G. B. Brayton.

Dies for Threading Screws.

No. 71360 — Patented Nov. 26, 1867.

Fig. 1

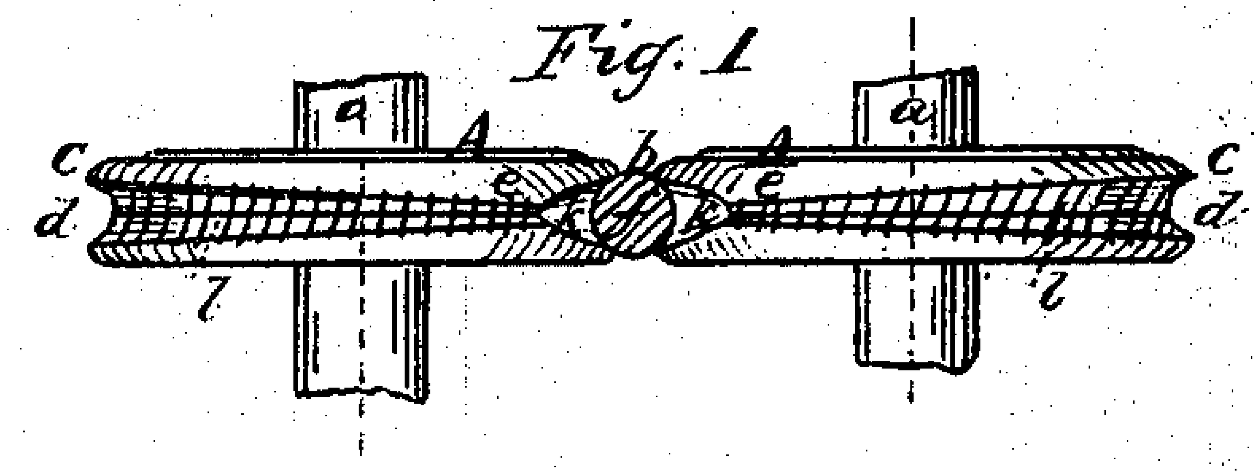


Fig. 2.

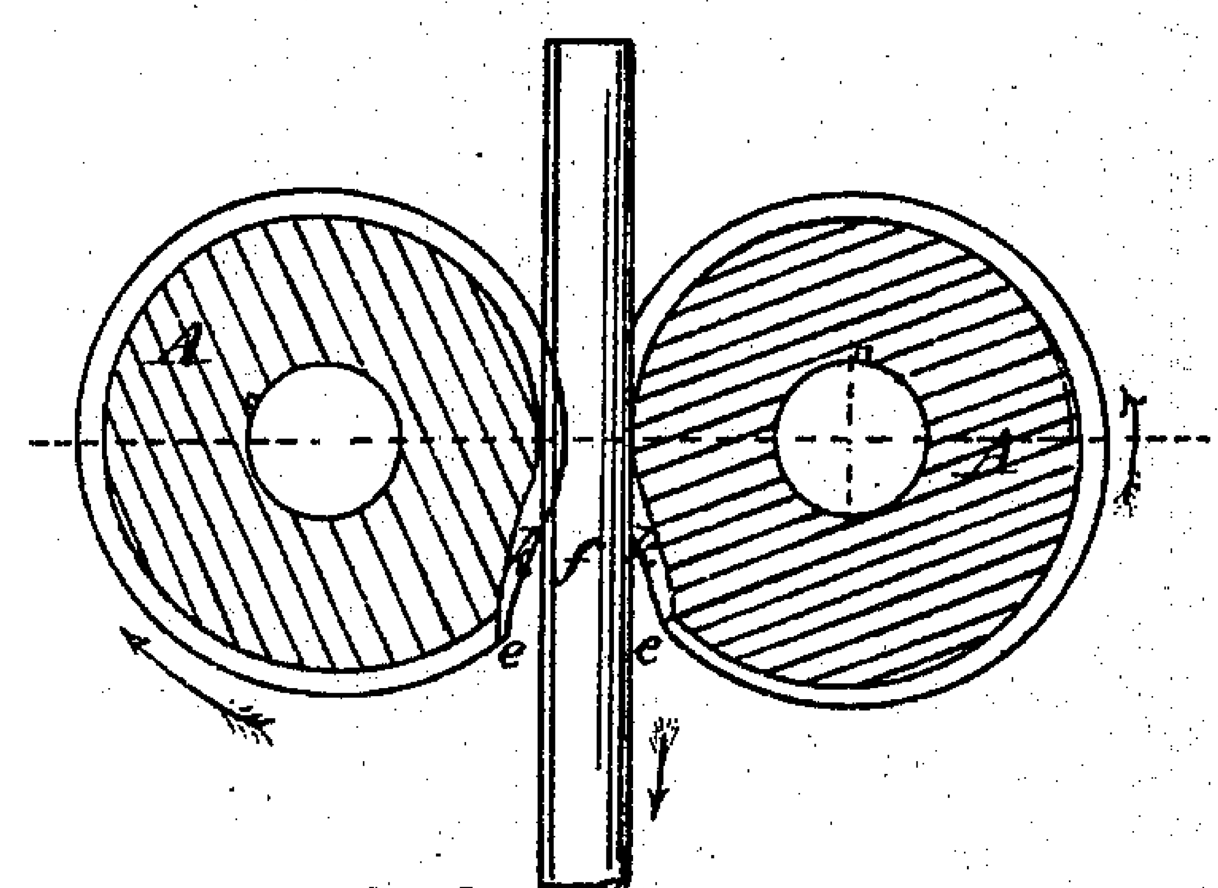


Fig. 3

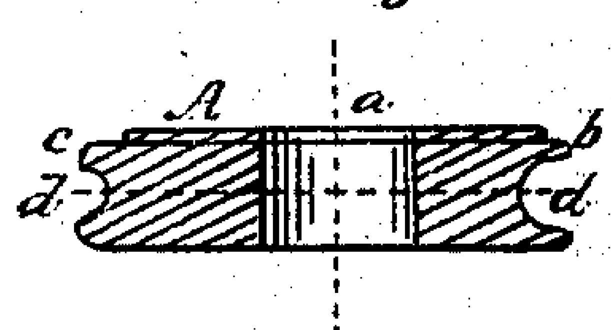
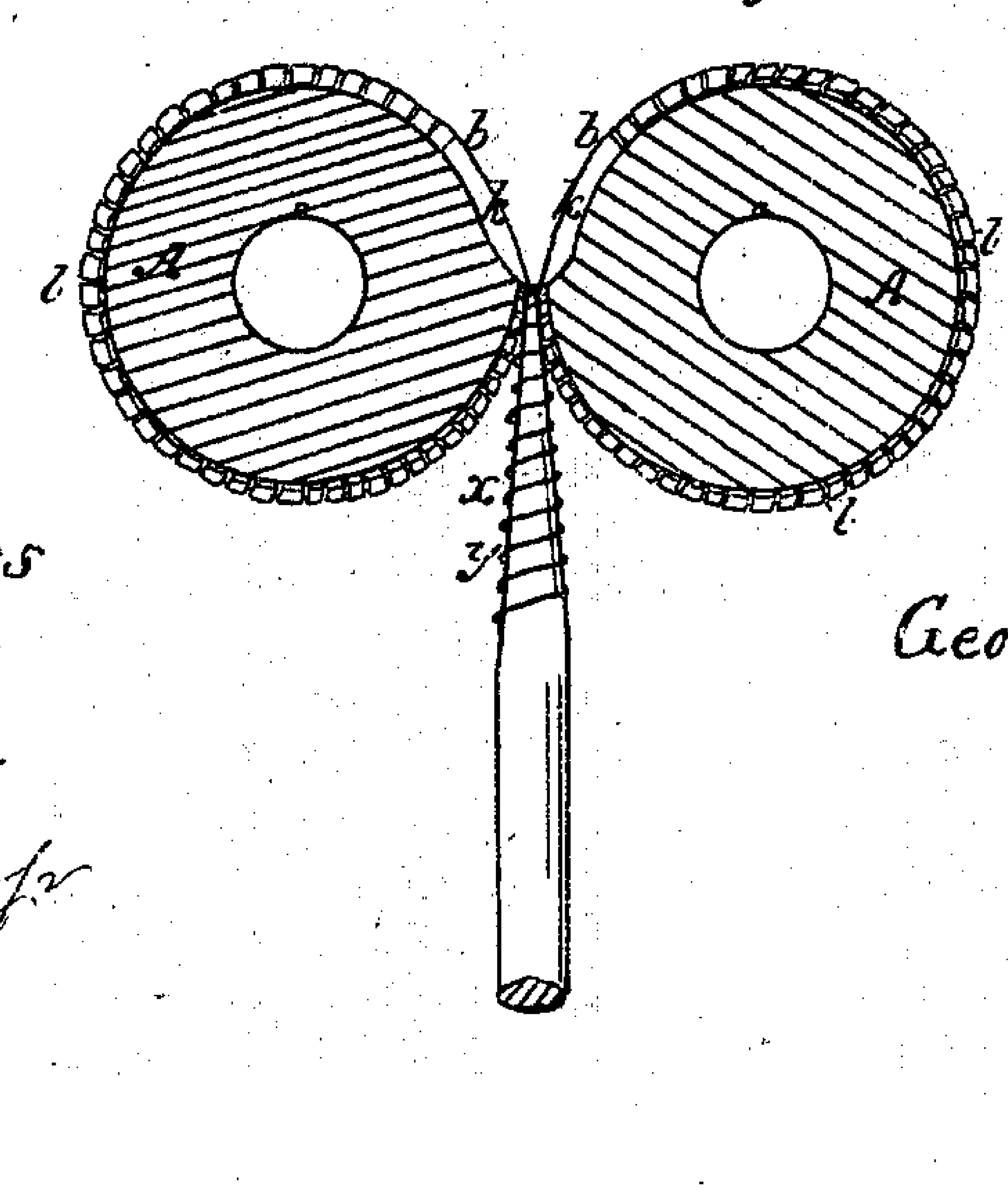


Fig. 4



Witnesses

[illegible]

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Letters Patent No. 71,360, *dated November* 26, 1867.

IMPROVEMENT IN DIES FOR THREADING SCREWS.

The Schedule referred to in these Letters Patent and making part of the same.

TO WHOM IT MAY CONCERN:

Be it known that I, GEORGE B. BRAYTON, of Providence, in the county of Providence, and State of Rhode Island, have invented certain new and useful Improvements in Cutting Screws; and I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings.

My invention relates to mechanism for cutting screw-threads upon blanks, and it has more particular reference to that species of such mechanism in which the screw-cutting surface or thread is formed upon the periphery of a die of circular form, ordinarily known as a "rotary die," the cutting surface being concave in shape, (including generally from one-third to one-half of a circle,) and extending continuously around the die. While the employment of such dies is, as is well known, productive of important advantages in certain respects, yet an objection arises to their use from the fact that, as they are of circular form, there is no variation in the distance of the cutting edge from the centre or axis of motion of the die, and, therefore, the die in itself is incapable of following the "taper," or gradual decrease or increase in the size of the blank, so as to cut a thread of uniform size and proportions upon all parts of the blank. This result can only be attained by the use of auxiliary mechanism, acting either in conjunction with the dies, or independently of them, such mechanism being, in many instances, both complicated and expensive.

The object of my invention is to produce a rotary die, which in itself, and without the aid of other mechanism, shall be capable of cutting a thread from one end of the screw-blank to the other, no matter what may be the "taper" or varying dimensions of such blank; and, to this end, it consists of a rotary die, in which the distance of each portion of the cutting surface from the centre of motion or axis of the die varies, or is graduated to conform to the dimensions of the corresponding part of the blank upon which such portion of the cutting surface is to operate. In other words, the die, instead of being circular, is cam-shaped, the gradual increase in the distance of the successive portions of the cutting surface from the centre of the die being determined by the form and taper of the screw-blank to be cut. Thus, when the blank is passing between two or more of such dies, (the feed of the blank causing the gradual rotation of the dies,) the decrease in the size of the blank will be compensated by the expansion or swell of the cam-dies, and their cutting surfaces will continue to be held in close contact with the blank until the thread is completed on the tapering point, and the screw is withdrawn from between the dies.

In order to adapt the concave cutting surface to operate upon all parts of the blank, it must be made tapering in the direction of its length, so as to conform to the shape which the blank will ultimately have. For instance, suppose the blank gradually decreases in size from the upper part of the shank to the point, the cutting surface of the die must, therefore, be of greatest dimensions at the point where it meets the upper part of the blank, and thence passing around the die, it decreases in width and depth, so as to conform to the shape of the blank, until, by the time it reaches that portion of the die from which it started, it has tapered to such a degree as to be capable of cutting, with perfect facility, a finished thread upon the extreme point of the blank.

It will be seen from this general description of my invention that it is susceptible of many modifications. The shape of the cam-die is of course determined by that of the blank, and its size, as well as the number of cutting threads or edges which it carries, must be regulated by the length of the screw to be cut, and the number of revolutions which the blank must make to cut any one portion of the thread.

These, as well as other features of my invention, will be more fully understood by reference to the accompanying drawings, in which I have illustrated one method of giving effect to my invention.

In Figures 1, 2, and 3, a die constructed according to my invention is shown in elevation, horizontal section, and vertical section, respectively.

The die A, which is cored out, so as to be mounted on a spindle, as hereinafter described, is not circular, but cam-shaped, as shown clearly in figs. 2 and 3, the distance from the axis or centre of motion *a* of the die to the point *b*, on its periphery, being less than that from *a* to the point *c*, on the periphery, diametrically opposite *b*. The concave cutting surface *d* is formed in the die by means of a tap of suitable size and shape, as will be readily understood without further explanation. Following the cutting surface around from the point *b*, where it is nearest the centre of motion *a* of the die, it will be seen that it gradually increases its distance from the centre of motion, so that, when it has completed the circuit of the die, arriving at the point *e*, adjoining *b*, it is at its greatest distance from the centre *a*.

In order to enable the cutting surface to operate with the best results upon the blank, it has a tapering formation, as seen in the drawings, figs. 1 and 3, its dimensions being gradually contracted as it approaches the point *e*, so as to cause it to conform to the corresponding taper or decrease in size of the blank. Thus, as the eccentricity of the die is augmented, the cutting surface becomes smaller, until, at the part *e*, where the eccentricity of the die is the greatest, the cutting surface tapers or is brought to a point.

It will be understood that the form and "taper" of the cutting surface, as well as the degree of eccentricity possessed by the die, are at all times governed by the size and shape of the screw to be cut, the die being so formed as to follow or conform to the varying dimensions of the blank.

The principle which regulates the construction of the die will best be understood by reference to figs. 2 and 4, where the screw-blank *f* is represented as being cut by two dies. It is manifest, however, that three or more dies may be employed, instead of two, as occasion may require.

The dies A A are mounted opposite each other, so as to lie in the same plane, and upon spindles which should, of course, be geared or otherwise suitably connected together, so that the dies shall move in unison, and present corresponding or similar portions of their cutting surfaces to each other. By means of mechanism, such as ordinarily employed in screw-cutting machines, they may be actuated to approach or recede from one another, according to the size of the blank which is placed between them.

When the blank is to be operated on, the points *b* of the dies, where the cutting surface is of the greatest dimensions, and where the eccentricity of the die is least, are brought opposite each other. The blank *f* is inserted between the dies until that portion of the shank is reached where the dies are to commence to operate, the thread being cut from the upper part of the shank towards the point or taper end. The dies are then moved up, so as to grasp the blank, the portion *b* of each cutting surface being in contact with the blank. The latter is now caused to rotate by any ordinary or suitable means, its feed, or movement whereby it is gradually drawn between the dies, being regulated by a leading-screw, or other suitable governing mechanism. The blank moves out from the dies in the direction indicated by the arrows, the rate at which it rotates upon its axis bearing such relation to the feed movement as to cause the thread to be formed and perfected upon each successive part of the blank drawn between the dies. For instance, the blank may be required to revolve eight or ten times, while in its feed movement it only passes over the distance *x y*, from one thread to another. This combined motion of the blank effects the gradual rotation of the dies.

It is manifest that the feed of the blank, and rotary movement of the dies, ought to bear such relation to each other that, when the taper end or point of the blank is about being withdrawn from between the dies, the latter shall have rotated sufficiently to bring the points *e* of their cutting surfaces opposite each other, so as to grasp and cut the taper end. Therefore, if the length of the cutting surface *d* is twice or thrice that of the blank to be cut, the movement of the dies must be proportionately in excess of the feed of the blank. This result is effected by means of the blank, which, in its revolutions, engages with the cutting threads or teeth of the dies, thus drawing the latter gradually around in the direction of the feed. The excess of the rotary movement of the blank over its feed imparts the requisite increased movement to the dies, the blank being operated on by three, four, or more successive teeth or cutting threads, according to the number of revolutions it makes in passing over the distance *x y*, as will be readily understood by those skilled in the art to which my invention pertains. If the blank make but few revolutions in traversing this distance, then, of course, the cutting threads or teeth will be proportionately few in number, and the length of the cutting surface will be shortened. But if in cutting a screw of the same length, it be required to rotate the blank at a higher rate of speed, then, as the blank, while traversing the same distance *x y*, will be brought in contact with a greater number of cutting threads or teeth, the length of the cutting surface must be increased to compensate for the increased rapidity of the movement of the dies, caused by the greater number of revolutions made by the blank.

By reason of this relation which exists between the feed movement of the blank and rotary movement of the dies, it will be seen that, in proportion as the blank is withdrawn from the dies, that part of it which is presented to the cutters gradually tapering or becoming smaller in diameter, those portions of the cutting surfaces *d* which are brought in contact with the blank as gradually increase their distance from their respective centres of motion *a*, so as to compensate for the decrease in the size of the blank. At the same time the tapering formation of the cutting surfaces enables them to fit upon and cut with perfect facility the tapering shank. By the time the point of the blank has arrived between the dies, the latter will have completed their revolution, and the end of the blank passes out from between the contracted ends *e e* of the cutting surfaces, which form the thread upon the extreme point of the screw. The thread is thus cut at one operation, and is equally well finished on every part of the screw, the end or gimlet-point being without any of the imperfections, or marks of the jamming and compressing action of the dies, so often seen in screws cut by ordinary means.

The die A may be made eccentric or cam-shaped before the cutting surface is formed in it, or it may be of a circular form, the edge being bevelled at *h h*, as shown in the drawings. In the latter case, the cam-like formation will be given the die when the cutting surface *d* is tapped out, a greater portion of the bevelled edge being cut away where the larger or deeper part *b* of the cutting surface is located, than at the points *e e*, where the surface is contracted and tapering. To form the cutting surfaces, a tap of suitable shape, to give the necessary taper to such surfaces, may be run through between the edges of two dies, placed opposite each other, as is done in the case of ordinary circular dies, or other suitable means may be employed.

In order to avoid the great increase in the diameter and size of the die, which would otherwise necessarily take place, in case it should be required to cut a screw of great length, the depth or thickness of the die may be increased, and the cutting surface may be formed spirally upon the die, being carried two, three, or more times around the cam-surface of the die, according to the length of the screw to be cut. By this means, without increasing the diameter of the die, I can obtain a cutting surface which will cut a screw of very great length, the thread being carried up as near the head of the blank or screw as may be desired.

Between the beginning *b* and termination *e* of the cutting surface *d*, a cleaning-space, *k*, may be formed in the edge of the die. This not only admits of the dies being more easily adjusted to the blank, before they commence to operate, but also allows the blank, when it is first placed between the dies, to clear the projecting parts *e* of the cutting surfaces, with which it might otherwise be brought in contact at the beginning of the operation. A notch or groove, *l*, is made in the cutting surface *d*, extending throughout its whole length, and dividing the threads, thus increasing the number of cutting edges or teeth.

The rotation of the dies may be effected by other means than herein described, and by a separate and independent mechanism. In any event, however, their movement should always bear the relation to the feed movement of the blank as hereinbefore set forth.

Having now described my invention, and the manner in which the same is or may be carried into effect, what I claim, and desire to secure by Letters Patent, is—

1. A rotary die for cutting screws, in which the cutting surface is at varying distances from the axis or centre of motion of the said die, so as to conform to the "taper" and varying dimensions of the screw-blank to be cut, substantially as herein shown and set forth.

2. A rotary-cam die, in which the concave cutting surface is made tapering or of varying dimensions, so as to fit both the shank and taper end of the blank to be cut, as herein specified.

3. The method herein described of cutting the screw-thread upon both the shank and taper end of a blank, by the employment of two or more rotary-cam dies, constructed and arranged as specified, so that, while their centres of motion are fixed and unchanged, their cutting surfaces shall approach or recede from each other, to conform to the varying dimensions of the blank passing between them.

4. In a rotary-cam die, as herein described, I claim the combination, with the tapering cutting surface, of the cleaning-space *k*, substantially in the manner and for the purposes herein shown and specified.

I testimony whereof I have signed my name to this specification before two subscribing witnesses.

GEO. B. BRAYTON.

Witnesses:
M. Bailey,
J. W. Hoard.