Jan. 2, 1923.

1,440,376

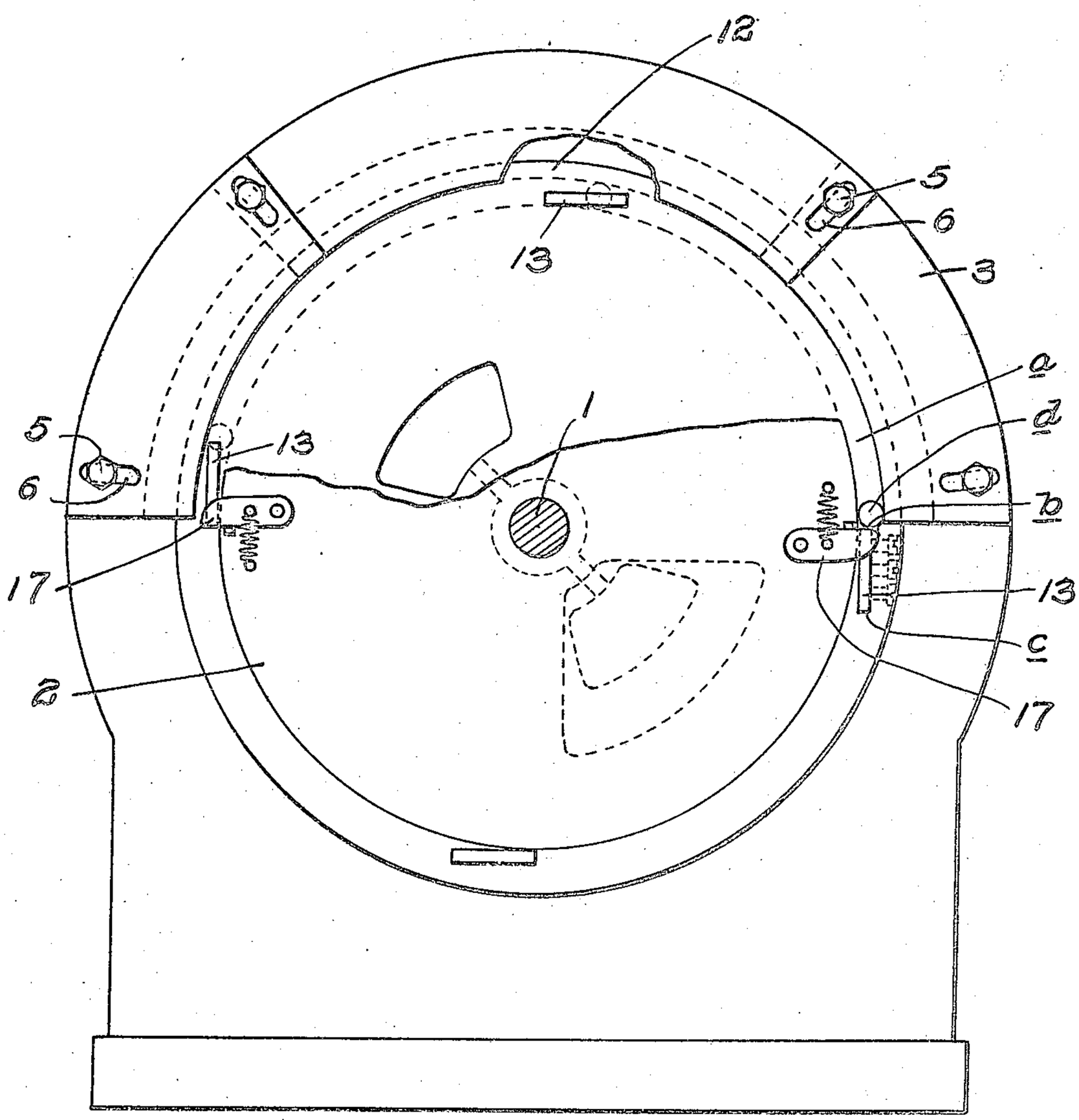
J. CRAIG.

METHOD OF POINTING BOLTS.

FILED JUNE 6, 1921.

2 SHEETS-SHEET 1

FIG. I.



WITNESSES

J. Hebel Bradley.

Francis J. Donahoe

INVENTOR

James Craig

by Christy and Christy

his attorneys

Jan. 2, 1923.

1,440,376

J. CRAIG.

METHOD OF POINTING BOLTS.

FILED JUNE 6, 1921.

2 SHEETS-SHEET 2

FIG. II.

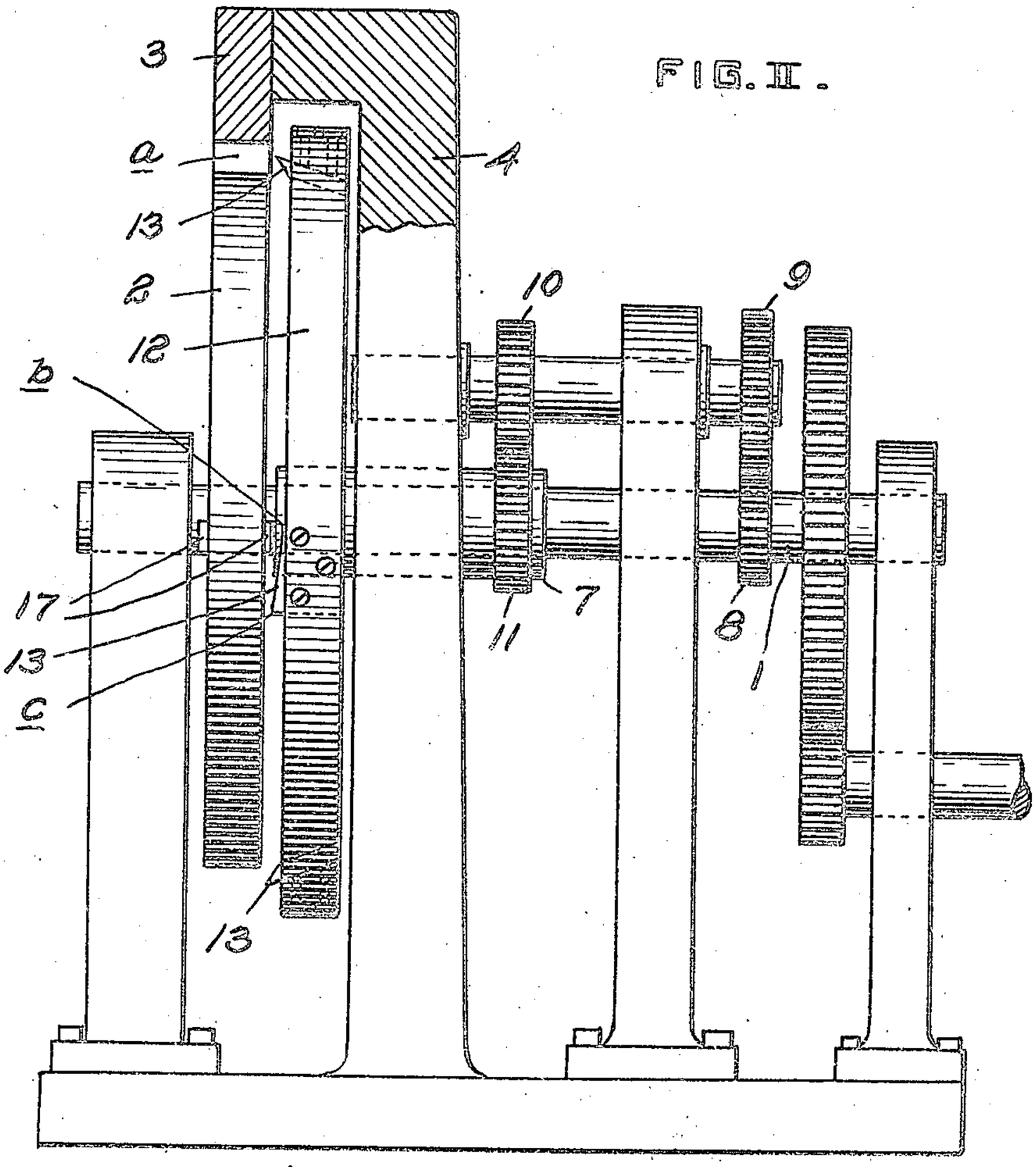


FIG. III.

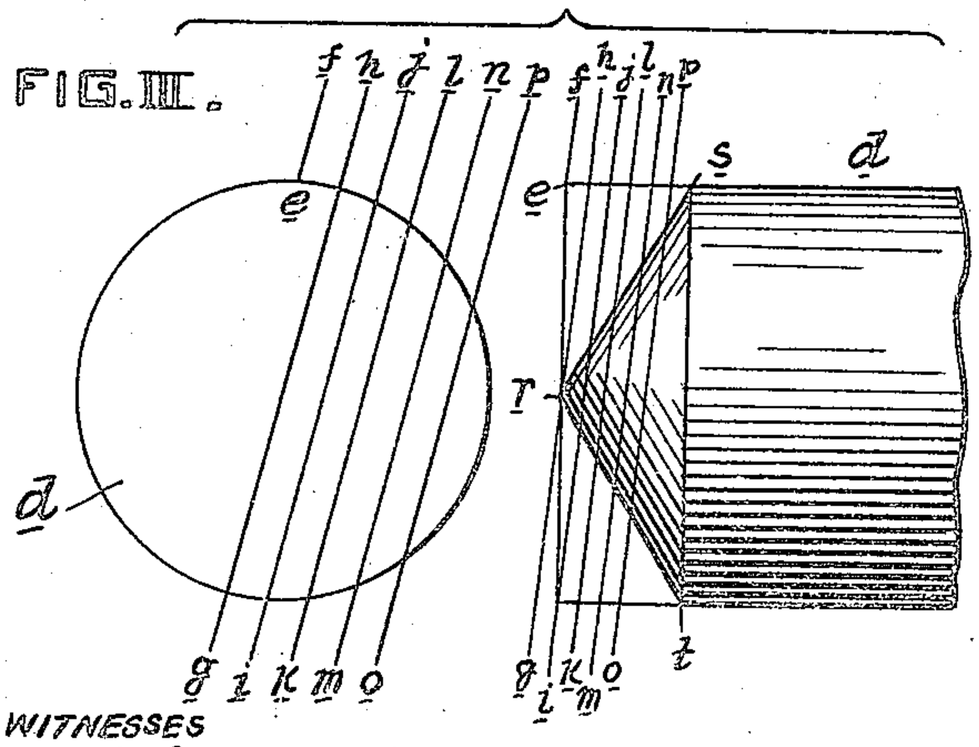
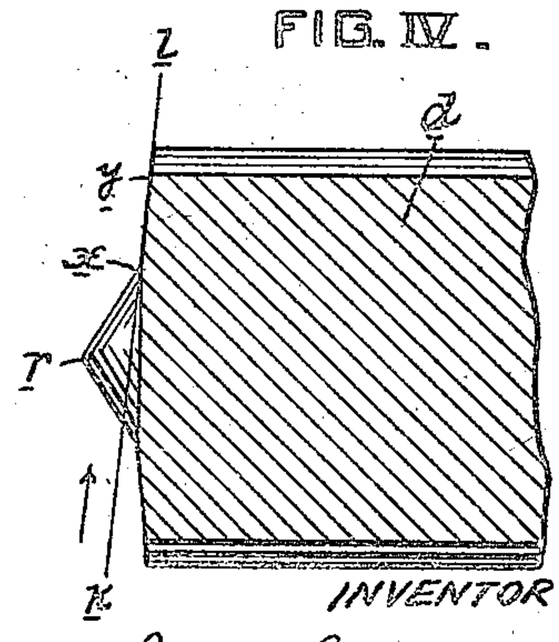


FIG. IV.



INVENTOR

James Craig

by Christy and Christy

his attorneys

WITNESSES

J. Herbert Bradley

Francis J. Donahoe

Patented Jan. 2, 1923. 1,440,376

UNITED STATES PATENT OFFICE.

JAMES CRAIG, OF BUTLER, PENNSYLVANIA.

METHOD OF POINTING BOLTS.

Application filed June 6, 1921. Serial No. 475,289.

To all whom it may concern:

Be it known that I, JAMES CRAIG, residing at Butler, in the county of Butler and State of Pennsylvania, a citizen of the United States, have invented or discovered certain new and useful Improvements in Methods of Pointing Bolts, of which improvements the following is a specification.

My invention relates to the machining of bolts and more particularly to the turning of pointed ends upon bolts. Bolts are formed from rolled stock from which ordinarily lengths of material are sheared, and it is requisite to form by a cutting operation a point upon the sheared-off length of stock or upon the blank otherwise prepared. The objects of my invention are simplicity of structure and adequacy and economy in operation. In the sequel it will appear that my invention is found not in apparatus merely, but also in a method of effecting the desired cut.

In this application I shall claim the method described. In a companion application filed November 24, 1922, Serial No. 602959 I claim as my invention the apparatus.

In a third application filed March 18th, 1921, Serial No. 453,264, an application still pending in the Patent Office, I have described and claimed a bolt-pointing machine of the same general character as that to which my present invention is addressed. It is characteristic of that machine and of the machine of my present invention also that the bolt under treatment is rolled in a slot formed by and between opposite parallel cylindrical surfaces, the width of the slot being equal to the diameter of the bolt blank. One of these two surfaces is stationary, the other is movable, rotating on the common axis of the two cylindrical surfaces. It will be understood that, if a cylindrical article be so rolled between plane surfaces which extend parallel one to the other, the rate at which the rolled article will advance will be exactly half the rate of relative movement of the two surfaces; but it will further be understood that, when the rolling is between cylindrical surfaces, the rate of advance of the rolled article will not be exactly half the surface speed of the moving cylindrical surface. There is a new factor introduced, namely, the difference in radius of curvature of the two surfaces, in consequence of which (in the machine of my prior application alluded to) the bolt, as a matter of fact, lags somewhat—that is to say, advances at something less than half the surface speed of the moving cylindrical surface (the surface of smaller radius). I have in the specification of that earlier application described the cutter for pointing the bolt as advancing at substantially half the speed at which the movable cylinder advances, and it will be understood from what has just been said that there must be a niceness of adjustment of relative speeds, to bring it about that the cutter shall advance in exact synchronism with the bolt blank.

In the machine of my present invention I eliminate the necessity of minutely adjusting the rate of advance of the cutter, to accord exactly with the rate of advance of the blank. I cause the cutter to advance at exactly half the speed of the moving cylinder and, adopting a cutter of the particular construction presently to be described, I take advantage of the difference in the rate of advance of cutter and of bolt blank, to effect the cutting operation.

In the accompanying drawings, Figure I is a view of the machine of my present invention seen in end elevation, certain parts being for the sake of clearness broken away; Figure II is a view of the machine partly in side elevation, partly in medial and vertical section; and Figures III and IV are diagrammatic illustrations of the manner in which cutting is effected, in which manner of cutting the improvement in method particularly resides.

On a shaft 1, suitably mounted and rotated from a sutable source of power, is integrally carried a drum 2. At an interval from and opposite the periphery of drum 2, a stationary block 3 is mounted. This block presents to drum 2 a concave cylindrical face, and its curvature is concentric with respect to the cylindrical face of drum 2,— the interval at which drum 2 and block 3 stand apart (an interval equal to the diameter of the bolt to be pointed) may be nicely adjusted by securing block 3 to a standard 4 by bolts 5, and forming in blocks 3 radially extending slots 6 through which the securing bolts extend. This standard (which as presently will appear serves other and additional purposes) is arranged opposite drum 2 at one side and at an interval from drum 2. It stands as shown in Figure II to rearward of drum 2 on the right.

Shaft 1 extends through an opening in this standard. As shown in Figure I the peripheral extent of block 3 around drum 2 amounts to approximately 180°. The angular extent of this block is however not a matter of limitation; for, as will be apparent in the sequel, its extent may be greater or less, according to the particular shape and position of the knife and the consequent rapidity with which cutting is effected. If the extent be, as advantageously it is, approximately 180°, the block 3 will, in order to make possible the desired adjustment, be composed of sections.

The space between drum 2 and block 3 constitutes a slot *a;* in this instance it is semi-circumferential in its extent. When the machine is assembled it will be understood that a bolt introduced into this slot and lying in a line parallel with the axis of rotation (that is to say, longitudinally of the drum) will be simultaneously tangent to the opposite faces of drum and of block. It will further be understood that rotation of drum 2 within the stationary block 3 will cause a bolt so lying between, to roll. As the bolt rolls, it will advance along the slot in the direction in which the drum turns, and from what has gone before it will be understood that the rate of bolt advance relatively to block 3 will be slightly less than one-half the rate at which the surface of drum 2 turns relatively to block 3. Accordingly, each complete rotation of drum 2 will effect the advance of the bolt something less than half way round the drum; or, if the slot extends exactly half way round the drum, then it will require a little more than one complete rotation of the drum to cause a bolt blank to advance throughout the entire length of the slot.

What may be the value of this difference, what may be the actual value of the lag of the advancing bolt, is an ascertainable amount, calculable from the difference between the radii of curvature of the two opposing cylindrical surfaces.

Loosely mounted for free turning upon shaft 1, but secure against longitudinal movement upon the shaft, is the cutter wheel 12. It is arranged to rearward, that is to say on the right-hand side (Fig. II) of drum 2, The hub 7 of the cutter wheel is prolonged and extends freely through the opening in standard 4. This cutter wheel 12 is caused to rotate in the same direction with drum 2 and at half the speed of drum 2 by gearing interposed between shaft 1 and hub 7, this gearing being indicated at 8, 9, 10, and 11.

The cutter wheel 12 carries the cutter 13, its cutting edge *b*—*c* (as appears in Figure I) extends at once longitudinally of and transversely of the slot *a*, and (as appears in Figure II) longitudinally of the cylindrical surfaces which define the slot *a*. In other words, it is oblique both to the radius and to the axis of the cylindrical surfaces. Furthermore, as will appear in the uppermost presentation in Figure II, there is clearance in the formation of this knife 13 from its cutting edge rearward, that is to the right. The length of this knife measured in the line of its travel is equal approximately to the lag above described of the bolt blank in its advance through slot *a*, less the diameter of the bolt blank itself.

Drum 2 is at its periphery provided with pairs of outwardly extending yielding fingers 17. When the parts are assembled the arrangement is such that, as the machine operates, fingers 17 carry a bolt blank laid upon them into slot *a* at the very instant when the forward end of the cutter blade comes opposite the end of the slot. This relative position is indicated in Fig. I on the right, where a blank *d* is shown just entering the slot *a*, while the knife appears in such position that the forward end *b* of its cutting edge also is coming opposite the end of slot *a*. Immediately upon entering slot *a* the bolt blank *d* engaged by the opposite surfaces of drum and block is retarded and advances at reduced and definitely controlled speed. The fingers 17, borne as they are by drum 2 at undiminished speed, swing aside, and, advancing, pass beyond contact with the bolt blank. When they have so passed they resume their normal position, ready to pick up another bolt blank on the next rotation. Inasmuch as drum 2 travels at twice the speed of the cutters, there will ordinarily be half as many pairs of fingers 17 upon drum 2 as there are cutters upon wheel 12. The drawings show four cutters arranged at quadrant points about the wheel 12, and correspondingly two pairs of fingers 17 arranged diametrically opposite one another.

It remains to be remarked that there is no movement of the cutters in a direction perpendicular to the plane of their orbit; there is no swinging of the cutters in their carrier; the cutter wheel and the parts which it carries advance as an integer. In this respect the machine of this application differs from the machine of my application Serial No. 453,264, alluded to above. And it should in this connection be remembered that there is no longitudinal movement of the bolt under treatment, no feeding of it forward toward the cutter. Its motion is one of rotation and advance along slot *a*. The progressive cutting of the point is due to the fact that the cutting edge of the knife is inclined to the axis of the bolt; that a portion only of the cutting edge engages the work at any given moment; and that this work-engaging portion progresses from end to end of the obliquely set edge.

Operation is as follows: The parts being assembled as shown in Figures I and II, the direction of rotation of drum 2 and of wheel

12 is anti-clockwise (cf. Fig. I) and the speed of rotation of drum 2 is as has already been made plain twice the speed of rotation of wheel 12. An unpointed bolt is laid on the fingers 17 approaching the right hand end of the slot. Rotation of shaft 1 carries the bolt into the slot where immediately it begins its rolling advance, traveling at something less than half the speed at which the surface of drum 2 turns, and at something less than the speed at which the cutters 13 advance. As has been said, fingers 17, advancing faster than the blank *d*, swing aside, and pass beyond.

Considering now the cutting operation more minutely, and beginning with the parts in the position shown at the right in Figure I, it will be seen that the cutting edge *b*—*c* of the knife is coming into engagement with the end of the blank *d*. (It should have been explained above that the blank *d* when applied is brought accurately to position projecting from drum 2 to the right—Fig. II—an exactly predetermined distance. And it should further be said that this distance does not change. There is in the operation of the machine as shown no advance of the blank longitudinally of the cylindrical surface throughout the operation.) As operation progresses, the knife overtakes the blank; and, compassing the three positions shown somewhat diagrammatically in Figure I, arranged at quadrant points, it will be seen that in the course of the advance of the blank throughout the extent of its semicircular path *a* the whole length of the knife passes across the diametrical width of the blank. On the right, the knife is rearward of the blank. On the left, the blank is rearward of the knife, while at the intermediate point above, the knife wholly overlies the blank.

Turning now to Figure III of the drawings, the line *e*—*f* will indicate the position of the cutting edge of the knife relatively to the blank *d* at the moment when the blank enters the slot *a*. Presently the edge of the knife will overlie the blank on the line *g*—*h*, and it will be observed that in this position a cut is being formed which extends from the center to the perimeter of the blank. As operation progresses, the edge of the knife will advance so that the line of cut will come progressively to the positions indicated by the lines *i*—*j*, *k*—*l*, *m*—*n*, *o*—*p*. The line upon which the cut is progressing then advances with the operation from the center of turning toward the perimeter; and meanwhile the clearance alluded to above in the shaping of the knife gives space for the developing point beyond the cutting edge of the knife. The outline of the ultimately formed point is in Figure III indicated by the lines *t*, *r*, *s*.

Fig. IV is a diagrammatic showing, being a view of the blank in section, on the plane indicated by the line *k*—*l*, Fig. III, the operation of pointing having advanced until the edge of the cutter lies in the line *k*—*l*, but no further. It will be observed that the point *r* has developed, and this point now lies within the under cut at the edge of the knife. Cutting is progressing on so much of the line *k*—*l* as is indicated at *x*—*y*. This line of cut *x*—*y* always extends to the periphery of the blank, and diminishes in length, until at the completion of the operation it is zero. The region *x*—*y* of actual contact, of diminishing length, as already explained, is, as operation progresses, constantly advancing along the knife edge in the direction indicated by the arrow in Fig. IV.

It will immediately be apparent to the engineer that minute shaping of the knife edge makes possible minute gradation in the shape of the point which is cut. This point may be rounded,—a shape which ordinarily is advantageous.

I do not mean to limit myself to details of structure, nor to details of machine operation. In these respects the foregoing specification is exemplary merely. It is manifest that the invention is applicable, not to the pointing of bolts merely, but generally to the pointing of spindle-shaped articles.

I claim as my invention:

1. The method herein described of pointing a spindle-shaped article which consists in causing the article to rotate on its axis under a knife whose edge extends in a line oblique to the axis of rotation and causing the line of engagement between article and knife to advance as operation progresses longitudinally of the knife edge and to recede from the center toward the perimeter of the article.

2. The method herein described of pointing a spindle-shaped article which consists in spinning the article upon its axis under a knife edge set oblique to the axis of the spinning article and, as cutting progresses, shifting the position of article to cutter both longitudinally of and transversely of the knife edge.

In testimony whereof I have hereunto set my hand.

JAMES CRAIG