No. 825,925. PATENTED JULY 17, 1906.

J. MORAVEC.

WOOD GRINDER.

APPLICATION FILED JULY 6, 1901.

2 SHEETS—SHEET 1.

Fig. 2.

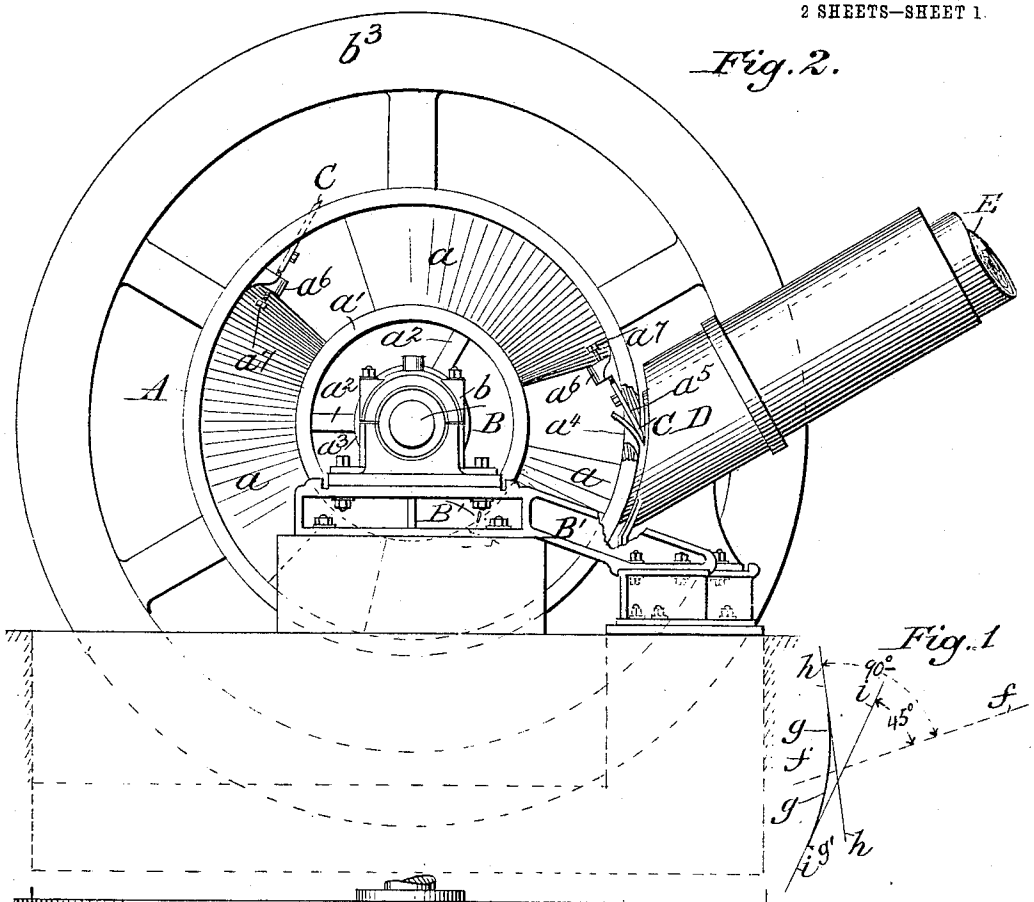
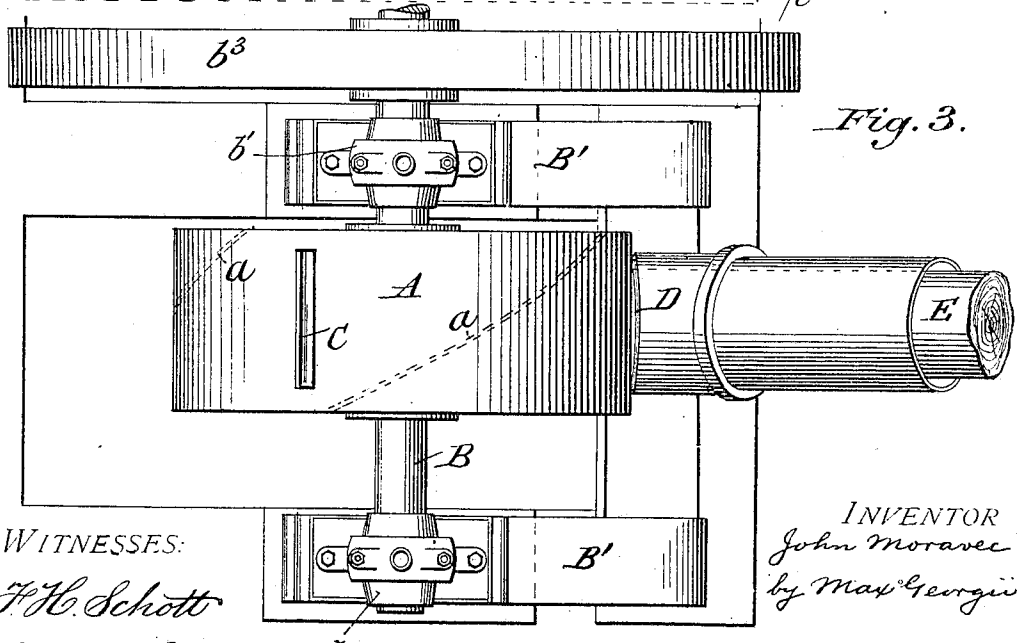


Fig. 1

Fig. 3.



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2 SHEETS—SHEET 2.

Fig. 4.

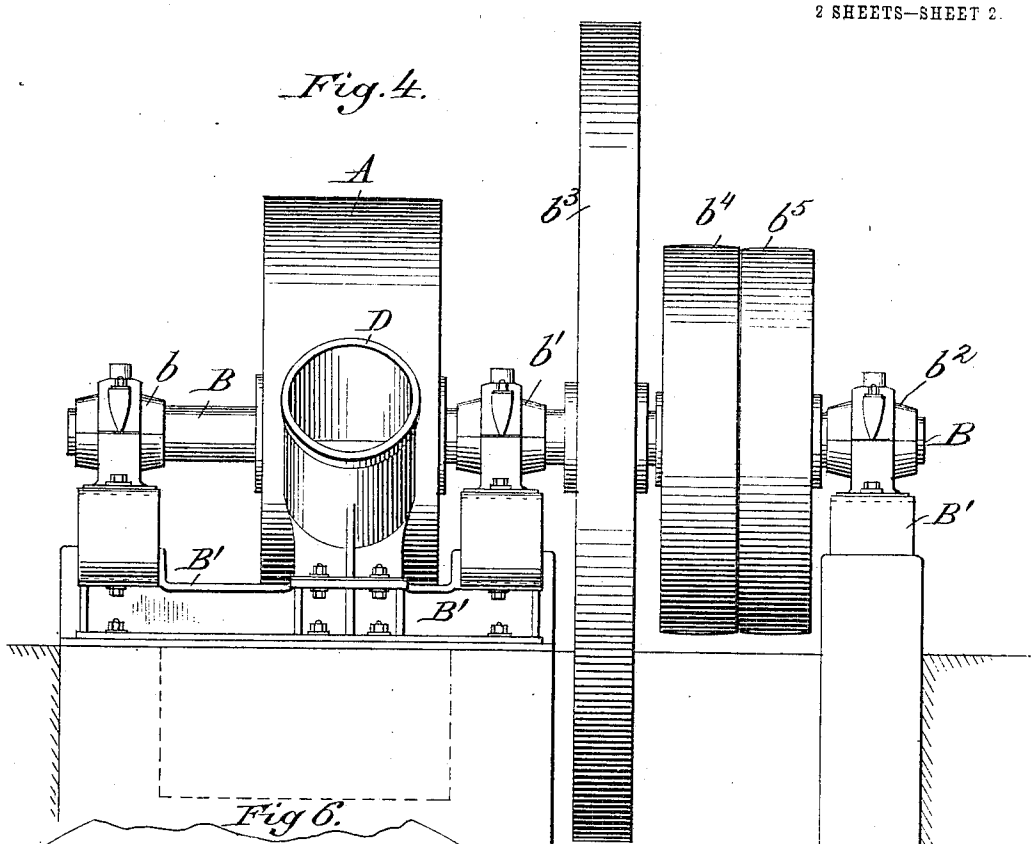


Fig 6.

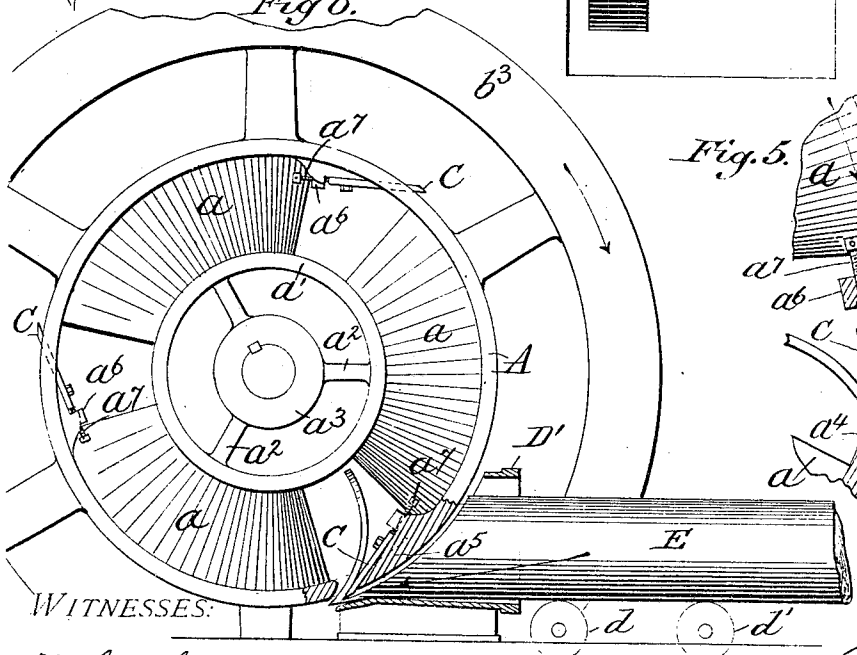
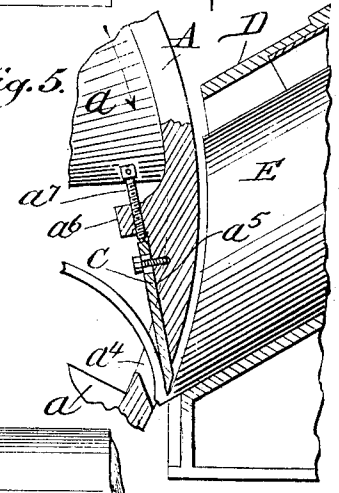


Fig. 5.



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JOHN MORAVEC, OF CHATHAM, CANADA.

WOOD-GRINDER.

No. 825,925. Specification of Letters Patent. Patented July 17, 1906.

Application filed July 6, 1901. Serial No. 67,329.

To all whom it may concern:

Be it known that I, JOHN MORAVEC, a citizen of Austria-Hungary, residing at Chatham, New Brunswick, Canada, have invented certain new and useful Improvements in Wood-Grinders; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in that class of machines known as "wood-grinders," and in particular to such a wood-grinder as is specially applicable in preparing wood to be used in making wood-pulp.

In the manufacture of wood-pulp it is important that the chips employed shall be as nearly uniform in thickness as is possible, and hence it has been customary heretofore to sort the chips as they were obtained from the wood-grinder in order that for the manufacture of a certain kind or amount of wood-pulp only a uniform size of chips would be employed. Such sorting of the chips has made clear the fact that by the use of the machines hitherto known there is a great lack of uniformity in the sizes of the chips cut from the logs, notwithstanding the adjustment of the knives or feeding devices of said machines to cut a uniform size of chip. At the same time the said sorting of the chips has also shown that an important proportion of the chips from such machine are of a size too small to be used satisfactorily in the manufacture of wood-pulp, thus entailing either a loss due to discarding said small chips or the production of a very inferior wood-pulp when said small chips are used. This lack of uniformity in the product of the wood-grinders hitherto employed has been found to increase with an increase in the speed of operation of such machines, and therefore it has been found to be absolutely necessary to operate said machines at speeds far below those at which they might be driven if uniformity in the product were unessential, and even at the said slower speeds the want of uniformity in the product has been appreciable and has entailed much care in the sorting operation. Many attempts have been made heretofore to avoid this difficulty. For example, various forms of mechanical devices have been employed to feed the log to the cutter, and also machines have been employed in which the force of gravity has been employed for this purpose.

The former class of machines—viz., those employing mechanical feeding devices—have not worked satisfactorily except at speeds too slow to be commercially useful, owing to the lost motion in the various parts whereby, although the log might be fed the proper distance to the cutter, it would be driven back by the cutter during the progress of the knife through the log, this backward movement being permitted by the lost motion of the feeding mechanism, thereby resulting in the production of chips of a tapering thickness; also, when such machines were driven at a commercially satisfactory speed the feeding mechanism would be unable to feed the log uniformly, owing to the inertia of the log and the slipping of the feed-rolls or equivalent devices on the log as a consequence of said inertia. Furthermore, since the inertia of the log varies with the shortening of the log as it is cut away by the cutters the amount of resiliency in the various parts of the feeding mechanism would also vary, and for this reason a lack of uniformity in the feed would result.

In that class of machines depending upon the force of gravity to feed the machine the weight of the log, or a certain proportion thereof, depending upon the angle of the log-chute, is carried by the disk, thus acting as a brake and causing an excessive amount of friction. If it is attempted to reduce this friction by reducing the angle of the log-chute, then it is found that the inertia of the log and the friction between it and the chute cause a delay in the sliding forward of the log after each cut, which delay varies according to the variation in weight of the log, due to its being cut away by the cutters. Owing to this delay and the variations of the same, it is impossible to operate a gravity-feed grinder at a commercially-practicable speed without obtaining a product deficient in uniformity. Indeed, if such a machine be driven with considerable speed the cutters will follow each other so rapidly that the log has no time to slide forward after one cutter has left it and before the other has come under it, and as a consequence the end of the log is beaten by one cutter after the other, and thereby is held away from contact with the disk unless the angle of the log-chute be very great, in

which event substantially the whole weight of the log rests on the rotating disk, and thus results in an enormous amount of friction, requiring the employment of an excessive amount of power.

The object of my invention is to overcome these disadvantages by providing a machine in which the logs may be advanced to the machine to a uniform extent after the passage of each cutter and before the arrival of the following cutter with such rapidity as to allow of a high speed of operation, while at the same time the power required to operate the machine is reduced to a minimum.

With these general objects in view a wood-grinder embodying my invention comprises a rotary cylinder having peripheral knives in combination with means for supporting the log loosely in such a relation to the rotary cylinder that the knives will cut such a curve in the end of the log that the tangent of the first part of the curve will make an angle with the axis of the log less than ninety degrees, while the tangent to substantially the last part of said curve will make an angle with the said axis of the log not greater than forty-five degrees, and at the same time the axis of the log will not make an angle with the horizontal greater than the maximum angle of friction between the log and its holder. As a result of these features the following advantages are obtained, viz: Owing to the fact that the axis of the log does not make an angle with the horizontal greater than the angle of friction between the log and its holder, the log will not be able to slide down by gravity against the rotary cylinder, and hence there will be no pressure of the log on the periphery of the rotary cylinder from the effect of gravity, whereby no power will be wasted in overcoming the friction due to such pressure. By supporting the log so that the tangent of the first part of the curve cut upon its end is less than ninety degrees there is no tendency on the part of the knife to drive the log away from the rotary cylinder; but, on the contrary, there is a tendency to draw the log toward the rotary cylinder, which tendency is greater the smaller the said angle. As the tangent of the last part of the curve cut on the end of said log makes an angle not greater than forty-five degrees with the axis of the log, there is produced by the knife a large component force acting to pull the log toward the rotary cylinder. Owing to these relations of the tangents of the initial and final parts of said curve, it follows that there can be no part of the curve intermediate its two ends having a tangent making an angle with the axis of the log greater than that of the tangent of the initial part of the curve, and hence there can be no tendency of the knife at any part of its passage through the log to force the log away from the rotary cylinder; but, on the contrary, there is always a tendency to draw the log toward the said cylinder, which tendency increases from the time the knife first enters the log up to the moment when it leaves the log, at which moment this tendency is a maximum.

In a machine embodying my invention it is important that the outer face of the knives shall not slope outward beyond the tangents to the respective radii of their orbit which pass through the cutting edges of said knives. Just forward of each knife is provided a throat or opening in the periphery of the rotary cylinder which has two functions, the first of which is to permit the shaving to pass into the interior of the cylinder and the second of which is as follows: The tendency of a knife to draw the log toward the rotary cylinder is counteracted during nearly the whole time that the knife is passing through the log, owing to the fact that the end of the log is resting against the periphery of the rotary cylinder, and hence no movement of the log can result; but when the knife has nearly passed through the log and when the portion of the chip remaining uncut is less in width than the throat or opening beneath the knife the draft on the log by the knife will cause the log to be dragged forward, the knife at that moment cutting deeper into the log, while the chip is cut loose and falls into the interior of the rotary cylinder, which is provided with means for removing the chips. In this way the log is jerked forward into close contact with the periphery of the rotary cylinder, but without exerting any pressure upon said periphery until it is struck by the next knife.

A machine embodying my invention comprises also a supporting device for the log, in which the friction between the log and the said supporting device is substantially neutralized or counteracted. This may be done, for example, by the use of suitable antifriction devices whereby the friction is reduced to a minimum or, for example, by putting the supporting device at such an angle as to cause a tendency of the log to slide forward, which tendency is approximately equal to the friction resistance of the log. The purpose of thus neutralizing said friction is to reduce the amount of draft which is required to overcome the resistance of the log to forward movement—that is to say, to permit the log to be moved forward readily by the minimum amount of force.

It is to be noted that the more nearly the means for neutralizing friction approach to perfection in function the closer may be the approach of the initial and final tangents of the curve on the end of the log to the limits fixed by me, as explained hereinbefore—viz., slightly less than ninety degrees for the initial tangent and forty-five degrees for the final tangent—that is to say, if more draft

is required when the knife first enters the log in order to hold the log firmly to the periphery of the disk the initial tangent must be considerably less than ninety degrees, and if a maximum amount of draft is required to draw the log forward just as the chip is being cut loose the final tangent may make an angle much smaller than forty-five degrees with the axis of the log.

My invention will now be more specifically described in connection with the accompanying drawings, and then particularly pointed out in the claims.

In the drawings, Figure 1 is a diagrammatic view illustrating some of the principles involved in my invention; Fig. 2, a side elevation of a machine embodying my invention; Fig. 3, a plan view of the same; Fig. 4, a front view of the same; Fig. 5, a detail view, partly in section, of a part of the said machine; and Fig. 6, a side elevation, partly in section, of another embodiment of my invention.

Referring to the drawings, and in particular to Figs. 2 to 5, inclusive, A is a hollow rotary cylinder provided inside with a plurality of inclined vanes or webs, (in the present case three,) which are indicated at a and serve as means for removing the chips from the machine, as will be explained hereinafter, and also act as spokes to support the rotary cylinder, said webs or vanes radiating from a central wheel a', which has spokes a^2 and a hub a^3, the latter being fixed on a shaft B, journaled in boxes b b', carried by the framework B′ of the machine and in an outboard-bearing b^2, mounted on a pillow-block B′. The shaft is provided with a fly-wheel b^3 and with the usual fast and loose pulleys b^4 b^5, respectively.

The rotary cylinder is provided with a plurality of throats or openings a^4, located opposite the spaces between the webs or vanes a, the forward walls of these openings being beveled outward, as shown in Figs. 2 to 5, while the rear walls are sloped inward, the slopes being in the same planes with the sloping surfaces of inward-extending projections a^5, which have lugs a^6, through which pass set-screws a^7. The inclined surfaces of the said rear walls of the throats and of the said projections a^5 serve as bearing-surfaces upon which are secured cutting-knives C, whose cutting edges extend through the throats and a slight distance beyond the periphery of the rotary cylinder. The knives are provided with slots through which extend set-screws threaded into the rotary cylinder, whereby the knives are held firmly in place. The rear ends of the knives abut against the ends of the respective set-screws a^7.

To the front of the framework of the machine is screwed a device for supporting the log, which in the present case consists of a log tube or chute D, whose front end adjacent to the rotary cylinder is curved concentric with the rotary cylinder and is separated therefrom by a slight space sufficient to permit the free passage of the knives when adjusted for making the maximum cut for which the machine is adapted.

It is to be noted that Figs. 2 to 5, inclusive, show a machine provided with its log-chute arranged at an angle to the horizontal.

Referring to Fig. 6, the construction there shown differs from that illustrated in Figs. 2 to 5, inclusive, only in having its log-chute D′ arranged substantially horizontal and provided with antifriction devices d d', arranged to support the log in such a manner that the friction will be reduced to a minimum.

In the construction shown in Figs. 2 to 5 the inclination of the log-chute takes the place of the antifriction devices d d' of Fig. 6, since said inclination of the log-chute causes a tendency of the log to slide forward, which tendency is overcome by the friction between the log and its chute, it being understood that the angle of inclination of the chute is less than the angle of friction, so that no movement of the log toward the rotary cylinder can be caused by gravity.

The operation of the machine described is as follows: The rotary cylinder being rotated by suitable power, the log to be operated upon (indicated at E) is placed in the chute and pushed up until it is struck by the first knife, whereupon no further attention to the machine will be required until it is necessary to supply it with another log. The knives cut the shavings from the ends of the logs and at the completion of each cut jerk the log forward until it strikes and is stopped by the periphery of the rotary cylinder, whereby the log is brought into position to be acted upon by the following knife. The end of the log is cut to a curve concentric with the rotary cylinder and having the relations with regard to the axis of the log which have previously been referred to and which will be more fully explained hereinafter. The shavings pass through the respective throats of the rotary cylinder and enter the interior of the said cylinder, where they are struck by the vanes or webs and thrown out of the machine, as shown by the dotted lines in Fig. 4, from which they may be removed in any suitable way.

Referring now to Fig. 1, the axis of the log is indicated by the line f, while the curve cut on the end of the log by the knives of the machine is indicated at g. The tangent of the initial part of the curve g is indicated at h, and it will be seen that this tangent h makes an angle with the axial line f slightly less than ninety degrees. The tangent of that part of the curve on which the knife acts just before cutting the shaving loose is indicated at i and is shown as making an angle of forty-

five degrees with the axial line *f*. The limits to these angles are indicated by the numerals marked on the figure. The maximum limit for the angle between the initial tangent *h* and the axis *f* is just less than ninety degrees, (indicated by "90°−,") and may be anything smaller than this limit, according to the pressure which it is desired shall be exerted to hold the log to the rotary cylinder, it being obvious that the smaller the angle the greater will be the component forces tending to drag the log toward the cylinder. The maximum limit for the angle between the final tangent *i* and the axis *f* is forty-five degrees, and the angle may be as much less than this as is necessary, even down to zero, according to the amount of force required to jerk the log forward into contact with the periphery of the rotary cylinder as the knife removes the chip.

In the machine shown in Fig. 6 the angle between the final tangent *i* and the axis *f* is very slight and approaches closely to zero. It is to be noted that the line *g*, which indicates the curve cut upon the end of the log by the knife, terminates in a very small curve *g'*, which represents the part of the knife when it runs deeper into the log as it drags the same forward and cuts off the chip just as the throat below the knife comes opposite the lower edge of the log.

Fig. 5 shows the knife at this moment—that is to say, just as it is commencing to drag the log forward and just before it has cut off the chip. It will also be noted from Fig. 5 that the knife has its outer edge so sloped that it will not extend outside the tangent through the cutting edge of the knife. If it did extend outside the tangent, it would tend to act as a wedge, and thus force the log away from the rotary cylinder, which is a construction to be avoided.

It is to be noted that in a wood-cylinder embodying my invention the axis of a log is never in a straight line with any radius of the orbit of the knives; but, on the contrary, the log is so supported by its supporting device that its end intersects the orbit of the knives at a point below the termination of that radius of the orbit which is parallel to the axis of the log. Of course it is to be understood that I allude to the radius of that part of the orbit which is adjacent to the end of the log and not to the corresponding radius on the opposite side of the orbit from the end of the log.

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

1. In a wood-grinder, the combination with a rotary cutter provided with chip-ejecting means and having knives disposed substantially parallel with the axis of the cutter and of a length commensurate with the width of stock to be cut, of a stock-support disposed at such angle relatively to the traverse of the knives that as the latter complete their cut they will exert a forward or feeding movement to the stock.

2. In a wood-grinder, the combination with a rotary cutter provided with chip-ejecting means, and having knives disposed substantially parallel with the axis thereof and of a length commensurate with the length of the stock to be cut, of a stock-support disposed obliquely with reference to the traverse of the knives and operating to exert sufficient retarding action on the stock to prevent its forward movement by gravity during the operation of cutting, but which will assist in overcoming the frictional contact between the support and the stock to permit the latter to be fed forward automatically by the completion of a cut.

3. In a wood-grinder, a rotary cutter having peripheral knives disposed approximately parallel with the axis thereof, and vanes or webs disposed obliquely to the said axis and operating to remove the severed chips from the apparatus.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN MORAVEC.

Witnesses:
R. A. MUELVEH,
DAVID SADLER.