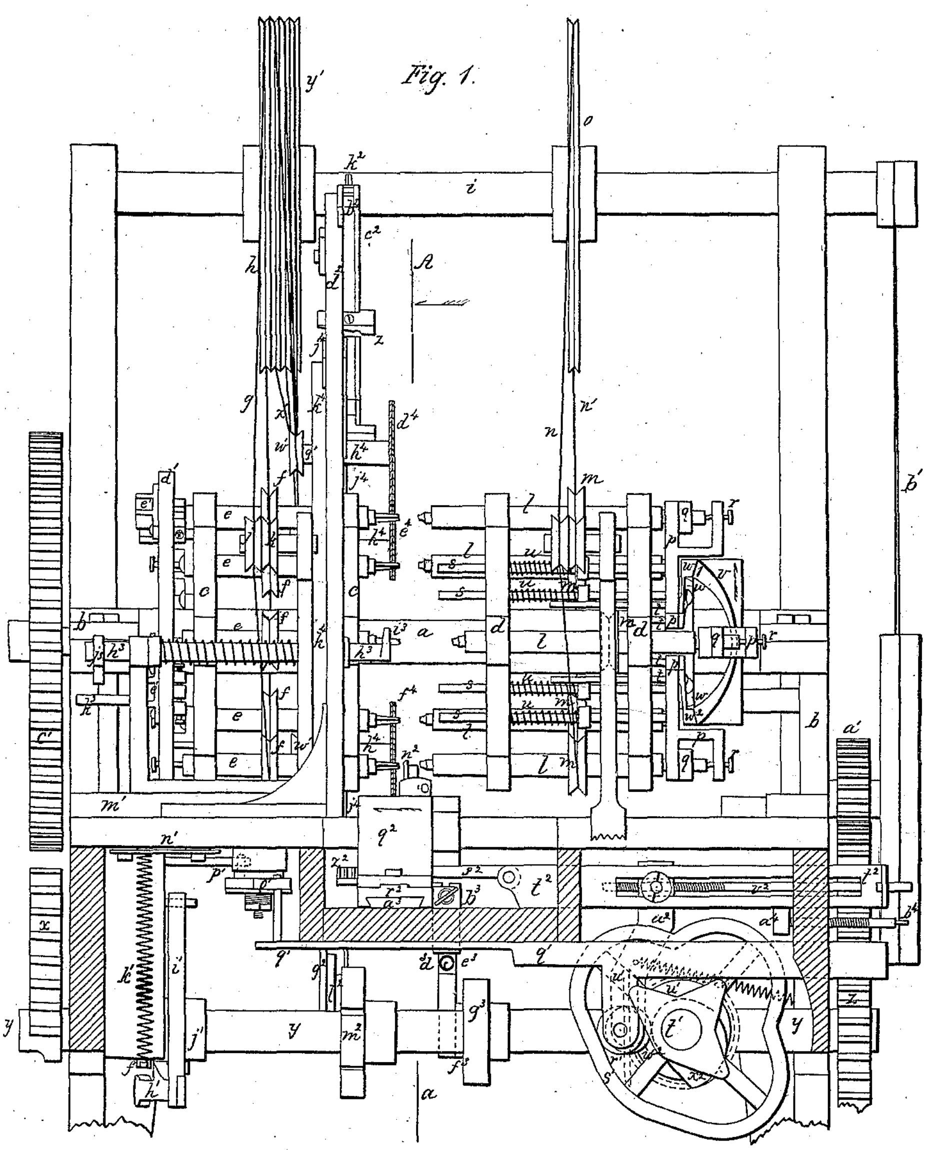
Sheet 1, 3 Sheets.

W. D. Sloan.

Turning Irregular Forms.

No. 16,936. Patented Mar. 31, 1857.

Fig. 1.



Witnesses.

Wm H Bishop

Joel B Wilson

Inventor.

Wm D. Sloan

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

Sheet 2, 3 Sheets.

W. D. Sloan.

Turning Irregular Forms.

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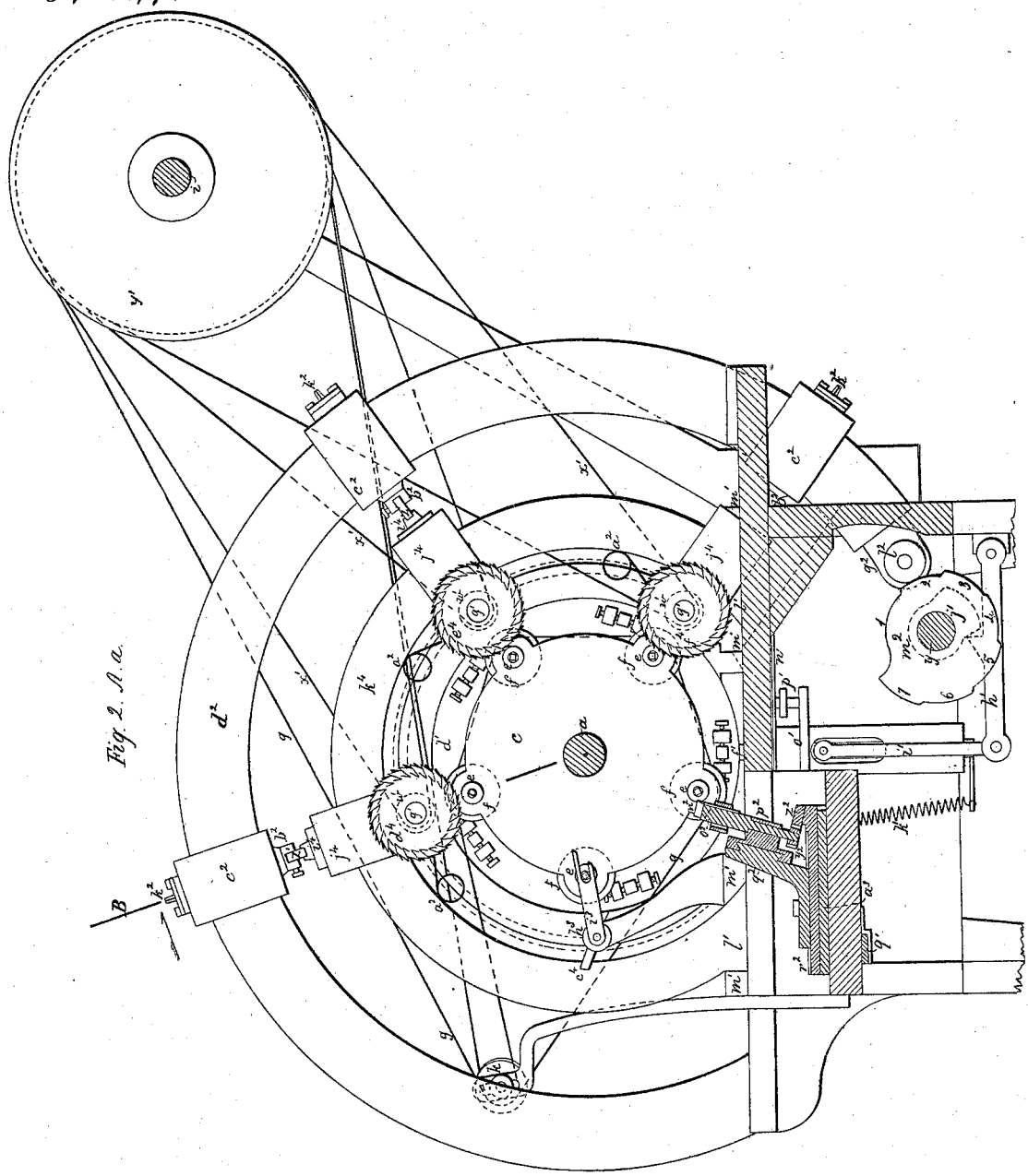

Fig. 2. N. a.

Witnesses.

Inventor.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

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W. D. Sloan.

Turning Irregular Forms.

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Fig. 3.

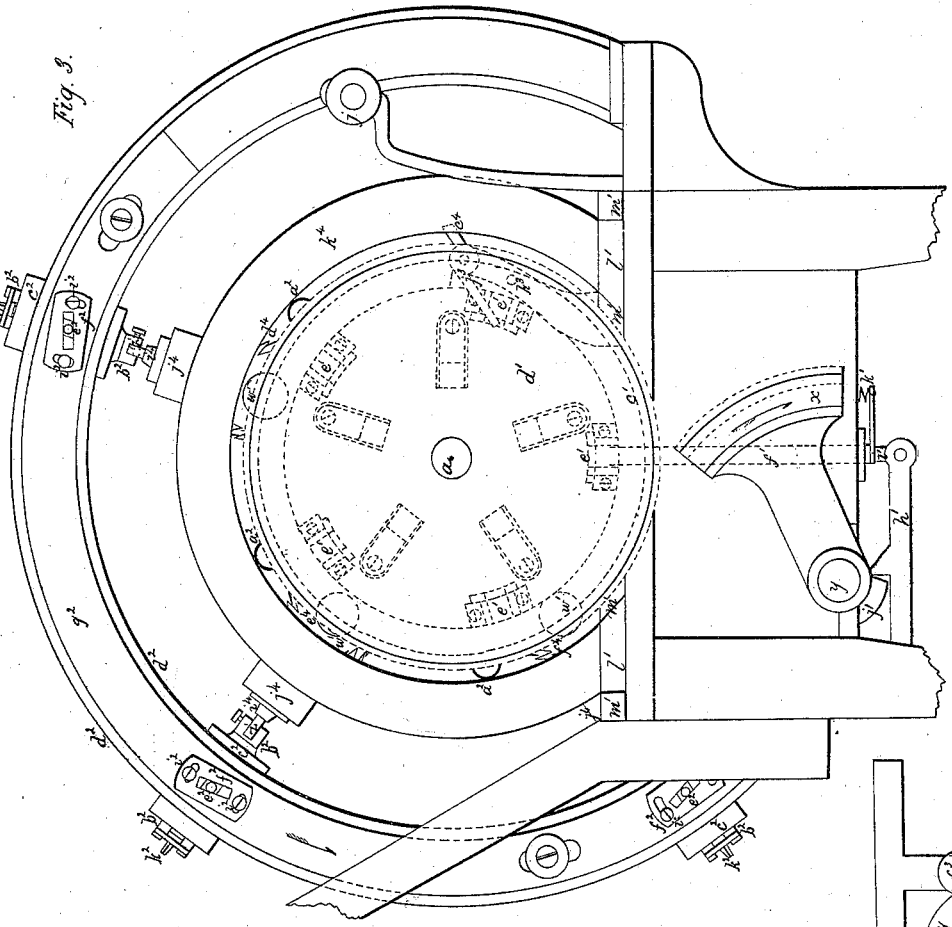


Fig. 6

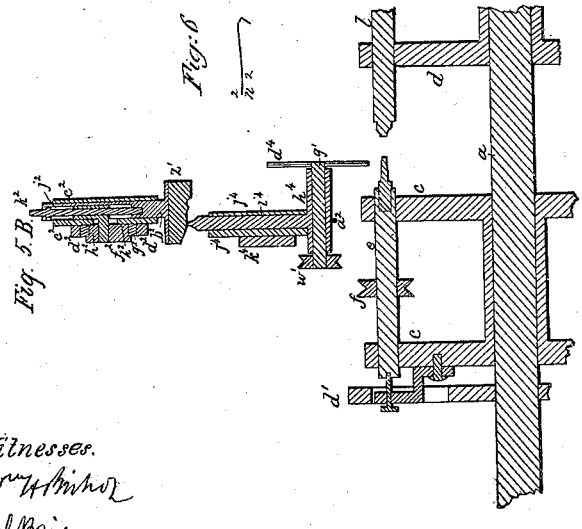
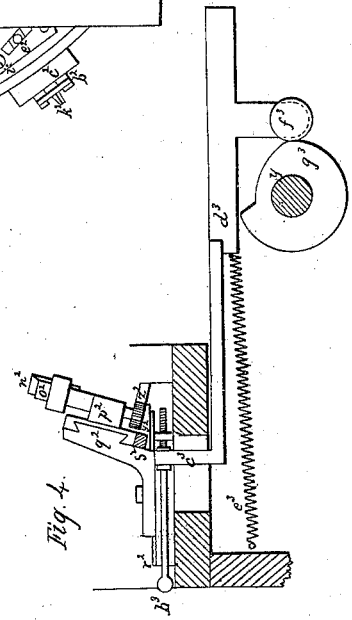


Fig. 5.

Fig. 4.



Witnesses.

Wm. H. Wilson

Joel B. Wilson

Inventor.

Wm. D. Sloan

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM D. SLOAN, OF NEW YORK, N. Y.

AUTOMATIC LATHE FOR TURNING IRREGULAR FORMS.

Specification of Letters Patent No. 16,936, dated March 31, 1857.

To all whom it may concern:

Be it known that I, WILLIAM D. SLOAN, of the city, county, and State of New York, have invented certain new and useful Improvements in Machinery for Turning Articles which are of Irregular Form in the Direction of their Length, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a front elevation of the machine with the frame work removed to exhibit the working parts below the table; Fig. 2, a vertical section taken at the line A, *a*, of Fig. 1 and looking in the direction of the arrow; Fig. 3, an elevation of the left hand end of the machine; Fig. 4, a separate elevation of the finishing cutter with the mechanism for operating it; Fig. 5, a longitudinal section taken at the line B, of Fig. 2; and Fig. 6, an enlarged view of the finishing cutter in the actual form and as developed on a flat plane.

The same letters indicate like parts in all the figures.

My said invention is mainly intended for turning the tips for umbrella whalebones, but it is applicable to the turning of various articles that are of an irregular figure in the direction of their length. In my said invention the block to be turned is shifted in succession from one to another of a series of cutters, each one of which operates upon the entire length to be turned, for the purpose of gradually reducing the block to the required form; and there are a series of mandrels, so that a series of blocks are in the process of being turned at the same time, that is to say, when one mandrel is brought to the required position to discharge one completed block and to receive a fresh block, another mandrel is in the position to present another block to the first rangling cutter, a third is in the position to present its block to the second rangling cutter, a fourth is presenting its block to the third rangling cutter, and a fifth to the finishing cutter, and so on to any desired number, more or less, there being always one more mandrel than there are cutters, or sets of cutters, in the machine. By this means the operations are subdivided, and yet one article is delivered completed and a rough block put in at the end of each one of the series of operations performed on any one block.

In the accompanying drawings *a* represents a shaft mounted in suitable boxes in two standards *b*, *b* of the frame; and this shaft carries four plates arranged in two pairs *c*, *c* and *d*, *d*. In the pair *c*, *c* are mounted five parallel mandrels *e*, *e*, *e*, *e*, *e* arranged at equal distances apart, and at equal distances from the axis of the shaft *a*. The mandrels are each provided with a suitable pulley *f* to receive a band *g* from a band wheel *h* on the driving shaft *i*. This band passes from the band wheel *h* around a guide pulley *g*, thence around the series of pulleys *f* on the mandrels, around another guide pulley *k* by the side of the one *j*, and then back to the wheel *h*. In this way this band drives all the mandrels except the one that happens to be in front, which is in the position required for discharging the finished article, and to receive a rough block at which time the mandrel should not turn. The inner end of each mandrel is to be suitably constructed to receive and hold the block to be turned, and in this case, for turning umbrella tips, it is of a conical shape to receive the block of bone or other material which is previously bored out at one end with the required conical socket to fit on the end of the whalebones. In the two other plates *d*, *d* are mounted a series of spindles *l* corresponding in number with, and in the line of the mandrels above described. These spindles are provided with pulleys *m* like the mandrels, and rotated by a band *n* from a band wheel *o* on the driving shaft, which band passes around guide rollers in every respect arranged to rotate the spindles, as the band *g* rotates the mandrels. The spindles are so mounted that they can slide longitudinally in the plates, and the outer end of each, beyond the outer plate, is connected with a sliding frame *p* by means of an adjustable collar (*q*) which can be shifted to adapt the distance between the spindles and mandrels to suit the length of blocks to be turned, and an adjustable center screw *r* which bears against the end of the spindle. Each one of these frames is provided with two guide rods *s* and *t* fitted to slide in suitable holes in the outer plate, and the rod *s* is of a sufficient length to slide also in a hole in the inner plate, a spring *u* being coiled around the rod *s* to force the frame, with its spindle, outward against the face of a cam plate *v* attached to the frame, and the face of this plate, from the point 1 to 2 in the direction of the arrow is perfectly flat, to keep the inner end of the spindles

against the end of the several blocks and thus hold them on the mandrel in a true central position; but from the point 2 to 1, the face is cut out, cam like, by a gradual inclination in opposite directions to permit the tension of the springs u to force back the frames and their spindles, when each in succession comes to that part of the circuit for the purpose of liberating the block on the corresponding mandrel. As the blocks to be turned may vary slightly in length, the frames do not bear directly against the face of the cam plate v, but, instead there is a spring w of sufficient tension interposed, to render each spindle self adjusting to any slight variation in length. The spring w may bear directly against the face of the cam plate, or each may carry a conical friction roller to reduce the friction.

An intermittent rotary motion is given to the shaft a with its plates to shift the mandrels and corresponding spindles from one position to another, which is done by means of a cogged sector x on a cam shaft y. This shaft carries a cog wheel x on the opposite end, which receives motion from a pinion a' on a belt wheel that receives motion in turn by a belt b' from the driving shaft. Once in every revolution the cogged sector x engages a cog wheel c' on the shaft a and turns it to the extent of the distance between the centers of any two of the mandrels; and as the sector wheel leaves the wheel c' the shaft a, with its appendages is locked to hold the mandrels in position until the next shifting operation. And this locking is effected in the following manner, viz: On the shaft a there is another plate d' with recesses e' in its face and near the periphery. The number and distance apart of these recesses correspond with the mandrels. When any one of these recesses is brought to the required position, a vertically sliding bolt f' that passes through a mortise in the table of the frame, enters the recess and there locks the whole in position until the next shifting operation is required to take place, at which time the bolt is drawn out. This bolt is operated by a lever h' connected with the bolt by a jointed rod i', and at the required time the lever is depressed by a tappet j' on the shaft y which keeps the lever depressed during the shifting motion, and then liberates it to permit the bolt to be forced into the next recess by the tension of a spring k'. The plate d' is just beyond the back end of the mandrels, and it is provided with screws, one for each mandrel, and in line therewith to form central pivots to take the friction of the mandrels.

When the machine is used for turning umbrella tips or other articles which are to be left with a round or pointed end, the end of the spindles l which form the central support to hold the blocks on the mandrels, are to be cup shaped as represented in the drawing Fig. 5, and as the spindles turn with the mandrels no friction will be developed between the spindles and the blocks; but when the articles to be turned are not so shaped at the end, the spindles may be pointed to form centers as in ordinary lathes, and in such case the spindles need not be made to rotate.

Three rangling cutter wheels d^4, e^4, f^4 are arranged outside of the series of mandrels in such positions that the three can act simultaneously on three different blocks. The three cutter wheels are mounted in the same manner, and hence the description of one will suffice for all. The cutter wheel I prefer to make of two plates with the cutting edges formed on the edge and one side of the edge of each, so that when the two are placed face to face and secured on the end of the arbor g' the edge and the two faces near the edge will present a series of cutting edges; but the cutters may be formed in any other suitable manner. The arbor g' is fitted to turn in a sleeve h^4 on the lower end of a plate i^4 fitted to slide radially in ways j^4 attached to the face of a segment ring k^4 placed outside of the series of mandrels, and the lower ends of this segment are formed into horizontal sliding bars l', l' fitted to slide horizontally in ways m', m' in the table of the frame, and below the table the sliding bars are connected by a plate n'. The object of this connection is to carry the series of rangling cutter wheels longitudinally over the length of the block to be turned and back again, that the cutters may act upon the said blocks along the length to be turned. The required longitudinal motion is given to this apparatus by a lever o' one end of which is connected by a connecting rod p' with the plate n', and the other end with a sliding rod q' which carries a roller or wrist pin r' that runs in the groove of a cam s' on a shaft t' which receives motion by bevel cog wheels u', u' from the cam shaft y. The form of the cam groove s' is such as represented in Fig. 1 as to cause the rangling cutters to traverse back and forth over the length of the blocks on the mandrels three times for every complete revolution of the shaft t' and then hold the cutters in a stationary position for a sufficient length of time to allow the series of mandrels, and the blocks which they carry, to be shifted from one position to another, as before described. The fulcrum pin of the lever o' passes through an elongated hole in the said lever so that it can be shifted to increase or decrease the range of motion of the rangling cutters to suit the length of blocks to be turned.

As the rangling cutters traverse back and forth over the length of the blocks they are made to rotate at a high velocity by a pul-

ley w' on the opposite end of each arbor g' each pulley receiving a band x' from a band wheel y' on the driving shaft. And as the said rangling cutters so traverse back and forth they are made to approach the axis of the blocks being turned and recede therefrom to determine the form to be produced by a mold or former z' the face of which presents the configuration required to be given to the blocks. There is one such mold for each rangling cutter, and the outer end of the plate i^4 which carries the arbor of the cutter, is formed so as to slide against the face of the mold, against which it is made to bear by the tension of a spring a^2 which acts on the under part of the sleeve. In this way the rangling cutter wheels are made to reduce the block to a form corresponding with the form of the mold; but as each cutter wheel traverses back and forth three times over each block, making six cuts along the entire length, (although the number may be increased or decreased) it is necessary that the cutters should be made to approach the axes of the blocks at the end of each longitudinal motion, which is effected by advancing the molds at the end of each cut. To do this, each mold is fitted to and held by a screw or key in a socket made in the inner end of a plate b^2 which slides radially in suitable ways c^2 attached to another segment ring d^2 permanently attached to the table of the frame. Each plate b^2 is provided with a pin e^2 which projects from its face and passes through a hole in the segment ring d^2 of sufficient size to allow the required extent of motion. This pin fits accurately in a long slot in a plate f^2 attached to another segment ring g^2 fitted to slide in the direction of its curvature in a recess in the face of the outer segment ring d^2 so that when this ring g^2 slides in either direction the slot in the plates f^2 attached thereto will slide on the pins e^2 of the plates b^2 that carry the molds, and thus move the molds in or out in proportion to the inclination of the line of the slots in the plates f^2 to the line of motion of the segment ring g^2. To vary this inclination of the slots to increase or decrease the extent of motion to be given to the cutters, that they may be set to cut more or less at each operation, the plates f^2 are made with a journal like projection h^2 on their inner faces which fit and turn in corresponding holes in the segment ring g^2, and the screws i^2 by which they are secured to the sliding ring pass through elongated holes so that the plates can be shifted on the ring. And for the purpose of setting the molds to turn blocks of greater or less diameter, the pins e^2 of the plates b^2 instead of being permanently attached to the plates have an enlargement fitted to slide in a longitudinal slot j^2 in the plate b^2, and an adjusting screw k^2 is tapped in the enlargement, and is fitted by suitable journals to turn in the said plate, so that by taking hold of the head of the screw, by a wrench or other means, and turning it, the pin being held in the slot of the plate f^2, the plate b^2 with the mold is moved in or out, which has the effect to carry the cutters nearer to, or farther from, the axes of the blocks, and thus turn them to a greater or less diameter.

As the sliding of the segment ring g^2 in one direction draws out the molds to permit the springs to force the cutters away from the blocks, and in the other direction to force the cutters toward the blocks, it is necessary, at the end of each complete series of cutting operations, to slide the segment ring in the direction of the arrow (see Fig. 3) that the cutters may be carried out to the farthest required position from the axes of the blocks. The motion in the direction of the arrow is imparted by the weight of the segment ring (which may be assisted by a spring) the greater part of which is on one side of a vertical line passing through the axis of the circle, and the extent of the motion in that direction is governed by a roller l^2 on the end of the segment ring coming in contact with the section 1 of a cam m^4 on the cam shaft y. This cam is divided into seven sections, correspondingly numbered, each successive section being at a greater distance from the axis of the shaft, and the position of this cam on the shaft is such relatively to the other movements that at the end of each motion of the cutters along the length of the blocks, the next section of the cam m^2 comes into action to move the segment ring g^2 and thereby advance the molds; and at the end of the series of traversing motions of the cutters, section 7 of the cam passes off and allows the roller to run onto section 1 and thereby move the segment ring in the direction of the arrow to draw back the molds preparatory to a new series of operations.

The three rangling cutters should be set in succession farther from the axes of the blocks, as each in succession cuts deeper into the block: the one d^4 makes the first cut, e^4 the second cut, and f^4 the third cut, as the block is shifted in succession from the first to the third. After the block leaves the third rangling cutter it is shifted to the fourth position where it is acted upon by the finishing or smoothing cutter n^2. The said smoothing cutter n^2 is peculiar in its mode of operation. It is in the form of a tube either entire or a segment, and in this instance a segment with a cutting edge on the end. It lies against the upper part of an arbor o^2 and is there held by a surrounding thimble and temper screw, but may be otherwise secured or may be a part of the arbor. The cutting edge of this cutter is such, as represented at Fig. 6, that if devel-

oped on a flat plane it will be the reverse of the figure to be produced on the article to be turned, and as in this case an umbrella tip, the cavity 1 forming the bulb or knob on the end of the tip and the gradual curvature from the cavity 1 to the point 2 corresponding with the form of the body of a tip. But it will be seen that any other configuration may be given to the cutter at the pleasure of the constructor.

The arbor o^2 stands slightly inclined from a vertical line so that the face of the cutter is in a line tangent to the block when turned, as the hand turner holds a gage to the block which he turns. The said arbor turns freely but accurately in the base of a stock p^2 which slides horizontally on ways made in the face of a standard q^2 attached to the upper face of a carriage r^2 by means of a screw or other suitable means. The stock p^2 is connected by a joint pin s^2 with one end of a rod t^2 that slides horizontally in suitable ways. This rod is provided with an arm u^2 which slides thereon and connected therewith by an adjusting screw v^2 journaled in the rod, so that by turning the said screw the position of this arm on the rod can be shifted for adjustment.

The arm u^2 carries a roller w^2 which is made to bear against the face of a cam x^2 on the shaft t' before named, and the form of this cam (as represented in Fig. 1) is such as to move the plate t^2 with the cutter n^2 in the direction of the arrow (see Fig. 1) and to the required distance to cause the cutter to pass along the length of the block, while the series of rangling cutters are performing their series of operations on other blocks, and then to permit the tension of the spring to draw it back. When the rod t^2 is drawn back it is gaged in its back motion by a stop a^4 which comes in contact with the end of a set screw b^4 which gages and regulates the point where the cutter is advanced to begin its operation. I propose in some instances to make this smoothing cutter act on the material in both directions, in which case either the return spring must have sufficient tension or the return motion must be given by a reversed cam or other equivalent. As the cutter is moved along the length of the block it is made to rotate on its axis by means of a cogged pinion y^2 on the lower end of the arbor, which engages a rack z^2 attached to the carriage r^2, and as the pitch line of the pinion is of the average of the radius of the cutter it follows that the face of the said cutter instead of sliding on the block which it cuts will roll on the surface, and in this way constantly change the active part of the cutting edge instead of having the same part of the cutting edge in action during the whole time of cutting. The carriage r^2 slides on ways a^3 on the table at right angles with the motion of the plate p^2, and the said carriage is connected by an adjusting screw b^3 with the arm c^3 of a horizontal sliding bar d^3 under the table, which said bar is drawn forward to draw the cutter away from the block which is being turned, by the tension of a spring e^3; and this sliding bar is also provided with a roller f^3 which, by the tension of this spring is kept in contact with the face of a cam g^3 on the cam shaft y, which cam is so formed as to advance the carriage with its cutter n^2 to the block just before the cutter begins to move laterally. And although I have stated that the cutting edge of the cutter when developed on a flat plane is the reverse of the form to be turned, it will be obvious that the mode of operation of this part of my invention can be applied by making the cutting edge a true circle, or a segment of a circle, and developing the figure desired to be produced on the face of the cam g^3, so that as the cutter is made to traverse from end to end it will be moved toward and from the axis of the block that is being turned, the compound motion causing the axis of the cutter to describe a line corresponding with the desired form. The form thus imparted either by the figure of the rolling cutter or by the cam should correspond with the form of the molds which direct the rangling cutters.

In front of the series of mandrels there is a rocking and sliding shaft h^3 with an arm i^3 the extreme end of which arm is bifurcated and the prongs extend within the circle of mandrels so that when the shaft a is turned to shift the mandrels from one position to another, the projecting end of the mandrel which carries the finished block shall enter the bifurcation of the arm which is so located as to pass onto the mandrel just back of the turned block.

There is a helical spring on the rock shaft h^3 the tension of which tends to rotate and also to draw the shaft endwise and hold the bifurcated arm in the required position, which position is gaged by another arm j^3 (see Fig. 3) on the other end of the rock shaft, which comes in contact with a stop k^3. As the mandrels are shifting place the one which carries the finished block first enters the bifurcation of the arm i^3, and as the mandrel continues to move it carries the arm with it and the spring yields to allow the shaft h^3 to turn; and this carries another arm c^4, on the said rock shaft in front of the segment ring k^4 so that when this segment ring is put in motion to traverse the rangling cutters it moves the rock shaft endwise to make the fork on the arm i^3 force the turned and finished block from the end of the mandrel to discharge it, the opposite end thereof having just before been liberated by the corresponding spindle in the manner already described. So soon as the finished

block is discharged the operative can put a rough block on the mandrel, and as he puts it on and holds it in line the spindle l is forced forward against the opposite end to hold it on the mandrel by the action of the cam plate v before described. And as soon as the rough block is brought into proper position the first rangling cutter wheel d^4 acts upon it to rough it down. It is then shifted to the second rangling cutter e^4 which brings it nearer to the required size and form, and while this operation is being performed the first cutter d^4 is acting on another rough block and so in succession to the third rangling cutter f^4, thence to the finishing cutter and finally to the place of discharge; and although there are five stopping places in the circuit and each block is in succession subjected to the operation of four successive cutters, yet every time the shaft a turns to shift the mandrels a finished block is discharged and a rough block put in.

It will be obvious from the foregoing that instead of three rangling cutters and five mandrels the number may be increased or diminished at the pleasure of the constructor. Instead of having one rangling cutter wheel on each arber, and one finishing cutter to act upon the entire length of each block, there may be two or more, each acting on a section of the length of the block, and there may be two or more finishing cutters to act simultaneously on different parts of the same block, and only one rangling cutter wheel for each division, such modification being wholly at the discretion of the constructor who in such matters will be in a great measure governed by the length of the articles to be turned and the character of the form to be produced. So with reference to the molds for directing the line of motion of the rangling cutters to determine the configuration of the article to be turned; instead of the molds above described for directing the cutters, the required form may be developed on the several sections of the cam m^2 which operates the sliding segment ring g^2 with its slots so that the said cam may move the said sliding ring and thereby move the axes of the rangling cutters toward and from the axes of the blocks as they traverse over the length of said blocks. And with regard to the detailed construction of the several parts it will be obvious that many changes may be made by the substitution of equivalent means without changing the character of my invention, as for instance, instead of the cogged sector to impart an intermittent rotary motion to the series of mandrels and spindles, an arm with a pin may be substituted, to act in radial recesses cut in the periphery of the cog wheel on the end of the shaft a. This is only given as an example of the changes which may be made without changing the principle or mode of operation of my invention.

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

1. The series of rotating and shifting mandrels for rotating the blocks to be turned and shifting them from one operation to another, substantially as described, in combination with the series of traversing cutters guided by patterns or molds to determine the form to be produced, substantially as described, whereby a series of blocks are simultaneously subjected to the series of operations, and each in succession subjected to all the operations, as set forth.

2. I also claim the mode of operation, substantially as described, of the cutter, termed the finishing cutter, which said mode of operation consists in rolling the cutting edge along the surface of the block that is being turned, as described, by reason of which a small portion only of the cutting edge is cutting at any one time, and immediately relieved and followed by another portion of the said cutting edge, as set forth.

3. I also claim the sliding segment ring, with its slots, substantially as described, in combination with the cutters and their appendages, substantially as described, for carrying the rangling cutters nearer to the axes of the blocks at each successive cutting action, as set forth.

WM. D. SLOAN.

Witnesses:
WM. H. BISHOP,
JOEL B. WILSON.