal-Necked Carriage and other Bolts, and like articles; and I do hereby declare the following to be a full, clear, and exact description of the invention, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a perspective view of devices which may be employed in carrying out my process. Fig. 2 is a sectional view of the same. Fig. 3 is a modification of die-sections. Figs. 4 and 5 are detail views of bolts and blanks, illustrating the steps of the process.

Like letters refer to like parts wherever they occur.

My invention relates to the manufacture of bolts with round shank and square or other polygonal-shaped neck from a blank of square or polygonal shape; and consists in upsetting that part of the blank which forms the angular neck of the bolt in dies having a correspondingly-shaped cavity, so as to increase its diameter beyond that of the blank, in addition to the ordinary operations of rounding that portion of the blank which forms the shank by compression between suitably-shaped dies, and upsetting the projecting portion of the blank to form the head, the object of my invention being to secure a full square or polygonal neck of greater length and diameter than the diameter of the shank portion of the finished bolt.

Heretofore, in the manufacture of articles of the class specified, several methods have been adopted, all more or less objectionable, either owing to the time, labor, and power necessarily involved in forming a perfect bolt, or because of the shape in which the neck of the bolt has been left.

One method has been to commence with a round blank of the diameter required in the round of the finished bolt, and then to form the neck by pinching the blank in dies at four or more points, whereby four or more projecting angles between the points of pinching were obtained, which would prevent the turning of the bolt when in use.

The objection to this process is the form given to the neck of the bolt, which is not the best for securing the bolt when in use, does not fill the bolt-hole, and is not shaped to the demand of the trade.

A second method has been to employ a square blank, whose cross-sectional area was the same as the square neck desired in the finished article, and then to reduce the same by dies to a round of the diameter required in the round of the finished article; but to reduce the square to a round whose diameter was even no less than the side of the original square required the elongation of the blank, and necessitated a more or less complex construction of dies which should have a drawing action on the metal.

Such method also involved the application of much power, and consequent great wear and tear of machinery, and was what might be termed a slow process, owing to the number of operations.

A third method has been to begin with a round blank of the diameter required in the round of the finished article, and, while the same was held or clamped in suitable dies, to form a square neck thereon by upsetting the end of the blank, the objection to which process is the difficulty of converting a round into a square by upsetting, and, consequently, the difficulty of thus obtaining a perfect square neck to the bolt when said neck was short, and the almost impossibility of obtaining a good result if the neck required was long, as it has been demonstrated in practice that the diameter of the blank is about the length that can be successfully upset when a change of form is to be made.

A fourth process has been to commence with a round blank whose diameter corresponded to the round of the finished article, and, while the same was clamped in suitable dies, to upset the end so as to obtain a round whose area in cross-section corresponded to the cross-sectional area of the square demanded for the neck, then to reheat and square the neck by independent dies, which latter process multiplied the operations and machinery necessary to produce a perfect article and increased the cost of manufacture.


As regards carriage-bolts, the object is to ob-

tain a bolt equal in quality to what is known as the "Philadelphia" or square iron bolt, in contradistinction to the pinch-necked bolt, and this in a rapid, perfect, and economic manner without the application of excessive force, and consequent undue strain and wear of such machinery as may be employed.

I will now proceed to describe my invention, so that others skilled in the art to which it appertains may apply the same, referring for that purpose to the machinery and diagrams shown in the drawings; but as the invention is a process, I do the same without prejudice or limitation as to machinery and form of blank.

I would here premise that it is well understood in the art of metal-working, first, that a bar of polygonal form in cross-section can be transformed into a round of the same cross-sectional area with comparatively little expenditure of force; and, secondly, that in upsetting metal to increase its cross-sectional area less force will be required and better results will be obtained if the original form of the blank corresponds to or approximates in form the ultimate or finished article. In carrying out my invention I avail myself of these two well-known laws.

For purposes of illustration I have shown two swaging-dies (one fixed, *a*, and the other movable, *b*, but both may be movable, if preferred) and a reciprocating upsetting-die, *c*, which, in the present instance, is shaped to form a header. Each of the dies *a b*, it will also be noticed, is sectional, one portion thereof having on its face a concavity corresponding to one half of the round to be formed, the other portions having recesses corresponding to the ultimate form to be given to the polygonal (or square) neck.

In order to show that the form of the cavity in the neck-dies may be varied at will, I have shown two of a series of sections—one V-shaped, the other  or half-square.

As the trade demands a square-necked bolt, the die-sections are here shown adapted to produce the same, and the blank used in carrying out the process is also shown as a square blank; but either or both may be made any given polygonal shape without further invention, provided the general rules herein laid down are followed.

The dies may be operated by any desired mechanism.

The machinery to be employed, as well as the size of the round section of the bolt, having been determined upon, I take a blank of polygonal cross-section, and whose cross-section in form corresponds to or approximates the cross-section of the neck to be given the finished article, and whose sectional area substantially agrees with the cross-sectional area of the round portion of the bolt (or like article) to be formed. This blank, after being properly heated, is subjected to the shaping-dies *a b*, the round cavities of which act upon the metal, transforming the polygon into a round

with little expenditure of force, as they are not required to draw, but simply displace and swage, the metal.

In the process the dies *a b* may be made to give one or more blows to the metal, as found necessary, but preferably several, the blank being turned on its longitudinal axis from time to time to avoid finning, &c. The upsetting-tool strikes the polygonal end of the blank while the blank is held by the dies *a b*, and as the original form of the blank remains unaltered at the point corresponding to the neck, and corresponds to the ultimate form of the neck, the metal will be forced equally in all directions to fill uniformly the cavities in the neck-sections of the dies *a b*, so as to obtain a perfectly-formed polygonal neck, and this with less power than is now commonly applied to the upsetting-die. As the upsetting-die shown is countersunk, as at *e*, the head of the bolt may and will be formed in the act of upsetting the blank to form the neck.

In carrying out my invention the blank may receive one or several blows of the transforming and upsetting dies; but in either event the saving of time, labor, and conservation of force, the saving of wear and tear of machinery, and the perfection of the article produced will show the marked advantages of my process over the several now known and in use.

One of the material advantages of my invention is, that while the benefit derived from re-forming the metal is obtained, the economy due to the saving of time by reducing the number of operations, and the further advantage of re-forming the neck, is gained. The imperfections of the original bar are also cured by thus re-forming the same.

It will be noticed that by my process I am enabled to use a bar which, while requiring to be enlarged to form the required size of neck, is still sufficiently large to form the required size of shank or round; and as the shank is much longer than the neck, the saving by the use of such a bar over the bars formerly used for making bolts from square iron is apparent.

Having thus described the nature and advantages of my invention, what I claim, and desire to secure by Letters Patent, is—

As an improvement in the manufacture of bolts from bars of metal of square or polygonal shape in cross-section, in addition to the rounding of the shank portion by lateral compression in dies, and upsetting the extremity of the angular portion to form the head, also upsetting the neck portion in the angular cavity of the dies, so as to increase its diameter and form the neck, substantially as and for the purpose hereinbefore set forth.

In testimony whereof I, the said GEORGE M. SMITH, have hereunto set my hand on the 6th day of February, A. D. 1879.

Witnesses: GEORGE M. SMITH.

R. H. WHITTLESEY,  
F. W. RITTER, Jr.