No. 704,960. Patented July 15, 1902.

J. ETTINGER.

ROTARY CUTTER.

(Application filed Oct. 5, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

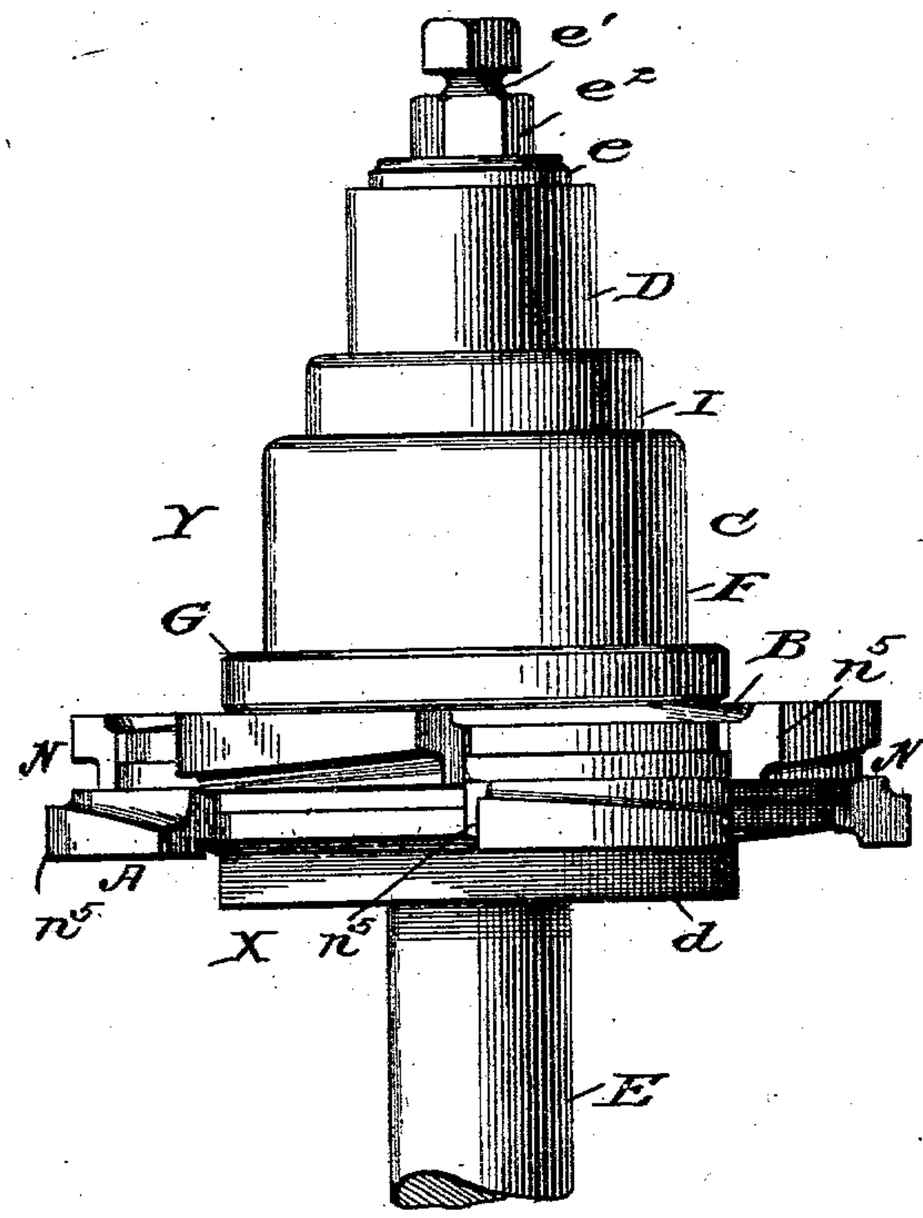


Fig. 2.

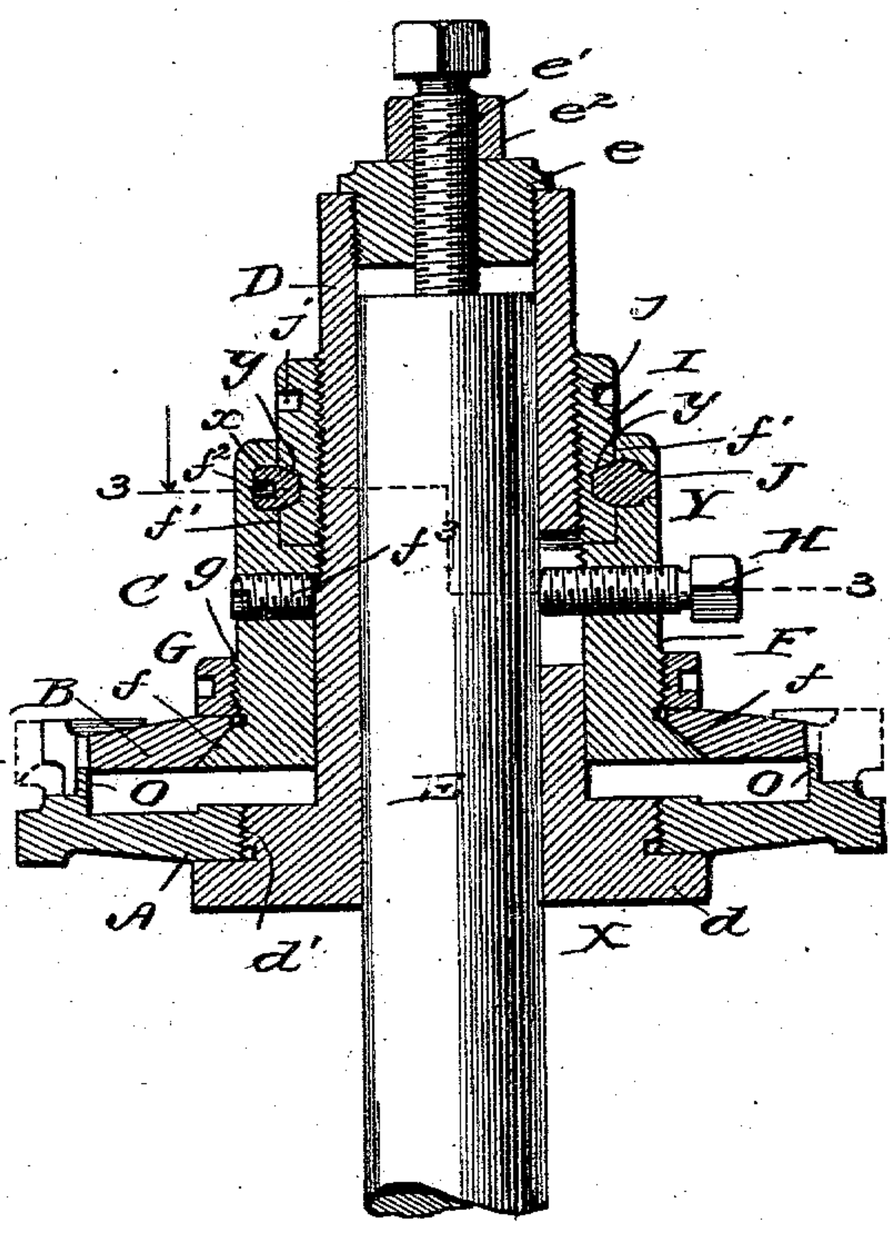


Fig. 3.

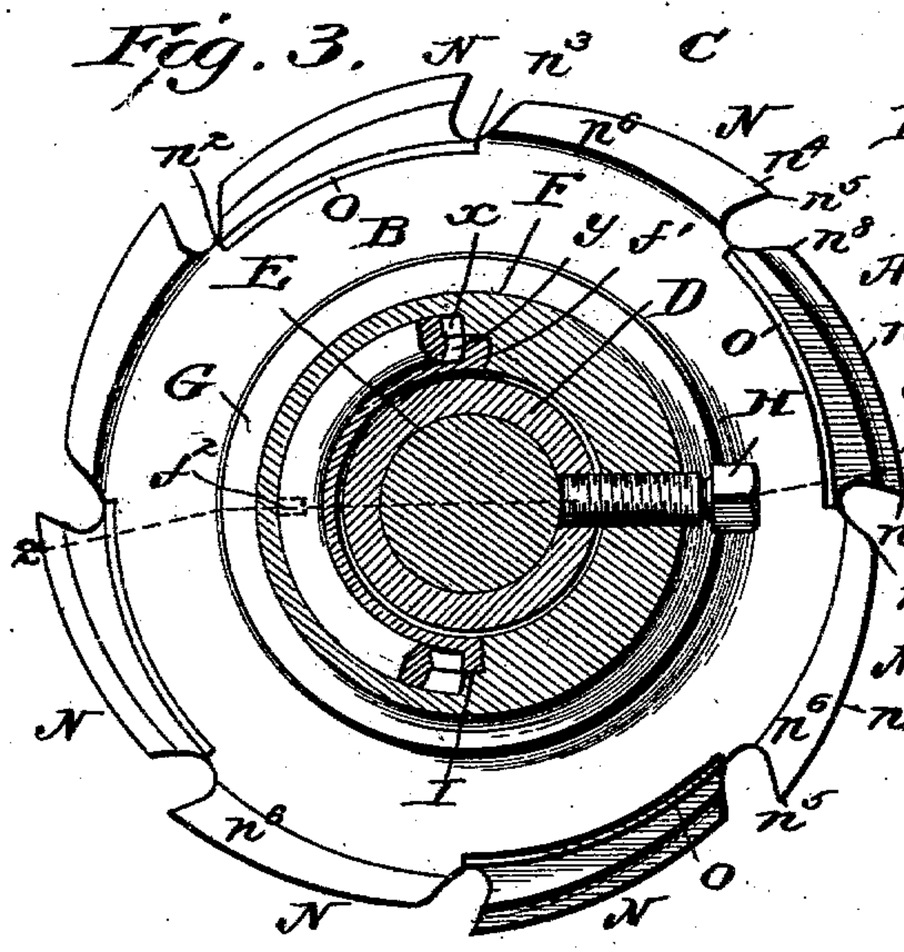


Fig. 4.

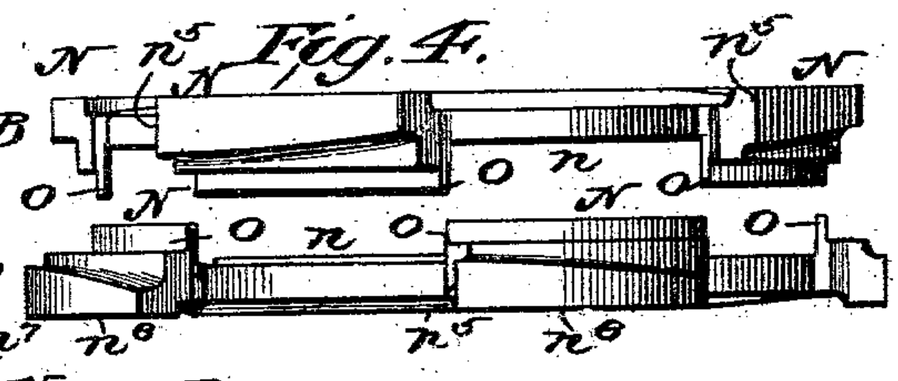
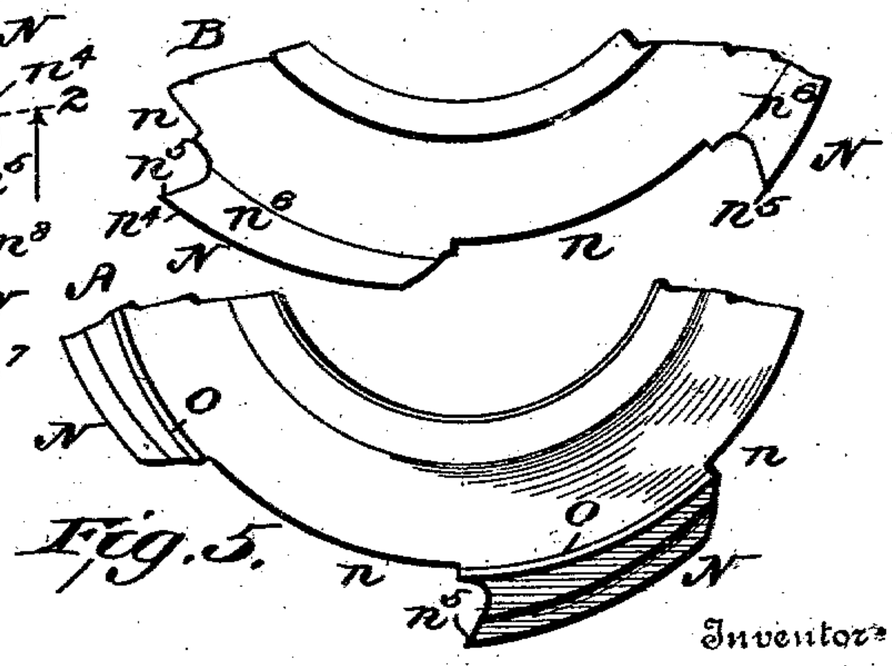


Fig. 5.



Inventor:

Witnesses

Joel Ettinger,

By his Attys

Baldwin, Davidson & Wright.

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Fig. 6.

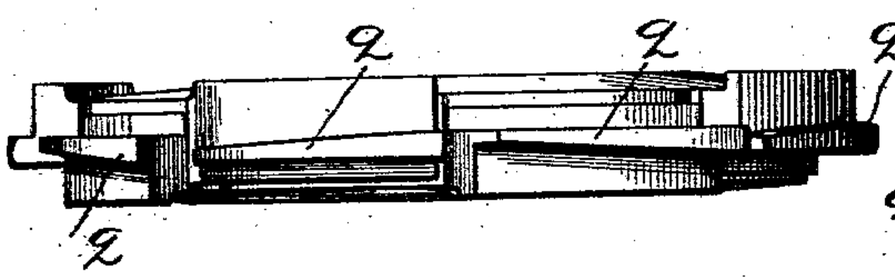


Fig. 7.

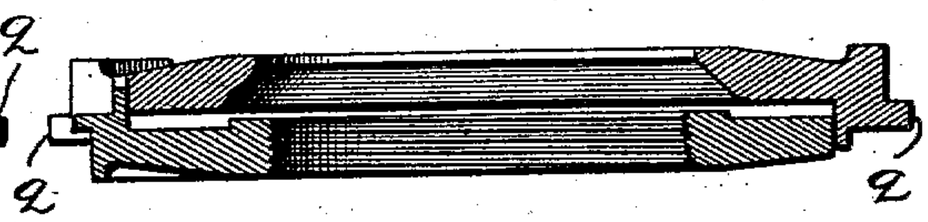


Fig. 8.

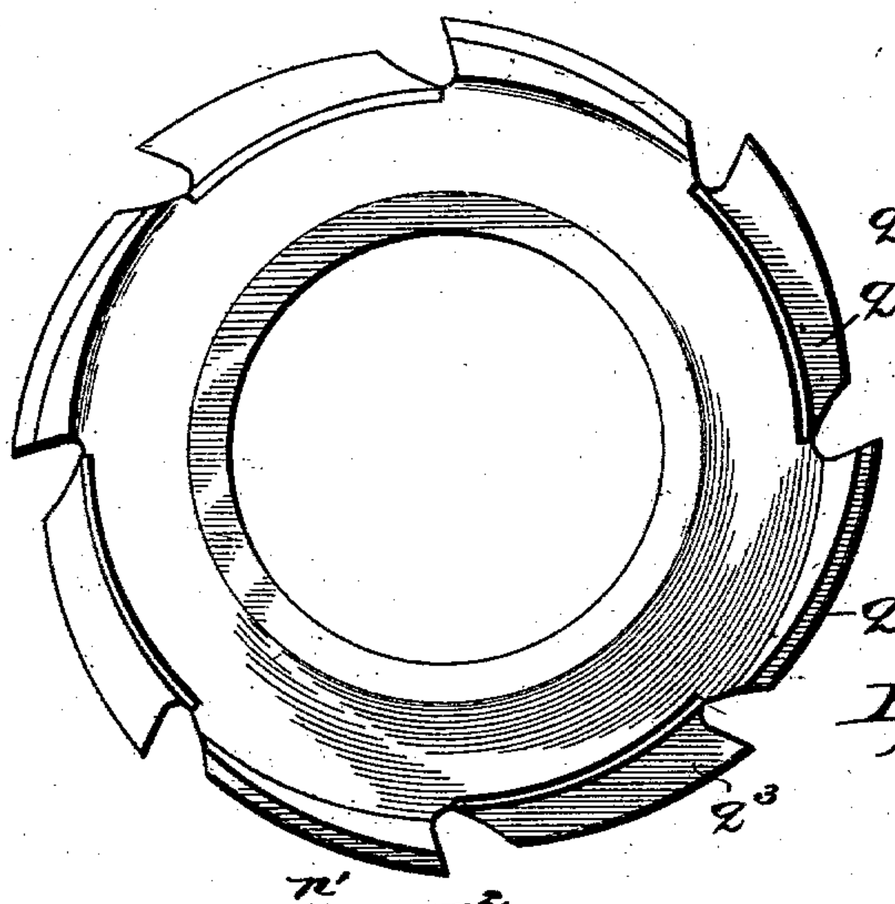


Fig. 9.

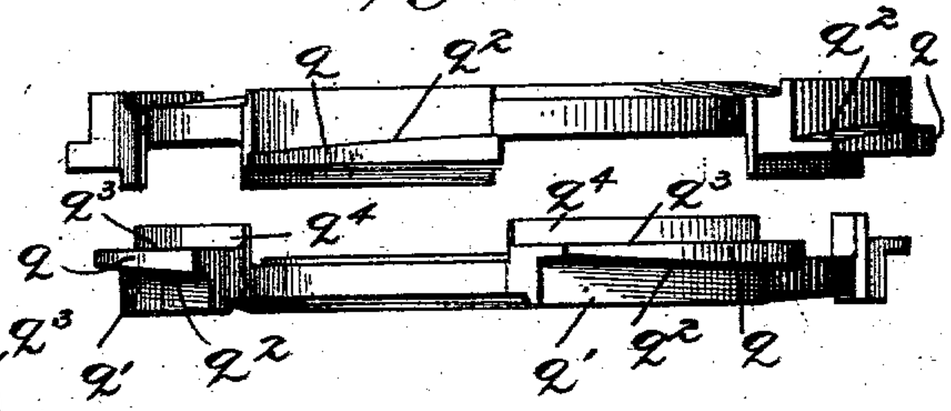


Fig. 10.

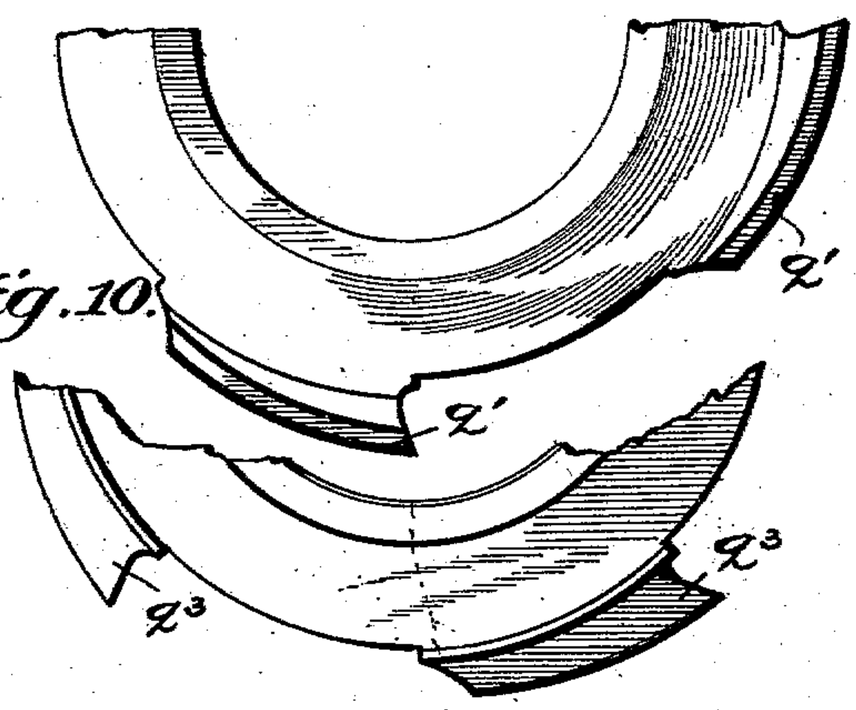


Fig. 11.

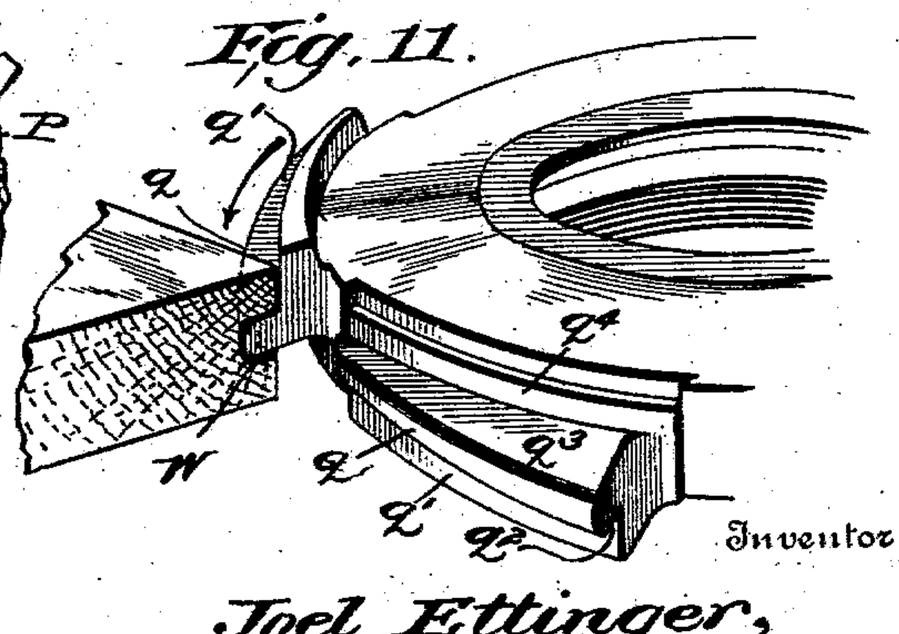
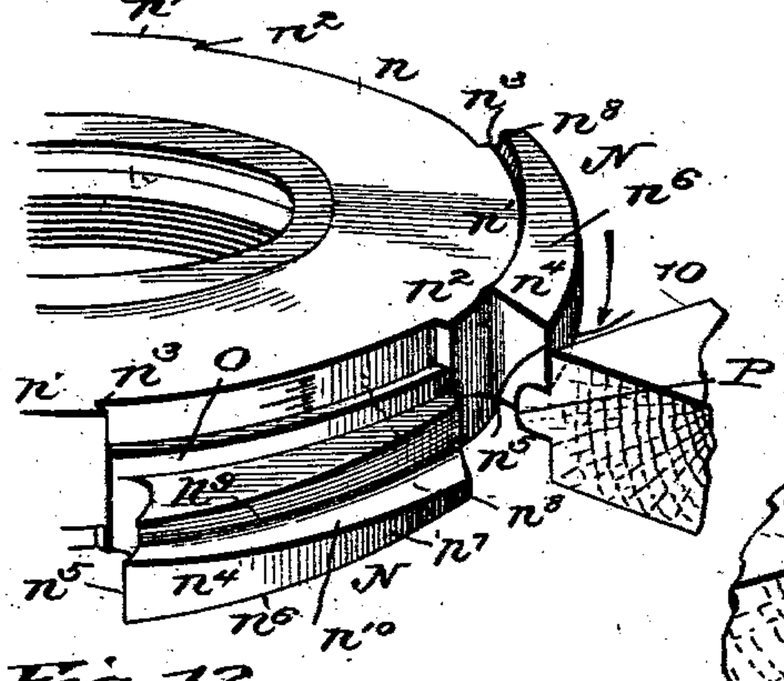


Fig. 12.



Witnesses
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E. A. Bullock.

Inventor:
Joel Ettinger,
By his Attys.
Baldwin Davidson & Wright

UNITED STATES PATENT OFFICE.

JOEL ETTINGER, OF CHESTER, PENNSYLVANIA, ASSIGNOR TO THE ETTINGER MACHINE COMPANY, LIMITED, OF CHESTER, PENNSYLVANIA, A PARTNERSHIP.

ROTARY CUTTER.

SPECIFICATION forming part of Letters Patent No. 704,960, dated July 15, 1902.

Application filed October 5, 1900. Serial No. 32,161. (No model.)

To all whom it may concern:

Be it known that I, JOEL ETTINGER, a citizen of the United States, residing at Chester, in the county of Delaware and State of Pennsylvania, (whose post-office address is No. 919 Madison street, Chester, Pennsylvania,) have invented certain new and useful Improvements in Rotary Cutters, of which the following is a specification.

My present invention relates to rotary cutters of the class in which cutting teeth or bits are arranged on supports from which they project laterally, and which may be adjusted to the desired extent to adapt the cutters to conform to the particular kind of work to be produced.

In my Patent No. 529,115, of November 15, 1894, I have shown a rotary cutter in which circular bits are arranged on inclined seats disposed alternately on opposite sides of the flanges of two members of an expansible cutter-head. The bits, as shown in said patent, are arranged to cut tongues on the edges of boards; but they may be arranged, as stated, to cut grooves in boards or to make cuts giving various forms to the surface acted upon. The bits may be adjusted independently about their axes, and the two members of the expansible head may be adjusted toward and from each other to accommodate boards of different sizes or to cut tongues or grooves of various widths. It is often difficult to clamp the bits so tightly that they will be fixed and immovable or to adjust them so that all the cutters shall present their cutting edges in the same circular path.

It is the object of my invention to simplify the construction of rotary cutters of this class and to render them more easy of adjustment and more firm and rigid when set.

In carrying out my invention I provide an expansible head of an improved construction adapted to support two cutters, which are adjustable flatwise toward and from each other and which are formed with teeth projecting from the body portion of the cutters and of the proper shape to cut a tongue, a groove, or other form in a piece of wood or other material. The cutters are formed with portions which interlock, so that when they are adjusted and set one cutter cannot move relatively to the other about its axis in line with the strain produced in working. The cutters are formed in a novel way to give side clearance and edge clearance, and they are formed with flanges to cover the spaces or openings otherwise left when adjusting them and which guard these openings or spaces and prevent the accumulation of chips or dirt. The teeth are of sufficient size to provide a requisite amount of material to allow grinding or sharpening, and the bodies of the teeth are so formed that when the teeth are ground at their advancing ends the same conformation will be given to the advancing ends produced in the grinding, and the walls of the shaped portions of the teeth in rear of the advancing ends are inclined in such manner as to give clearance at all points which would tend to come in contact with the material acted upon.

A more detailed description of the organization of the various parts of my improved cutter and the details of construction will be given hereinafter, and the subject-matter deemed novel will be set forth in the claims.

In the accompanying drawings, Figure 1 shows a side elevation of an expansible cutter-head equipped with cutters constructed in accordance with my invention. Fig. 2 shows a vertical section therethrough on the line 2 2 of Fig. 3. Fig. 3 shows a transverse section on the line 3 3 of Fig. 2. Fig. 4 shows a side elevation of a pair of cutters constructed in accordance my invention separated a short distance from each other in order to more clearly show their construction. Fig. 5 is a detail view showing in plan the form of portions of the cutters. Fig. 6 shows a side elevation of a pair of cutters for cutting grooves assembled or interlocked in position for operation. Fig. 7 shows a vertical central section through a pair of such cutters. Fig. 8 is a plan view of a pair of groove-cutting cutters constructed in accordance with my invention interlocked and ready for operation. Fig. 9 is a side elevation of a pair of groove-cutting cutters constructed in accordance with my invention, the two cutters being separated the better to illustrate the details of construction. Fig. 10 is a detail view in plan of portions of my improved groove-cutting cutters. Fig. 11 is a perspec-

tive view showing details of a groove-forming cutter and illustrating how it operates upon a piece of board. Fig. 12 is a perspective view showing how the teeth of the tongue-cutting cutters operate.

The cutters A and B, which will be hereinafter described in detail, are supported by a cutter-head C, which comprises two members X and Y, adjustable toward and from each other for the purpose of adjusting the cutters to regulate the width of cut. One member of the cutter-head consists of a sleeve D, bored centrally to receive the shaft E and formed on one end with a flange or hub *d*, having an annular recessed portion *d'* to receive the cutter A. The vertical circular wall of the recess *d'* is screw-threaded and matches a corresponding screw-thread in the hub of the cutter A. The shaft E extends to near the top of the sleeve D, and the end of the sleeve is closed by a cap *e*, which may be secured to the sleeve by screw-threads, as shown, or other suitable devices. Through the cap *e* extends an adjusting-screw *e'*, provided with a locking-nut e^2, by which means the cutter-head may be adjusted on the end of the shaft.

The cutter B is supported on the member Y, which consists of a sleeve F, having a flange *f* at its lower end, which is preferably beveled, as shown, and fits a correspondingly-beveled circular opening in the cutter B. Both of the beveled surfaces are plane or unthreaded, and while the cutter B is held up by the flange *f* it is free to rise therefrom or to be turned thereon as far as the particular formation of the beveled surfaces is concerned; but the cutter is securely clamped on the flange *f* by means of a collar G, which is screw-threaded on its interior and fits a corresponding screw-thread *g*, formed on the exterior of the sleeve F above the flange *f*. The sleeve D is secured on the shaft E by means of a bolt H, which extends through a threaded lateral opening in the sleeve F and through a vertical slot in the sleeve D and bears against the shaft. By means of the bolts *e'* and H the cutter-head may be securely fastened on the shaft E at the desired elevation.

In order to adjust the cutter B toward and from the cutter A, I provide a nut I, which operates on a screw-threaded portion of the sleeve D and is loosely connected to the sleeve F. Preferably the sleeve F is formed at its upper end with an annular recess *f'*, into which the lower end of the nut I projects. In order to accomplish the desired result, it is necessary that the sleeve F and nut I shall be loosely connected—*i. e.*, in such manner that the nut may rotate relatively to the sleeve, but at the same time shall move the member Y up and down relatively to the other member, so as to vary the distance between the cutters. This may be accomplished in various ways. The way shown in the drawings consists in forming annular grooves *x* and *y* in the sleeve F and nut I and so locating them that they shall register, and thus form a continuous annular space. This space may contain or may be filled with a suitable key which, while compelling the nut and sleeve to move up and down together, will permit the nut to move about its axis without turning the sleeve. In the drawings I have shown the grooves *x* and *y* filled with soft metal, such as Babbitt metal. This may be poured into the grooves through an opening J, which opening may be filled with the metal after the grooves are full. In order to rigidly connect the Babbitt metal with the sleeve F, I form on the sleeve one or more lugs f^2, about which the metal is poured, and in order that the nut may turn relatively to the key I preferably coat the surface of the groove *x* with plumbago or similar material before the metal is poured in. The arrangement is such that the nut I may be turned about the sleeve D without turning the sleeve F, while the sleeve F is made to move up and down correspondingly with the nut. In order to conveniently turn the nut, I preferably form it with one or more holes *j* to receive a wrench or other suitable tool. The sleeve F carries a set-screw f^3, by means of which the sleeve F may be tightly clamped to the sleeve D when the cutter-head is not mounted on the shaft, so as to preserve the relative arrangement of the cutters, and this screw also serves to more securely lock the cutters in their adjusted position after the nut I has been manipulated to adjust them. I thus provide an improved cutter-head for carrying the cutters, which is expansible to adjust the cutters to any desired extent and which securely holds the cutters in their adjusted position when once properly set.

Heretofore rotary cutters of the class to which my invention especially relates have usually been constructed by providing an expansible head with flanges on which individual bits have been mounted. Great care is required to adjust the bits, and it is very difficult to so secure the bits in their seats that they shall not slip. I overcome these difficulties by forming the bits or cutters proper integrally with the body portion of the cutter, and so form the bits or cutters proper as to give the required clearance at all points where there would be a tendency to bind or heat.

The cutting edges of my improved cutters are formed on teeth arranged on the periphery of an annular body portion which is adapted to be carried by the cutter-head. Two similar cutters are employed and are adjustable toward and from each other, as hereinafter explained; but each cutter carries on its periphery a series of teeth formed integrally with the body portion of the cutter and provided with cutting edges at their advancing ends shaped to conform to the figure to be produced and having the walls of the shaped portions in rear of their advanc-

ing ends inclined to afford the requisite clearance at such points as lie adjacent to the work produced by the cutting edges. Each tooth of the cutter is of sufficient length to provide ample material to allow grinding or sharpening, and the conformation of the tooth is such that as the advancing end is ground back the same conformation is preserved at the cutting edge, and the same clearance on the walls of the figured portion in rear of the advancing edge is preserved.

The cutters A and B (shown in Figs. 1 to 5, inclusive) are of the same general form, each of them being circular and flat or disk-shaped and each being provided with a series of teeth N. The body portion of each cutter has a central opening, allowing it to pass over the end of the cutter-head and to find its support therein. Preferably the cutter A is screw-threaded around its central opening, as before described, to fit the screw-threaded portion d' of the member X of the cutter-head, while the cutter B is beveled at its central opening to conform to the beveled flange f on the sleeve of the other member Y of the cutter-head. Each cutter has a series of teeth N around its periphery and formed integrally with the body portion of the cutter. The teeth are arranged at suitable distances apart, leaving spaces n between them to receive the teeth of the other cutter. By this means the cutters themselves are made to interlock. One cutter cannot move about its axis relatively to the other cutter, but both must necessarily move together, and as the teeth are all formed integrally with the body portions of the cutters the teeth carrying the cutting edges must also all move together without any possibility whatever of one or more teeth moving relatively to the others, and thus getting out of adjustment. Preferably the teeth are arranged on projections n'. (Illustrated more particularly in Fig. 12.) These projections form shoulders n^2 n^3, and when the cutters are assembled and interlock the opposite ends of the teeth fit closely against these shoulders, the arrangement being such that the cutters may move vertically relatively to each other, but are prevented from moving in any other direction. Each tooth N of the cutters (shown in Figs. 1 to 5, inclusive, and in Fig. 12) is formed with an advancing end n^4, having an outer cutting edge n^5, suitably shaped to cut the proper figure on the material acted upon. The tooth at its front end is of sufficient width to hold the cutting edge a sufficient distance from the periphery of the body portion of the cutter, and the surface between the cutting edge and the inner end of the advancing end of the tooth is preferably cut back or beveled in the manner indicated. The outer wall n^6 of each tooth, which is either the top wall or bottom wall of the tooth, according to whether the tooth is on the upper cutter or on the lower cutter, may be made perfectly straight or horizontal, as this portion of the tooth does not come in contact with the material acted upon. The outer wall or periphery n^7 of each tooth is, however, inclined—that is, it is circular, but of gradually decreasing radius from the outer cutting edge n^5 to the heel n^8 of the tooth. By this construction an edge clearance is given to the tooth, which will prevent binding or heating where it comes in contact with or in proximity to the material at the point indicated by z.

The walls n^9 and n^{10} of the shaped portion of the tooth in rear of the advancing end thereof are also inclined in such manner as to provide clearance. The wall n^9 is shaped correspondingly with the outer wall or periphery of the tooth—that is, it gradually decreases in radius from the advancing cutting end of the tooth to the heel thereof. The wall n^{10} is gradually inclined rearwardly from the advancing end of the tooth toward the top or bottom of the tooth, according to whether the tooth is on the upper or lower cutter—that is, this wall n^{10} inclines rearwardly away from the tongue P on the board, so as to give clearance to the wall n^{10}. It will thus be seen that as the tooth rotates the tongue is cut on the board by the advancing edge n^5, while the shaped walls in rear of the advancing cutting edge are so formed as to provide clearance at all points which would tend to come in contact with the material acted upon. Each of the cutters is provided with a series of flanges O, projecting from that side of the teeth on which the shaped portion is formed and projecting into the recesses between the teeth of the opposing cutter. This is clearly indicated in Fig. 12. The purpose of these flanges is to close the spaces which would otherwise be left between the cutters, in which there would be a tendency for chips and dirt to accumulate. This arrangement is illustrated in Fig. 2 and also in Fig. 7.

It will be seen by reference to Fig. 7, and particularly to the left-hand side thereof, that if the flanges O were omitted there would be an opening between the body portions of the cutters which would allow the entrance of chips and dirt. This would be especially apparent if the cutters were adjusted a wide distance apart.

When the cutters are new and the teeth have not been ground to any great extent, it is necessary to hold the cutters a maximum distance apart or a considerable distance apart, as indicated in Fig. 2. After the teeth have been ground it is necessary to adjust the cutters closer together in order that the cutting edges of the teeth may be properly disposed to cut the required width of tongue or groove, because, as before explained, the walls n^9 n^{10}, as well as the wall n^7 of the teeth, are inclined, and therefore the walls n^{10} on opposing cutters would be too wide apart to produce the same width of tongue or groove unless the cutters were adjusted bodily in the manner specified. The same principles of construction apply not only to cutters adapt-

ed to form tongues, but also to cutters adapted to form grooves, in the manner indicated in Fig. 11. It will be seen that each tooth of these cutters has an outer wall q of gradually-decreasing radius from advancing end to heel, and the wall q', inside the tang or that portion of the tooth which enters the groove and which is parallel with the wall q, is also of gradually-decreasing radius, while the wall q^2 on the inner side of the tang inclines rearwardly and inwardly (upwardly or downwardly, according to whether the tang is on the upper or lower cutter) from the front or advancing end of the tooth toward the heel. The wall q^3 of the tooth need not be inclined to give it clearance, nor need the wall q^4 be inclined, as this latter wall does not come in contact with the material. The wall q^3 need not be inclined, because, inasmuch as the teeth of the upper and lower cutters are made to overlap, the teeth on one cutter clear the way for one side of the tooth on the opposite cutter, and hence there is no necessity for making provision for clearance. This is illustrated in Fig. 11, where it will be seen that the teeth on the upper cutter are somewhat narrower than the groove produced; but the teeth on the opposing cutter overlap the horizontal plane between the teeth of the two cutters, so that the teeth on the lower cutter clear the way for the lower portion of the teeth on the upper cutter, as indicated at w in Fig. 11, so that there is no tendency to bind along the lower surface of the teeth of the upper cutter, and hence the lower sides of the teeth need not be specially shaped to give clearance. In like manner the teeth of the upper cutter clear the way for the upper surface q^3 of the lower cutter.

I have illustrated the manner in which my improvements may be applied to cutters adapted to cut plane tongues and grooves on boards; but the same principles of construction may be applied to cutters of different configuration adapted to form different configurations on boards or other material in order to give various shapes thereto. My improved cutters possess material advantages over those now generally in use. As before stated, the formation of the teeth integrally with the body portions of the cutters insures rigidity, so that the teeth cannot be moved or loosened when in operation. The cutters may be readily removed from the cutter-head and replaced by other similar cutters.

The interlocking feature by which the opposing cutters are connected insures that one series of cutters shall not move relatively to the others except toward and from each other, and the cutters are guided when being assembled, so as to assume the proper relative position. The flanges before referred to prevent clogging, and the particular formation given to the teeth provides for their efficient operation without binding or heating.

I claim as my invention—

1. A cutter-head comprising two members, one of which is provided with devices for securing one of the cutters in place, and the other of which is provided with independent devices for securing the other cutter in place, means for adjusting one member of the cutter-head toward and from the other, a circular cutter-disk arranged concentric with the axis of one member of the cutter-head formed integrally with a series of teeth on its periphery and directly secured to this member of the cutter-head, a similar circular cutter-disk arranged concentric with the axis of the other member of the cutter-head formed with a series of teeth on its periphery and connected directly to said other member of the cutter-head.

2. The combination of an expansible cutter-head and two opposing cutters, each comprising a disk formed integrally with a series of teeth on its periphery and each disk being arranged concentric with the axis of the cutter-head and movable toward and from each other coincidently with the movement of the two members of the cutter-head, said disks being also formed with projections which interlock, substantially as described.

3. The combination of a cutter-head member having a flanged screw-threaded portion, a circular cutter secured to such threaded portion, a second cutter-head member having a tapered flange, a circular cutter provided with a series of teeth on its periphery and having a tapered opening fitting the tapered flange, a clamping-collar for holding the cutter on the tapered flange, and means for adjusting the cutter-head members to move the cutters toward and from each other.

4. The combination of a cutter-head member consisting of a sleeve having a flanged end to receive a cutter, a second cutter-head member surrounding the sleeve of the first member and having a flanged end to receive another cutter, a screw-collar for clamping the cutter on the outer member of the cutter-head, a bolt extending through a threaded hole in the outer member of the cutter and through a slot in the sleeve of the inner member, a nut engaging a screw-threaded portion of the sleeve of the inner member of the cutter-head, and connections between the nut and the outer member of the cutter-head.

5. The combination of a pair of cutters provided with teeth on their peripheries which interlock and which are provided with flanges to guard or cover the openings otherwise left between the body portions of the cutters.

In testimony whereof I have hereunto subscribed my name.

JOEL ETTINGER.

Witnesses:
W. W. MOSS,
ARTHUR D. ANDERSON.