(No Model.) 3 Sheets—Sheet 1.

M. W. DOTY.

TURNING LATHE.

No. 489,248. Patented Jan. 3, 1893.

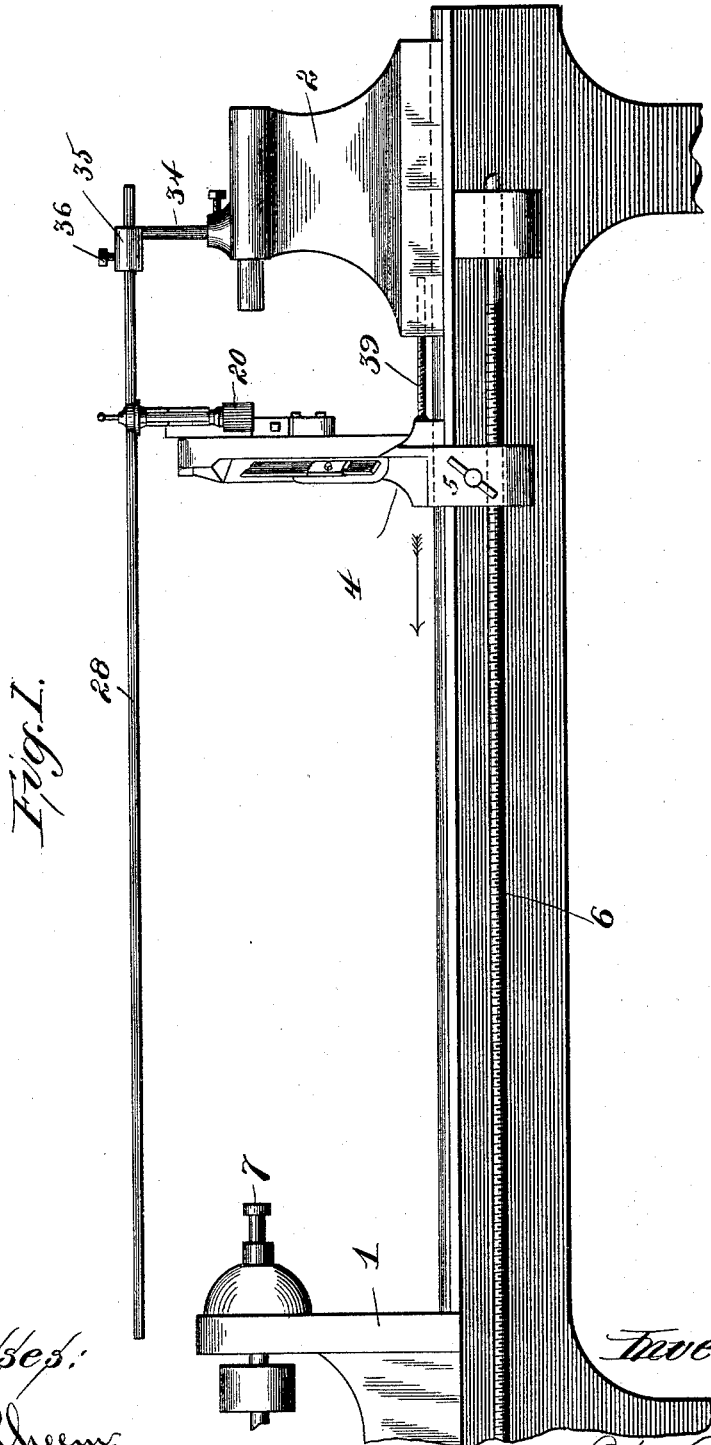

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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TURNING LATHE.

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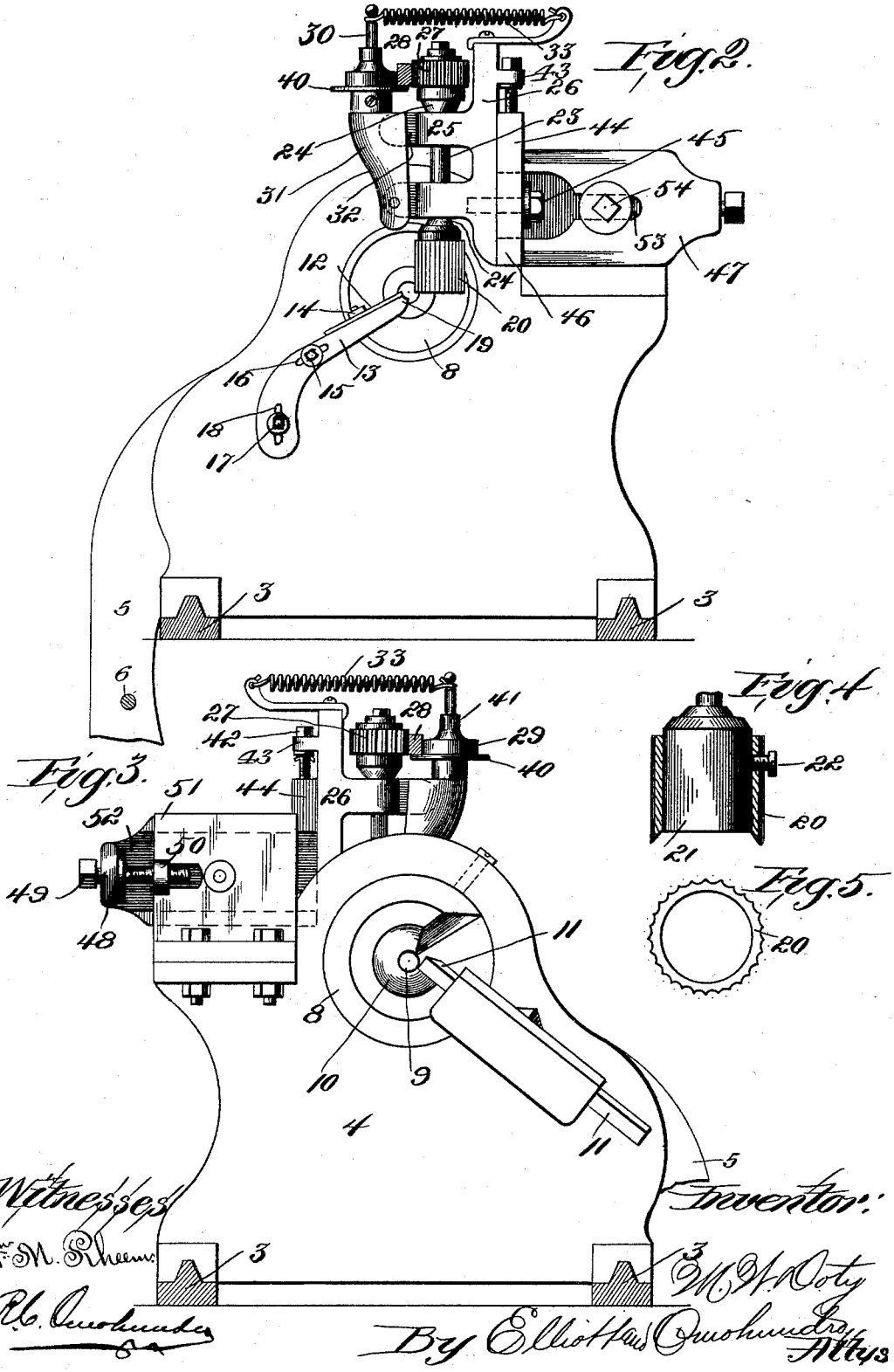

(No Model.) 3 Sheets—Sheet 3.

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Fig. 6.

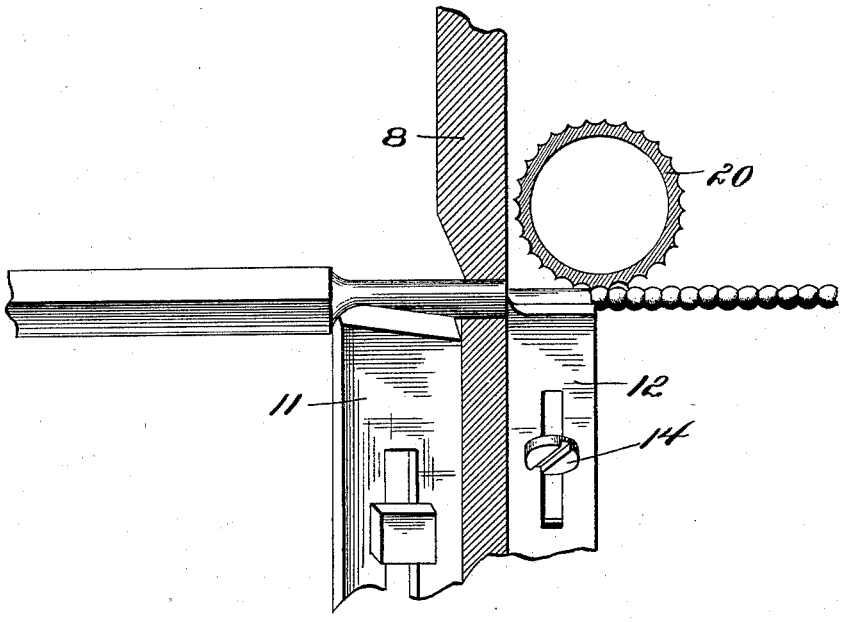
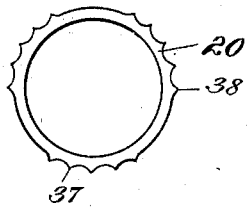


Fig. 7



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UNITED STATES PATENT OFFICE.

MILTON W. DOTY, OF CHICAGO, ILLINOIS.

TURNING-LATHE.

SPECIFICATION forming part of Letters Patent No. 489,248, dated January 3, 1893.

Application filed December 15, 1891. Serial No 415,111. (No model.)

To all whom it may concern:

Be it known that I, MILTON W. DOTY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Turning-Lathes, of which the following is a specification.

My invention relates more particularly to attachments for lathes, for automatically turning out ornamental work such as knurl, ogee or bead used in interior decoration and furniture ornamentation, which attachments usually employ rotary cutter heads or pattern-knives provided with cutting edges having the form of the design to be produced, adapted to be held in contact with the revolving stick and rotated throughout the length of the latter so as to reproduce its design thereon. Machines for producing heavy work of this character such as chair rounds, baluster rails, &c., and in fact all work whose smallest diameter is not less than about one-fourth of an inch, have long been in use; but prior attempts to produce diameters smaller than this and as small as one-sixteenth of an inch have invariably failed. The result has either been that the stick, twists in two before completion, or else its surface is rendered so rough and ragged as to be totally useless for all ornamental purposes. This style of work when properly produced, with a smooth, polished surface is highly ornamental, but to be a success from a commercial point of view, it must be produced by an inexpensive method, that is by automatic machinery, and be ready for use without further dressing or finishing, as it leaves the turning machine.

The prime object of my invention therefore, is to automatically turn out sticks of the unusually small diameters before mentioned.

Another object of my invention is to turn out ornamental work of the described character and to provide the same with a finished or polished surface by one and the same operation. And still another object of my invention is to so arrange the rotary cutter that it may be set to automatically begin to cut the stick at any particular point on its cutting edge irrespective of the length of the stick, or of the distance that the cutter or pattern knife may have to travel before it reaches the stick.

With these ends in view my invention consists in certain features of novelty in the construction and arrangement of parts, hereinafter more fully described with reference to the accompanying drawings, and particularly pointed out in the claims.

In the said drawings—Figure 1 is a side elevation of a portion of a lathe showing its head and tail stocks and my improvements, certain well-known parts of the lathe being omitted for the sake of simplicity. Fig. 2, is an enlarged side elevation of the carriage upon which the knives are mounted, showing the lathe bed in transverse section. Fig. 3, is a similar view of the opposite side of the carriage to that shown in Fig. 2. Fig. 4, is an enlarged detail view of the cutter head or pattern knife showing the cutter in section. Fig. 5, is an end or axial view of the cutter detached from the head. Fig. 6, is an enlarged diagrammatic view showing the relative positions of the roughing knives and cutter or pattern knife and also illustrating the different phases of the stick during its transit through the attachment, and Fig. 7 is a diagrammatic view of the cylindrical cutter, or pattern knife but of a different pattern from that shown in Fig. 5.

In the drawings wherein like signs of reference indicate like parts throughout the several views, 1, 2, are respectively the head and tail stocks of an ordinary lathe, mounted upon the bed or way 3, as usual, the tail stock 2, being provided with any suitable and well-known means (not shown) for moving it to any desired position on the bed. Mounted upon the bed between the head and tail stocks is a knife carrying carriage 4, of any suitable and well-known construction, which is provided with a detachable connection 5, or shear nut with the advancing screw 6, in the usual manner whereby such carriage may be caused to travel along the bed as the cutting proceeds. This connection 5 which is shown fully in Fig. 1, only, it being broken away in Figs. 2 and 3 for economizing space, may be similar to any of the well known forms used on the knife carriages of ordinary turning lathes.

The head stock 1, is provided with a chuck 7, of any suitable pattern adapted to receive one end of the stick to be turned, and the

carriage 4, is provided with a removable die 8, held in place in any convenient manner, and this die on the side or face next the chuck 7, is provided with a bore or aperture 9, having a flaring mouth 10, as shown in Fig. 3, which is adapted to receive the end of the rough stick and hold the same concentric with the bore 9, and against the edge of a primary roughing knife 11, suitably mounted on the side of the carriage 4. The knife 11, is preferably so arranged that it will trim the stick down to a diameter that will fit the bore 9, accurately so as to prevent the slightest vibration of the stick but without precluding its free revolution. The die 8 being removable it is apparent that sticks of any diameter may be turned by putting in a die having a bore of the proper size, and re-adjusting the primary roughing knife 11. For convenience of illustration we will suppose that the machine is set and the parts proportioned for the production of a finished stick or beading whose largest diameter is about one-eighth of an inch, while its smallest diameter is about one-sixteenth of an inch. For the production of a stick of this size, it is desirable that the stick after it leaves the primary roughing knife, be about one-fourth of an inch in diameter, and hence the bore 9, of the die should also be about one-fourth of an inch in diameter so as to fit the stick accurately. It will of course be understood that the rough stick must be of sufficient diameter to withstand the resistance of the knives without twisting in two, but it is impossible to at once reduce such a stick to the small diameters required without producing a ragged, splintered surface, if not entirely destroying the stick. Hence it is necessary to reduce the stick very gradually, leaving very little to be taken off by the final cutter; but to be practicable, this reduction from the maximum to the minimum diameter must be rapid and result from one and the same operation. And to this end, on the other side of the carriage I arrange a secondary roughing knife 12, which is so arranged with relation to the die 8, as to impinge the stick as it comes through the bore 9, and trim it down to approximately what is to be the largest diameter of the finished stick. By such an arrangement the stick is firmly held against vibration by the die, while the roughing knives perform their work and the secondary roughing is begun at a point sufficiently close to the beginning of the primary roughing as to preclude the twisting of the stick after it leaves the primary roughing knife. This secondary roughing knife 12, is mounted upon a stock or bracket 13, and adjustably held in place thereon by means of a set-screw 14, passing through a slot in the knife. The knife 12 is thus made capable of endwise adjustment to and from the stick, and in order that it may be adjusted to bite the stick at a higher or lower point, I mount the stock 13, upon a pivot formed by a set-screw 15, passing through a slot 16, in the stock into the carriage, the lower end of the stock being preferably held by means of a set-screw 17, passing through a slot 18, all as shown in Fig. 2.

The upper end of the stock 13, constitutes a shoulder or support 19, for supporting the stick after it leaves the die 8, and sustaining it while undergoing the secondary roughing and the final turning. This support 19, as clearly shown in Fig. 2, is rounded so as to conform approximately to the contour of the stick as reduced by the secondary roughing knife and thus preventing downward bending or other vibration of the stick while undergoing the final finishing by the rotary cutter or pattern knife 20. This cutter is so arranged that its cutting edge will impinge the stick directly opposite the outer edge of the secondary roughing knife 12, so that the stick may yet receive the support of the shoulder 19, while the cutter 20 performs its work, the cutter 20 being preferably of such diameter as to touch the stick with but a very small portion of its cutting edge at one time, for reasons hereinafter explained.

The cutter or pattern knife 20, is preferably cylindrical that is, its sides are parallel, as shown in Figs. 5 and 7, having the desired pattern formed longitudinally in its outer periphery, and is preferably mounted in an upright or vertical position with its cutting edge at its lower end. The cylinder or band thus formed into a cutter is adjustably sleeved upon a rotary cutter head 21, and held in place by any suitable means, such as a set screw 22. The cutter head 21, is carried by an upright shaft 23, preferably provided with cone bearings 24, journaled in arms or brackets 25, projecting from a vertically adjustable casting 26. Upon the upper end of the shaft 23, is secured a pinion 27, with which engages a rack bar 28, whose teeth are held in engagement with the teeth of the pinion by means of an anti-friction wheel or roller 29, suitably journaled on a pin 30, projecting from the upper end of an arm 31. This arm 31, is pivoted at its lower end to the lower one of the arms 25, the upper arm 25 being provided with a tongue 32, which fits into a slot in the arm 31, as shown in dotted lines in Figs. 2 and 3, and thus steadies the upper end of the arm 31. To the upper end of the pin 30, is secured one end of a coil spring 33, whose other end is attached to the casting 26, in any suitable way, so as to draw the wheel 29, against the back of the rack.

The rack 28 is mounted upon and carried by the tail stock 2, by means of any suitable standard as 34, adjustably planted in the tail stock and having a horizontal sleeve or socket 35, in which the rack is held by means of a set screw 36. By mounting the rack upon the tail stock I am enabled to begin the configuration or ornamentation of the stick at any particular point on the periphery of the cutter, by simply advancing the tail stock and carriage along the bed together until the cut-

ter reaches the end of the stick whereupon the connection 5, may be thrown into engagement with the advancing screw 6, and the tail stock with the rack 28, secured thereto, being permitted to remain at rest, the carriage proceeds on its way, causing the pinion to rotate the cutter against the stick and to leave therein peripheral grooves corresponding to the design of the cutter. As the cutting proceeds the end of the finished stick projects through the die 8, or more properly speaking the die moves along the stick, the tail-stock and stick remaining stationary, and such finished end may be supported in any convenient manner, but in practice it is found that no support is necessary for sticks of ordinary size, and when the very small diameters are turned they may be supported by the hand of the operator. The tail-stock of course does not touch the end of the stick. Of course where the cutter is simply designed to produce beads or knobs like that shown in Fig. 6, it is immaterial at what point on the periphery of the cutter it strikes the stick first, but where for instance a cutter formed like that shown in Fig. 7, is used and it is necessary to start the figure on the stick at some particular point on the periphery of the cutter, as for instance at the point 37, it is obvious that the cutter should be set with such point 37, in a position to be the first part of the cutter to strike the stick. But inasmuch as the sticks vary in length and some enter the chuck farther than others, thus varying the distance between the end of the stick and the tail stock, the cutter ordinarily in approaching the stick would make more revolutions at one time than at another before it reached the end of the stick, and hence if the point 37 struck first on one stick, a shorter stick would probably not be cut until, say, the point 38, came into cutting position. Hence the importance of moving the rack and cutter along the bed together until the stick is reached. The carriage 4, may be run back until it strikes against the adjustable stop 39, on the tail stock, the rack disengaged from the pinion 27, and the cutter set with the proper point on its cutting periphery outermost in a position to engage the stick. If now the carriage is fed forward to the stick by pushing it in advance of the tail stock, the cutter will remain in the position in which it was set until the tail stock and rack come to rest and the coupling 5, thrown into engagement with the screw 6. When the carriage has traversed the full length of the stick, the latter may be broken or cut off at the chuck 7, by any of the appliances well-known and in use on turning lathes. It is also quite obvious that if the carriage is returned to its former position against the stop 39, of the tail stock, the cutter will rotate in the reverse direction and come to the adjusted position in which it was originally set, ready to be again advanced by the tail stock until the end of the new stick is reached, no matter what the length of the new stick might be. The rack is held against slipping downward out of engagement with the pinion preferably by means of a flange 40, on the wheel 29. When it is desired to hold the rack and pinion out of engagement while the carriage is being shifted, the rack may be pulled upward and supported upon the top of the pinion with its back resting against an anti-friction roller 41, on the pin 30.

In order that the rotary cutter may be made to subserve as a burnisher simultaneously with its cutting action, it is necessary that such cutter should be so adjusted as to remove only a sufficient quantity of the stick to produce the ornamentation, and at the same time be in such a position that the stick after it is cut will rub slightly against the upright sides of the cutter. I have found that the best results are produced with a cutter whose sides are parallel, with the side of the cutter arranged at a true tangent to the stick as shown in Fig. 2, so that the wood after it passes the cutting edge, by virtue of its resiliency and the slight vibratory motion imparted to it by the rapid rotation of the stick against the edge of the cutter, will spring back against the smooth sides of the cutter and thereby receive its final finish and be ready for immediate use upon leaving the machine.

As the cutter must be readjusted whenever the other knives are changed for varying the diameter of the stick, and as the proper adjustment of the cutter can be determined only while the cutting is going on, it is important that the cutter should be provided with means whereby it may be readily adjusted with great nicety in an axial as well as a diametric direction.

I am aware that cutters have before been adjusted transversely on an arc, but such is not the equivalent of a diametric adjustment in a straight line, for it is readily seen that if the cutter swung on an arc it could not be at a tangent to every size of stick, and hence would not only defeat the polishing action performed by the arrangement above described, but would snag and splinter the wood. I accomplish the axial or vertical adjustment of the cutter by means of an adjusting screw 42, secured rotatably in an ear or lug 43, of the casting 26, and having its lower end engaging in a casting 44, which is fixed against vertical movement. Thus by turning the screw 42 to the right or left, the rotary cutter may be adjusted up or down to the desired position, and when the adjustment is attained the casting 26, may be locked in position by means of a set bolt 45, passing through a slot 46, in the casting 44. The casting 26, is carried by the casting 44, which is laterally adjustable and which is provided with a horizontal portion 47, whose rear end is formed with a perforated ear or lug 48, through which passes a set bolt or screw 49, held against longitudinal movement therein and engaging at its inner end in a screw-

threaded ear 50, on a casting 51, which latter is securely bolted to the carriage 4, as shown in Fig. 3. The casting 47, for the sake of greater security, may be provided with a groove 52, in which fits a tongue formed on the casting 51, as shown by the dotted lines in Fig. 3, and in order that the casting 44, 47, may be locked in position when the desired diametric adjustment is accomplished, I provide the latter with a slot 53, through which passes a set screw 54, having its end screwed into the casting 51. Thus by turning the screw 49, the cutter may be adjusted to any desired position in a straight line transversely of its axis.

Inasmuch as the stick is very frail and apt to snap or splinter when it reaches the rotary cutter, it is necessary that such rotary cutter should present but a very small portion of its cutting edge to the stick at one time as the frictional resistance resulting from a great extent of surface in contact with the stick would result in twisting the reduced portion off before it is finished. Hence it is necessary to make the cutting bands or cylinders of very small diameter, and since the cutting band or cylinder revolves several times during the formation of a single stick, it becomes essential to make the cutting edge in the form of a continuous loop or ring and to form it of a single piece, that is integrally or without joints, because the slighest irregularity in the cutting edge of the rotary cutter, such as would be produced by the meeting edges of two parts, would snag and splinter the stick to such an extent as to render it useless, and this result is due to the fact that the small particles of fiber wedge between the parts and form a bunch, which not only prevents the portion of the edge which it covers from cutting, but holds the stick partially aloof from the other portion of the cutter. A further reason why the cutting cylinder should be formed integrally, is that its whole cutting edge should be arranged in the same running circle or, in the same plane, as otherwise the stick would be unevenly turned and snagged and splintered at the points where one section left off and the other began, and it is almost impossible to grind two sections of a cutter alike and accurately adjust their edges on the cutter head.

Having thus described my invention what I claim and desire to secure by Letters Patent is—

1. The combination with the die for holding the stick and means for revolving the stick, of a roughing knife arranged on one side of the die in juxtaposition thereto, a rotary pattern knife arranged opposite said roughing knife and a rigid supporting shoulder located in close proximity to the opening in said die, and opposite and adjacent to said pattern knife, substantially as set forth.

2. The combination with the die for holding the stick, and means for revolving the stick; of a roughing knife, a shoulder arranged in close proximity to the opening in said die for supporting the stick as it leaves the die, and a rotary cutter arranged opposite said shoulder, substantially as set forth.

3. The combination with the die for holding the stick, and means for revolving the stick; of primary and secondary roughing knives, a supporting shoulder having a rounded bearing surface for the stick, coincident with the opening in the die, and being arranged in close proximity thereto and a rotary cutter arranged opposite said shoulder, substantially as set forth.

4. The combination with the die for holding the stick, and means for revolving the stick; of the roughing knives, a stock to which one of said roughing knives is secured, having a supporting shoulder for the stick as it leaves the die, and a rotary cutter adjacent to said shoulder, substantially as set forth.

5. The combination with a carriage and a rotary cutter journaled therein, of an adjusting screw connected with said cutter for moving it in axial direction, and a second adjusting screw connected with said cutter for moving it in a diametric direction; substantially as set forth.

6. The combination with a roughing mechanism, and means for revolving the stick; of a rotary cutter, a casting upon which said cutter is mounted, a second casting upon which the first casting is supported, said castings being respectively adjustable axially and diametrically of the cutter, transversely of the stick, set screws for locking said castings in their adjusted positions and adjusting screws fixed with capability of rotating, having their ends connected with said castings respectively, substantially as set forth.

7. The combination with a tail-stock, means for revolving the stick, and a rotary cutter head provided with a pinion or gear wheel, of a horizontally movable rack engaging said pinion and being connected with said tail-stock, and adapted to move in unison therewith, substantially as set forth.

8. The combination with a roughing mechanism the tail-stock and means for revolving the stick; of a rotary cutter head provided with a pinion 27, a casting upon which said cutter head is mounted, a rack carried by said tail-stock for engaging said pinion 27, and a spring for holding said rack and pinion in engagement, substantially as set forth.

9. The combination with a roughing mechanism, the tail-stock and means for revolving the stick; of a rotary cutter head having a pinion 27, a casting upon which said cutter head is mounted, a rack carried by said tail-stock for engaging said pinion, a wheel pivotally mounted on said casting, and a spring for holding said wheel against the said rack, substantially as set forth.

10. The combination with a roughing mechanism and means for revolving the stick, of a carriage, a rotary cutter mounted on said carriage, a rack for rotating said cutter and

a flanged wheel on said carriage, for supporting said rack, substantially as set forth.

11. The combination with a roughing mechanism and means for revolving the stick, of a carriage, a rotary cutter mounted on said carriage, a rack for rotating said cutter, means for moving said rack and cutter in unison and a flanged wheel on said carriage for supporting said rack, substantially as set forth.

12. The combination with a roughing mechanism, and means for revolving the stick, of a carriage, a rotary cutter mounted upon said carriage, a pinion for rotating said cutter a longitudinally movable rack yieldingly held in engagement with said pinion, and means for moving said cutter and rack in unison longitudinally substantially as set forth.

13. The combination with a roughing mechanism, and means for revolving the stick, of a carriage, a rotary cutter journaled rigidly upon said carriage, a pinion for rotating said cutter a longitudinally and transversely movable rack yieldingly held in engagement with said pinion, and means for moving said rack and cutter in unison longitudinally substantially as set forth:

14. The combination with a roughing mechanism, and means for revolving the stick; of a carriage, a rotary cutter mounted on said carriage, the tail stock having a stop adapted to strike said carriage, and a rack carried by the tail stock, and means for rotating said cutter by engagement with said rack. substantially as set forth.

15. The combination with a roughing mechanism, a die and means for revolving the stick, of a carriage in which said die is mounted, a rotary cutter journaled on said carriage and having a pinion, an arm pivoted to said carriage, a flanged wheel journaled on said arm, a rack resting on said wheel and engaging said pinion, and a spring for forcing said wheel and rack toward said pinion, substantially as set forth.

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