(No Model.) 3 Sheets—Sheet 1.

S. K. WHITE.

GEOMETRIC LATHE.

No. 291,451. Patented Jan. 1, 1884.

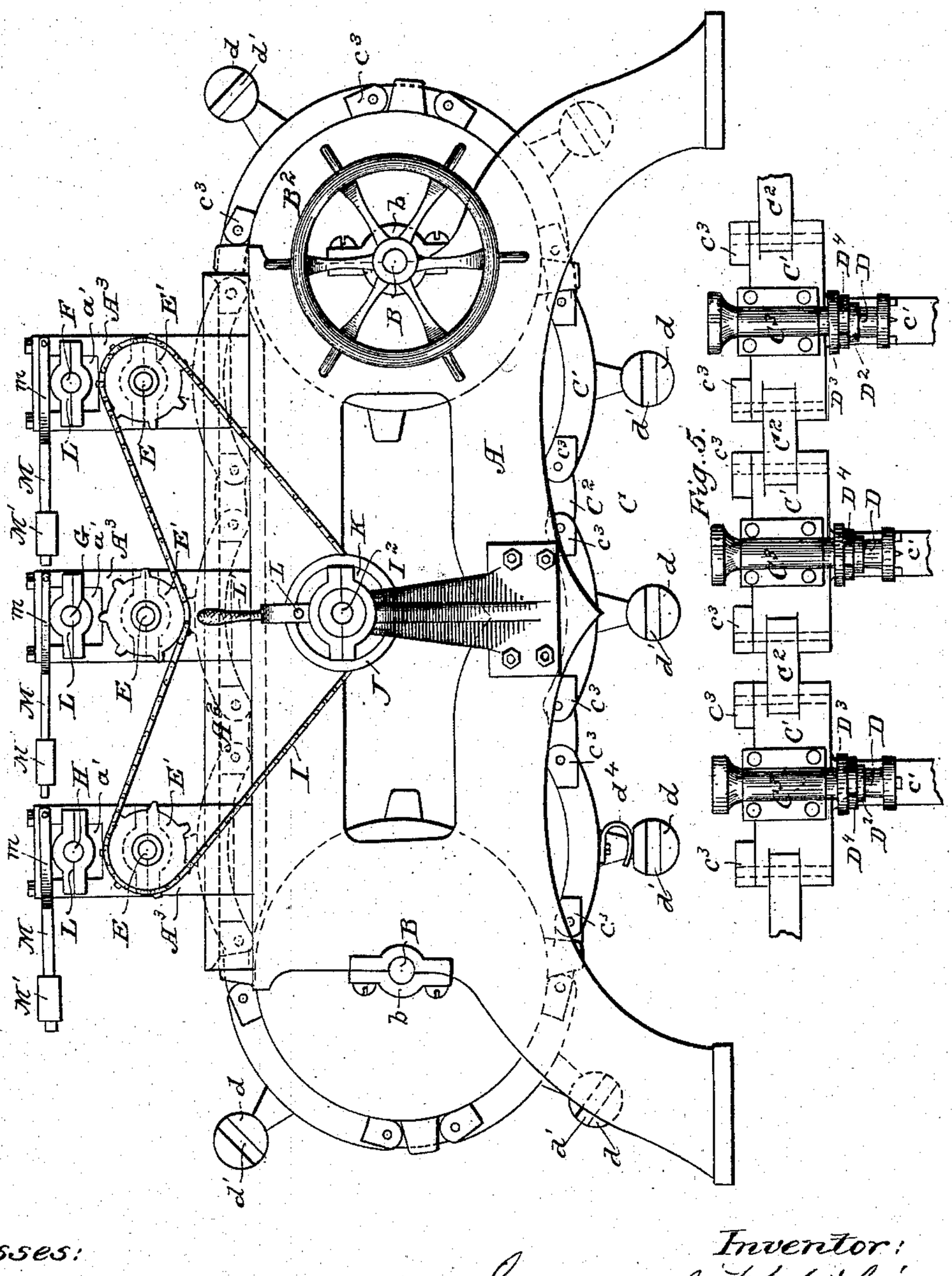

Fig. 1.

Fig. 2.

Witnesses:
Jno. H. Stockett,
C. C. Poole

Inventor:
Samuel K. White
per W. D. Dayton
Attorney

(No Model.)

3 Sheets—Sheet 2.

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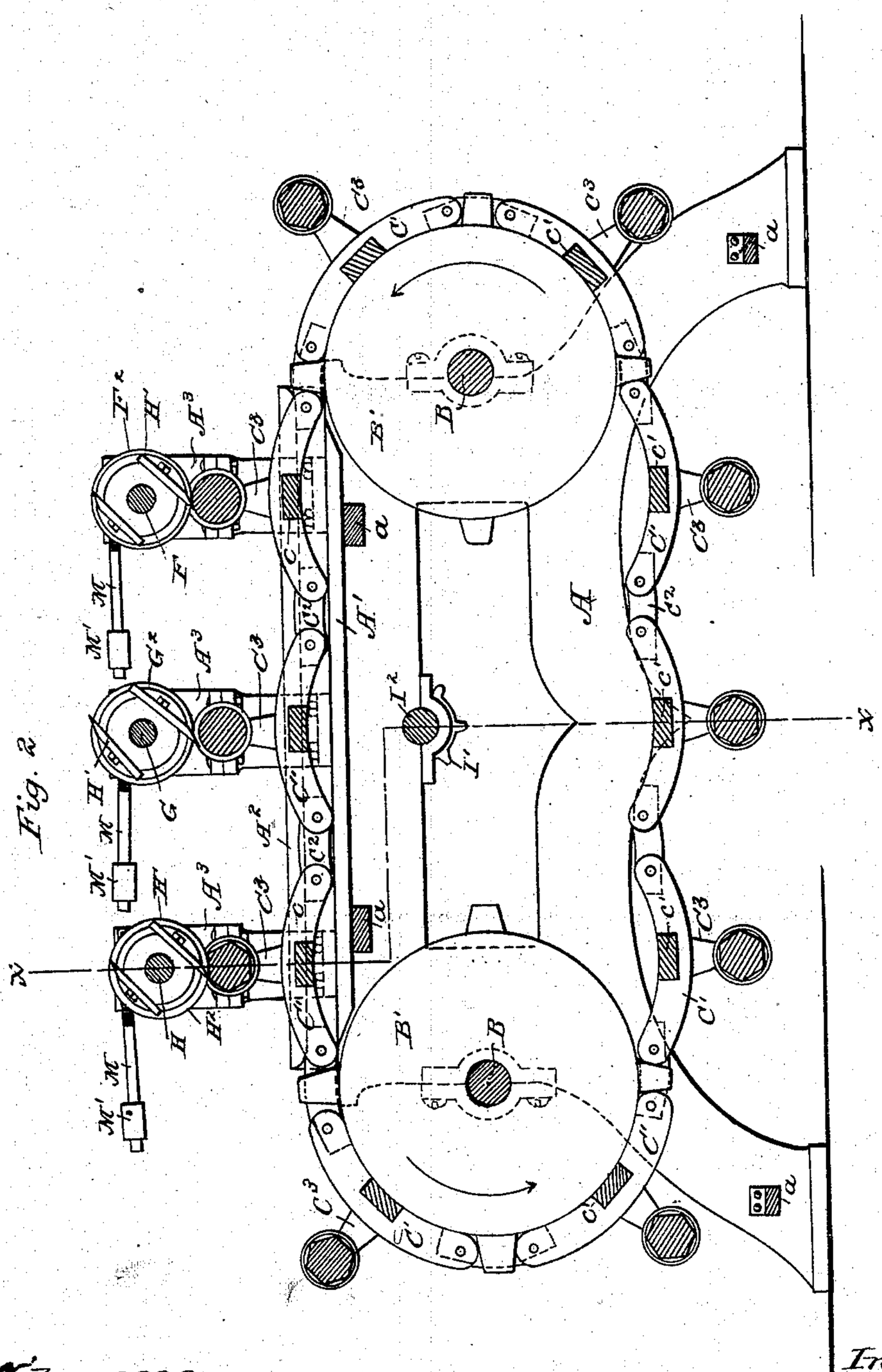

Witnesses:
Jno. W. Stockett.
C. C. Poole.

Inventor:
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(No Model.)

3 Sheets—Sheet 3.

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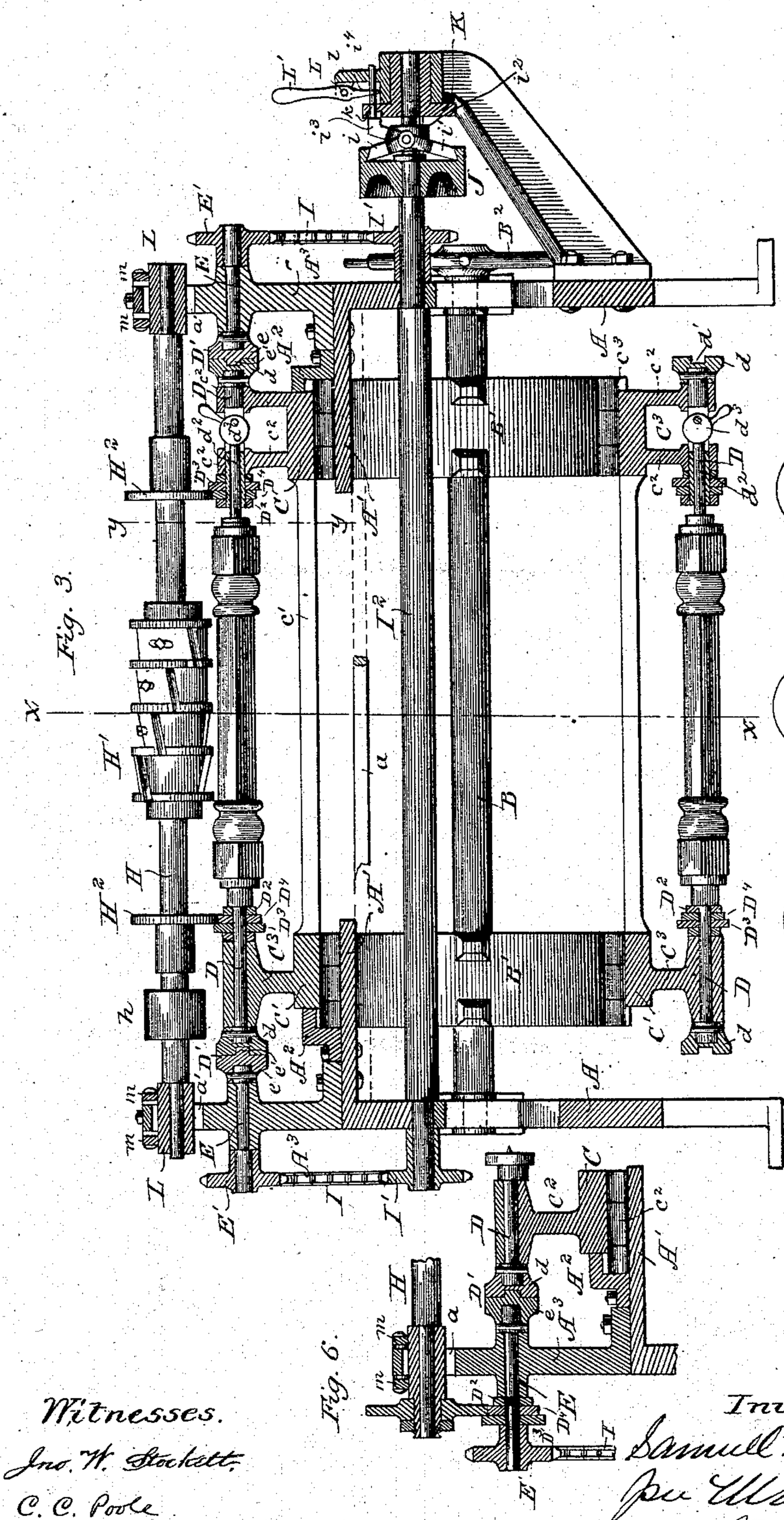

Fig. 3.

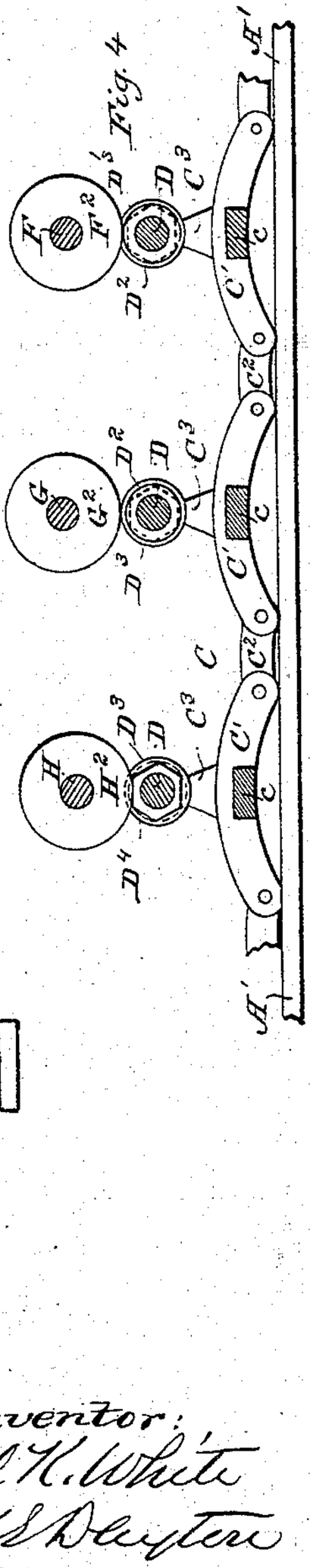

Fig. 4.

Fig. 6.

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Inventor:
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UNITED STATES PATENT OFFICE.

SAMUEL K. WHITE, OF CHICAGO, ILLINOIS.

GEOMETRIC LATHE.

SPECIFICATION forming part of Letters Patent No. 291,451, dated January 1, 1884.

Application filed March 29, 1883. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL K. WHITE, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Geometric Lathes; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to geometric lathes of that class in which a series of blanks are supported and successively carried into engagement with the cutters, and in which the desired form is given to the article turned by pattern-cams, which control the space between the cutter and blank axes, made relatively movable toward and from each other for this purpose.

In the machine herein shown as embodying my invention, three cutter-arbors are employed, each one movable independently of the others, and each having its several ends independently movable with reference to the path through which the blanks are carried. By means of a series of separate cutter-arbors the blank may be first turned in the rough to proximate the size or form, or both, of the article to be produced, and the succeeding cutter or cutters may give to said article its final form. When two or more cutters follow the roughing-cutter, one may be used to give a certain form to one portion of the article being turned, and another may give a different form to another portion of said article. Such is the arrangement and intention in the machine as herein illustrated.

It is a feature of my improved machine that the blanks are mounted so as to be brought into stationary position opposite the cutters, so that all three cutters, or any number of cutters that may be employed, shall be simultaneously at work upon the corresponding number of blanks; and it is also a feature of the machine that while said blanks are thus locally stationary and being operated upon by said cutters they are rotated upon their axes. The pattern-cams are applied to the blank-spindles, and, as here shown, operate to control the relative bodily movement of the cutters by engagement with circular disks or plates applied to the cutter-arbors or to the bearings of said arbors; and in order that the cutters may produce a blank of the same shape or conformation as the pattern-cams, said circular disks or plates are made of practically the same radius as the cutters on the arbor to which said plates are applied. The traveling blank-supports consist, as here shown, of a series of plates, which carry the spindle-bearings, which plates are rigidly connected in pairs by cross-bars, and the plates so connected are linked with others of similar construction, to form, practically, a broad, continuous chain. Said chain is arranged upon sprocket-wheels at opposite ends of the machine, and is suitably supported and guided in its movement beneath the cutters and between said wheels, whereby when the cutters are at work the blanks are held perfectly stationary. The cutter-arbors are movably supported in uprights attached to the frame, provided with slots in their upper ends, in which the bearing-boxes of said arbors may rise and fall independently of each other; and in the same uprights are mounted stationary spindles constructed to engage with the spindles in the traveling blank-holders, and provided with sprockets or pinions by which they may be driven.

In the accompanying drawings, Figure 1 is a side elevation of a machine containing my improvements. Fig. 2 is a central vertical section transverse to the axes of the rotating parts, or through *x x* of Fig. 3. Fig. 3 is a vertical section in the vertical planes of the indirect line *x x* of Fig. 2. Fig. 4 is a vertical section through *y y* of Fig. 3, looking to the right. Fig. 5 is a plan of the blank-carrying plates with blank-spindles attached. Fig. 6 shows a preferred construction of certain parts.

The main frame of the machine consists of two side pieces, A, upon which the several operative parts are supported, said side pieces being connected by cross-braces *a*.

B are two shafts, arranged transversely at either end of the machine, and having bearings in their ends in boxes placed on the ends of the side pieces, A.

Upon each of the shafts B are two sprocket-wheels, B′, around which are placed two chain belts or carriers, C, consisting of a series of plates, C′, and connecting-links C^2. The plates C′ are shown as being curved on their

under sides to correspond with the curvature of the sprocket-wheels B′, and have standards C^3 upon their outer surface, in which are journaled short spindles D, for supporting the blanks, said spindles being placed axially in line with each other at the opposite ends of the machine. The plates C′, which are opposite each other in the two chains, are rigidly connected by cross-bars *c′*, preferably made integral with the said plates, whereby the said spindles are kept in perfect alignment. The spindles D are for the purpose of supporting and rotating the blanks, and are provided upon their inner ends with devices for supporting said blanks between them, as will be hereinafter described.

Upon the inner faces of the side frames, A, between the wheels B′, and on a level with the upper surfaces of said wheels, are placed guide-plates A′—one upon either side of the machine—which act as supports for the plates C′, and upon which they travel in passing from one wheel to the other in the operation of the machine. An inwardly-projecting flange, A^2, is attached to the top of the guides A′, and arranged longitudinally thereof, which flange extends over lateral projections c^2 on the outside of the plates C′, whereby said plates are held down to the said guide-plates and any tilting or lateral motion in the standards C^3 prevented. The guides A^2 preferably consist, as shown, of inwardly-projecting flanges, forming part of the frame-pieces A.

Upon the frame-pieces A, at either side of the machine, are placed three oppositely-arranged standards, A^3, which afford bearings for short shafts or spindles E, by which the spindles D are driven, and which are also constructed to afford proper support for three rotating cutter-arbors, F, G, and H, arranged vertically above the spindles E. The shafts E are arranged upon the same level as the spindles D, and are placed at the same distance apart, so that three of the spindles D may be placed in engagement with the shafts E at the same time. Said shafts E and the spindles D are connected, so as to transmit motion for rotating the blanks, by means of clutches D′, Fig. 3, said clutches consisting of disks *e* and *d*, attached, respectively, to the adjacent ends of the spindles D and E, the disk *d* being provided with a horizontal groove, *d′*, in its face, and the disk *e* with a corresponding projection, *e′*, so that when the spindles D are moved forward in order to carry the blanks from one cutter-arbor to the next the said clutches will be disengaged and engaged automatically. Motion is given to the spindles E on both sides of the machine by means of chain-belts I, which pass over sprocket-wheels E′, placed on the outer ends of the spindles E, and sprocket-wheels I′, placed on the ends of a centrally-arranged driving-shaft, I^2, which is journaled on the frame-pieces A. The said driving-shaft has upon it a driving-pulley, J, connected to said shaft by a clutch mechanism, as will be hereinafter described, for giving an intermittent rotation to the said shaft and the spindles E. The cutter-arbors F, G, and H are journaled at each end in boxes L, arranged to slide in vertical recesses or grooves *a′* in the upper part of the standards A^3, and said arbors are each provided with a series of cutting-knives, F′ G′ H′, of any desired or preferred construction.

Upon each of the spindles D, at both sides of the machine, are two disks, D^2 D^3, and a pattern-cam, D^4, which are arranged to engage correspondingly-placed collars F^2 G^2 H^2 on the cutter-arbors.

In the machine illustrated the cutter-arbor F is for the purpose of roughing the blank or reducing it to the appropriate size of the finished article. The cutter-arbor G is for the purpose of finishing a molded portion at either end of the blank, and the arbor H is for producing a polygonal or irregular figure on the central portion thereof. The disks D^2 and D^3, which engage the collars F^2 and G^2, are, as shown, circular in form, and serve as gages to the cutters in turning or roughing an article that is circular in cross-section. The cam D^4, which operates upon the collar H^3, is shaped to correspond with the form of the article to be turned, and, by acting upon the collar H^3 as the spindles D and the blank are rotated, moves the cutter-arbor, so as to cause the cutters to work to a figure corresponding in cross-section with the shape of said cam.

It has been found in machines of this class as heretofore constructed that when a pattern-cam of the character described is caused to act directly upon a frame carrying the cutter-arbor the cutters do not receive the precise motion necessary to reproduce the form of the cam in the article being turned, the reason being that although the movement of a point on the said frame would develop a figure similar to the cam, yet the curvature of the rotary cutters causes a variation in the form of the article cut thereby. In order to eliminate this cause of inaccuracy in the use of the pattern-cam, the collar H^2 upon the cutter-arbor is made of the same diameter as the path of the cutters, so that the cutting-edges of the knives are moved to precisely the same extent that the collar H^2 is moved by the cam, and will follow the outline of a figure similar to said cam as the blank is rotated.

Instead of placing the collar H^2 upon the cutter-arbor, said collar may be placed upon a movable frame or bed which supports such arbor; or, instead of using a rotating collar at all, the cam may bear against a curved surface upon the frame of the same radius as the cutters, with the same result. The blanks are held to the spindles D by the ordinary means, one of said spindles being provided with a rod, d^2, which slides in an aperture in said spindle, and which is forced forward so as to engage the end of the blank by means of an eccentric, d^3. In order to save space, the standards C^2, which are used to support the spindle to which said sliding rod is applied, are divided, as shown

in Fig. 3, to form two bearings, c^2 c^2, and the eccentric mentioned is placed between them.

Although, in the machine described, clutches are employed for connecting the spindles D and E at both sides of the machine, it is not essential that the blanks should be driven at both ends, and the clutches shown at one end of the blank may be dispensed with. In such case, however, in order to give the proper reciprocating movement to both ends of the cutter-arbor H and to gage the work in the case of the other arbors, F and G, the pattern-cams and collars here shown upon the spindles D may be placed on the spindles E, retained for this purpose, and rotated simultaneously with the cams at the opposite side of the machine by the chain I, also retained. The principal object of driving the blank from one end only would be to enable a movable or sliding tail-block to be used, whereby considerable differences in the lengths of the blanks would be provided for. Said movable tail-blocks would obviously take the place of the corresponding fixed standards, C^2, and would be contrived to run on the cross-bars c'. This preferable construction of the machine with respect to the location of the cams and their opposing collars is shown in Fig. 6, in which said cams are placed upon the spindles E, exterior to the frame-uprights A^3, and the collars are placed in such manner as to rotate upon the bearing-boxes of the cutter-arbor. By this location of the cams only one set of a given shape need be constructed for each of the spindles, or three sets in all, while if placed as shown in Fig. 3 a set is required for each spindle D, or as many sets as the number of blanks the machine is constructed to simultaneously hold. Placing the collar H^2 upon the bearing-box of the cutter-arbor, instead of upon the arbor itself, has also an advantage, for when upon the arbor the rapid movement of the latter tends to carry the collar also at a higher speed than that of the cams, and to thereby produce a sliding movement of the collar on the cams, and corresponding wear and friction. When placed on the bearing-box, on the other hand, said collars will rotate only as carried by contact with the cams, and the friction above referred to will be avoided. If preferred, a segmental non-rotating plate may be applied to the bearing-box of the cutter-arbor in place of a rotating disk, H^2.

In a machine having independently-movable bearings for each end of the cutter-arbor H, as shown, and having cams for controlling both ends of said cutter-arbor in relation to the blank, it is obviously practicable to make an article of tapered form by simply varying the sizes of the cams at the opposite ends of the blank. Another advantage of such construction is, that by partially rotating the cam at one end of the blank in relation to that at the other end before securing them to the spindles an article having the same cross-section as the cams, but with spiral faces, may be produced. Such structure admits of great variety in the form of articles produced by varying the shape, size, and relative position of the cams at the opposite ends of the blank. The cutter-arbors F and G may also be moved at each end independently, as described, in connection with the arbor H, by using larger or smaller disks D^2 D^3 upon the blank-spindles. The blank may thus be reduced by the roughing-cutters to the approximate shape of the tapered or other irregular figure formed by the pattern-cams acting on the finishing-cutters; or the intermediate cutters for finishing a portion of the article may be adjusted at each end as desired, so as to cut a larger or smaller circle. It is manifest that the disks D^2 D^3 may be replaced by pattern-cams, and that cams or disks of any size or shape may be placed upon either of the blank-spindles, as desired, so that an article may be formed of any desired shape in its different portions. Any number of cutter-arbors may be placed upon the machine in the manner shown, and a great variety of different ornamental forms may be made upon the same article by multiplying the pattern-cams which control the movement of the several arbors.

For the purpose of keeping the cutters down to their work and the collars on the several cutter-arbors in contact with the disks and cams on the blank-shafts, in case the weight of the arbors is not sufficient for the purpose, I have pivoted weighted levers M to the upper ends of the standards A^3, which are constructed to act upon the bearing-boxes L of said arbors and press them constantly downward, while at the same time allowing them to yield when the arbors are moved. The levers M are preferably provided with forked ends m, which are pivoted at m' upon either side of said standards and rest upon the projecting ends of the boxes L. Sliding weights M′ are placed upon the levers M, whereby the downward pressure of the cutter-arbors may be regulated.

Instead of the weighted levers described, springs or other suitable means may be used for accomplishing the same purpose.

In order to prevent the spindles D from being turned accidentally during the time that the clutches D′ are out of engagement, so as to prevent the projections e' from entering the grooves d' in the disks d when they come together, springs d^4 may be placed on the plates C′ and arranged to press upon the periphery of the disks d, as shown in Fig. 1, said disks having a flattened face upon one side so arranged that the spindles will be held in proper position for the engagement of the clutches by the action of the spring upon said flattened portion.

For the purpose of giving a simultaneous movement to the several spindles E at each side of the machine, a sprocket-wheel, I′, is placed upon each end of the driving-shaft I^2, from which said spindles are driven. The blanks are preferably rotated but once in a while, being operated upon by each set of cut-

ter-knives, and the spindles E are necessarily brought to rest after each rotation, so that the blanks may be advanced to the next cutters. In order to accomplish this intermittent rotation of the spindles E, and to cause the said spindles to stop at exactly the same point after each rotation, that the projection e' and the grooves d will be in a position to automatically engage each other, I make the loose driving-pulley J fast to said shaft temporarily by means of a clutch mechanism adapted to place the shaft in engagement with the pulley at any moment desired, and to thereby arrest the movement of the shaft automatically after it has made one complete rotation. Such clutch mechanism may be made in any one of a number of well-known ways; but as a preferable form of such clutch, and as shown in the drawings, it is constructed as follows: The arms i and i' are pivoted to a sliding collar, i^2, upon the shaft I^2, said collar being prevented from rotating on the shaft by means of a feather thereon, as shown. The ends of the arms i and i' are adapted to bear against an annular friction-surface formed on the inner surface of the driving-pulley, and the opposite end of the arm i' is extended beyond the pivotal point, and forms an arm, i^3, which bears against a stationary collar, K, attached to the frame of the machine. In the upper portion of the collar K is formed a notch, k, adapted to receive the end of the arm i^3. The parts are so arranged that when the arm i^3 rests against the face of the collar K the arms i and i' are forced against the friction-surface of the pulley, and the arms are carried around thereby, and the shaft is rotated with them. When the arm i^3 reaches the notch k as it traverses the disk K, it will enter said notch, the arms will be released from contact with the pulley J, and the shaft be stopped. The arms i and i' are again caused to grip the pulley by forcing the end of the arm i^3 out of the notch k. This is accomplished, as shown in the drawings, by means of a sliding bolt, i^4, which is acted upon by an arm, l, attached to a rock-shaft, L, which is provided with a hand-lever, L', by which it may be operated.

Instead of operating the clutch mechanism described by means of the hand-lever L', such clutch may be operated automatically by suitable connections with the chain C, so that at the moment the blanks are brought into position opposite the cutters the arm i^3 will be thrown out of the notch k and the shafts H and D rotated, thus making the operation of the blank-rotating devices entirely automatic.

The clutch mechanism described is not original with me, and forms no part of this invention.

For the purpose of rotating the shafts B so as to accomplish the forward movement of the blank-carrier C, I have shown a hand-wheel, B^2, upon the end of said shaft at the feed end of the machine. Such hand-wheel may manifestly be replaced by a belt-pulley and the blank-carrier driven by power, if desired, a suitable device being provided to make the forward movement thereof intermittent. The blanks are placed in the machine and the finished article removed therefrom by hand, and such operation will usually cause no interruption to the continual operation of the machine, as the time consumed in finishing each article will usually be sufficient for the purpose of performing it.

In the arrangement of the cutter-arbors substantially in a plane the use of the chain-carrier for the blanks traveling continuously in one direction is not strictly essential, since obviously a reciprocating horizontal bed-plate carrying the blank-spindles may be employed in its stead.

I claim as my invention—

1. In a geometric lathe, the combination, with a rotating movable cutter-arbor and relatively stationary blank-spindles, of independently-movable bearings for the several ends of the cutter-arbor, and a cam on each blank-spindle for controlling the distance between the several ends of the cutter-arbor and the ends of the blank, substantially as described.

2. In a geometric lathe, the combination, with the rotating movable cutter-arbor and with the blank-spindle, of a pattern-cam secured to the blank-spindle and a plate opposed to said cam, mounted on the said arbor, or a part belonging thereto, and having a curved surface for contact with the cam of practically equal radius with the cutters, substantially as described.

3. In a geometric lathe, the combination, with a movable cutter-arbor, a traveling support provided with spindles for the blank, and a stationary spindle constructed to engage the blank-spindle when the latter is in working position with reference to the cutter-arbor, of a disk or cam upon said stationary spindle, arranged to control the distance between the cutter-arbor and the blank, substantially as described.

4. In a geometric lathe, the combination, with two or more rotating and independently-movable cutter-arbors arranged in a practically horizontal plane, of a series of blank-spindles, a continuous chain-carrier for supporting said blank-spindles, means for guiding said chain-carrier in a plane parallel with that of the cutter-arbors, means for intermittently moving said chain-carrier so as to present each one of the blanks in succession to the said cutter-arbors, and means for rotating the said blank-spindles when opposite the cutter-arbors, substantially as described.

5. The combination, with two or more cutter-arbors, and with the series of connected plates C', for supporting the blank-spindles at the same distance apart as the cutter-arbors, of mechanism for moving said plates, stationary guides for said plates, and means for rotating the spindles when opposite the cutters, substantially as described.

6. The combination, with the cutter-arbors and a chain-carrier for the blank-spindles, of

wheels B′, guides A′, placed between said wheels, and means for rotating the blank-spindles when opposite the cutters, substantially as and for the purposes set forth.

7. In a geometric lathe, the combination, with a rotating cutter-arbor and with spindles for supporting the blanks, of the blank-spindle carrier composed of a double series of plates, C′, oppositely arranged and rigidly connected in pairs, mechanism for moving the carrier, and stationary guides for said plates, substantially as described.

8. In a geometric lathe, the combination, with the slotted standards A^3, the independently-movable cutter-arbors mounted therein, and traveling carrier for the blank-spindles D, of the spindles E, mounted in the standards A^3, and driving mechanism applied thereto, substantially as described.

9. The combination, with the standards A^3, with the cutter-arbor journal-boxes mounted movably therein, and with driving-spindles E, also mounted in said standards, of pattern-cams secured to said spindles, and plates mounted on the boxes of the cutter-arbor in position to engage said cams, substantially as described, and for the purposes set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

SAMUEL K. WHITE.

Witnesses:

M. E. DAYTON,

PETER J. ELLERT.