

1,189,557.

3 SHEETS—SHEET 1.

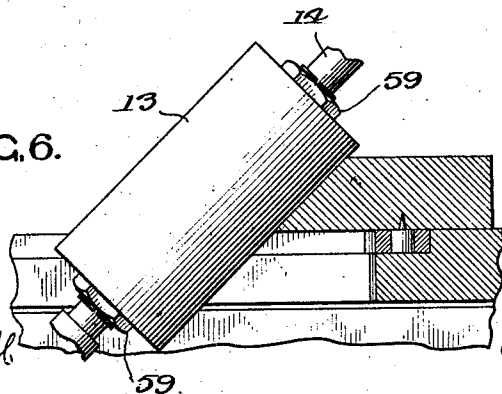
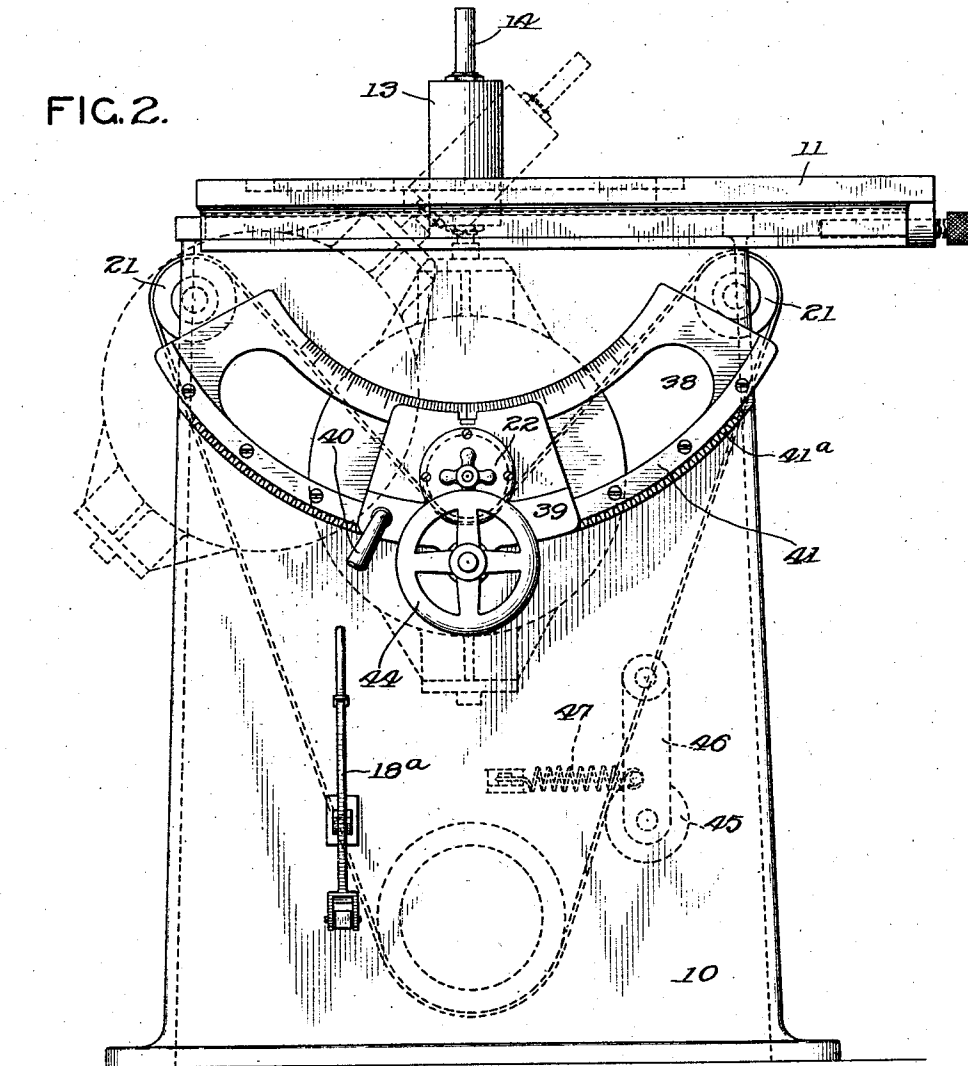
FIG. 1.

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APPLICATION FILED NOV. 23, 1912.

Patented July 4, 1916.
3 SHEETS—SHEET 2.



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A. M. GARDNER, EXECUTRIX OF F. N. GARDNER, DEC'D.
GRINDING MACHINE.
APPLICATION FILED NOV. 23, 1912.

1,189,557.

Patented July 4, 1916.

3 SHEETS—SHEET 3.

FIG. 3.

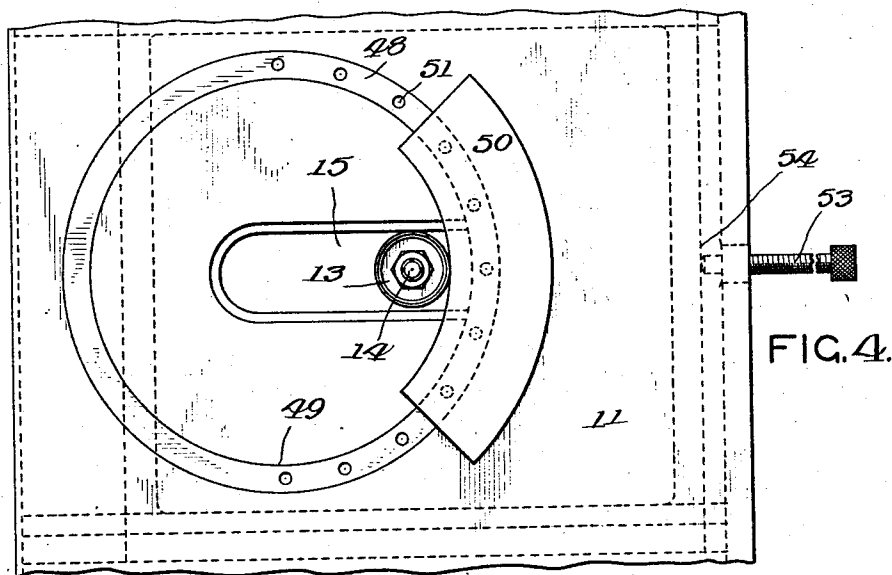
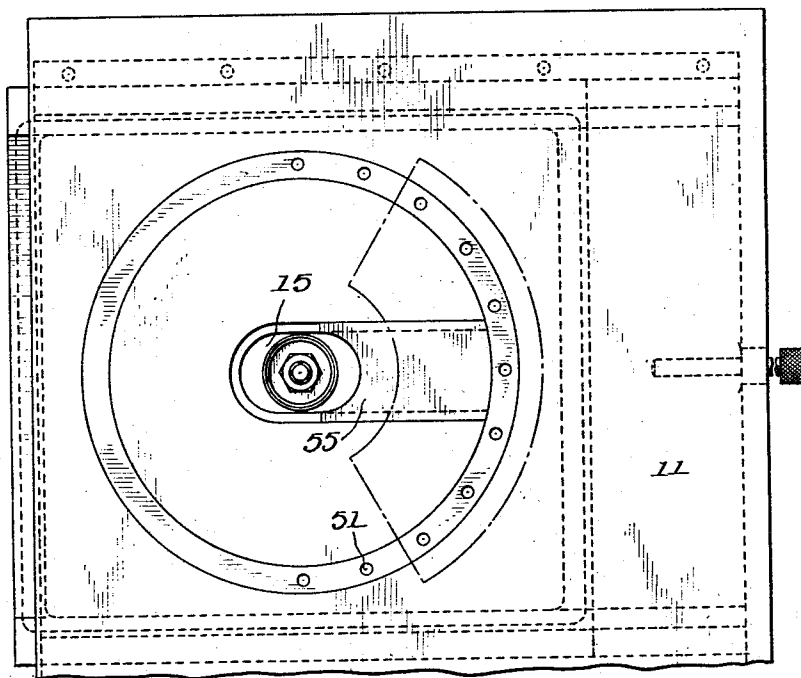


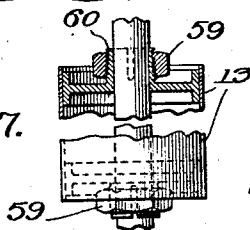
FIG. 4.

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FIG. 7.



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UNITED STATES PATENT OFFICE.

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GRINDING-MACHINE.

1,189,557.

Specification of Letters Patent.

Patented July 4, 1916.

Application filed November 23, 1912. Serial No. 733,026.

To all whom it may concern:

Be it known that we, FREDERICK N. GARDNER and FREDERIC E. GARDNER, citizens of the United States, residing at Beloit, in the county of Rock and State of Wisconsin, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

This invention relates to machines used for grinding purposes, and more particularly that class of machines which has for its object the grinding of material by means of a roll or cylinder mounted on a rotating spindle and faced with sandpaper, emery cloth, or other grinding surfaces, the machine being especially adapted for use in making wood patterns.

The invention has for its object the production of such a machine so constructed and with suitable attachments so arranged that curved surfaces which are either like or unlike the surface of the grinding cylinder may be conveniently, quickly and accurately ground.

It has for a further object such construction as allows the grinding cylinder to be inclined from the vertical toward the horizontal to an extent of at least 45° in opposite directions so that surfaces not perpendicular with the plane of the object being ground may be suitably operated upon. In previous grinding machines employing a vertical roll, the work-table has been tiltable, but this arrangement has the disadvantage that the operator is obliged, when the table is tilted, to support and move the work upon an inclined surface. By tilting the roll, instead of the table, the operator always has a horizontal surface on which to move the work.

Other objects of the invention will be apparent after the mechanism of the machine used to illustrate the invention is understood by consideration of the following description.

In the accompanying drawings, Figure 1 is a side view of the machine. Fig. 2 is a front view of the machine. Fig. 3 is a plan view of the work support and grinding cylinder of the machine in which the parts occupy one relation to each other, and Fig. 4 is a similar view showing parts in another relation to each other. Fig. 5 is a vertical section of a portion of the work support and

of the work, with the grinding cylinder adjusted vertically. Fig. 6 is a view similar to Fig. 5 with the grinding cylinder adjusted at an angle approximately of 45°. Fig. 7 illustrates a means for securing the cylinder to the spindle.

In general, the machine comprises a slidable support upon which the work to be operated upon is placed, above which projects the grinding rotary cylinder. Means are provided for tilting the cylinder at any angle up to 45°, or more, with the vertical, and in opposite directions, without in any way interfering with the mechanism for rotating the cylinder. Special means are provided for guiding the work as it rests upon the supporting surface so that its movement with relation to the grinding surface corresponds to the curved surface to be ground. And finally, in order to vary the grinding surface so as to produce a smooth surface on the work, and also to prevent the dust and particles from clogging the grinding surface, means are provided for oscillating the grinding cylinder spindle, and hence the cylinder itself, longitudinally as the spindle rotates. The manner in which these various operations are carried out will now be described in detail.

The machine comprises a frame upon which is mounted a work support. The support is slidably mounted on the frame by means of guides. A grinding roll or cylinder 13, which is mounted on the spindle 14, projects through the opening in the work support, and extends upwardly above the support so far as may be necessary to properly perform its function in grinding work that may be placed on the support.

Mechanism provided for suitably rotating the cylinder comprises a shaft mounted in bearings in the frame, carrying loose and tight pulleys 17 and 18 for receiving the driving belt, a lever 18^a, with suitable connecting means, being provided for shifting the belt from one pulley to another. Also, fixed on the shaft is a machine-driving pulley 19 adapted to carry a driving belt which passes over two idle pulleys 21, journaled in the frame of the machine, and a spindle-driving pulley 22. This pulley 22 is fixed to a shaft 23 mounted in bearings in a tubular arm or stem 24 projecting from one side of a casing 25. At the other side of the

casing 25 is a similar arm or stem 24^a. The cylinder spindle 14 is mounted in bearings 26 in the casing 25. Fixed to the shaft 23 is a friction disk 27, and mounted on the spindle 14 is a friction disk 28 which is constantly in contact with disk 27 and is caused to rotate thereby when the machine is in operation. The pressure between the two disks may be governed by means of a set screw 29 acting against the end 30 of the shaft 23.

A consideration of the mechanism will show that when the driving shaft 16 is operated the pulley 22 will be rotated, causing the disks 27 and 28 to rotate and thus also the grinding cylinder 13.

In order to vary the speed of rotation of the grinding cylinder means are provided for shifting the friction disk 28 with reference to the disk 27. These means comprise a screw shaft 31 threaded into the member 32 which is mounted in the casing 25 slidably parallel with the spindle 14 and with which the disk 28 is non-rotatably connected, the disk 28 being slidably, but non-rotatably connected with the spindle 14.

It will be seen that when the screw shaft 31 is rotated the block 32 will be moved longitudinally with reference to the spindle 14 and will thus shift the disk 28 nearer to or farther from the center of the disk 27 and thus vary the speed of rotation of the spindle 14 and the grinding cylinder 13. The screw 31 may be rotated in any suitable manner. Herein, for the purpose, we have provided bevel gears 33, one of which is fixed to the shaft 31, and the other of which is fixed to a shaft 34 journaled in bearings 35 fixed to the casing 25. A hand wheel 37 is fixed to the shaft 34 so that the shaft 34 may be manually rotated.

In order to suitably incline the grinding cylinder when desired, we have provided in each side of the frame 10 of the machine an arcuate slot 38, the center of which lies approximate to or in the surface of the support 11. The arms 24 and 24^a projecting from the casing 25 pass through these slots. Fixed to the arm 24^a is a member 39 external to the frame of the machine. A clamp operated by the handle 40 is adapted to clamp in an ordinary manner the member 39 rigidly to the frame 10. Parallel with the slot 38 is an arcuate guide bar 41 fixed to the frame of the machine. The member 39 is slidably mounted on said guide bar. Rack teeth 41^a are formed in said guide bar, and meshing with these rack teeth is a pinion 42 fixed to a shaft 43 which is journaled in the member 39 and which may be rotated by means of the hand wheel 44.

It will be seen that, by rotating the handle 44, the pinion 42 will be rotated, and, as it meshes in the rack teeth 41^a, will carry the member 39 and with it the casing 25 to any desired position, whether vertical or in-

clined. The casing may then be clamped firmly in the desired position by means of the handle 40.

The arm 24 is attached to a member 39^a which is slidably mounted on an arcuate guide bar 41^b. On the member 39^a is a bracket 39^b in which the adjusting screw 29 is carried.

A consideration of the belt system hereinabove described will show that with the pulleys 21 placed symmetrical with reference to the center of the arc 38 the pulley 22 is free to move along an arc concentric with the slot 38, and will be operated by the belt in any position in which it may thus be located. In order, however, to maintain constant the belt pressure there may be provided a pulley 45 which is journaled in an arm 46, pivoted to the frame of the machine, and which is yieldingly held against the belt by means of the spring 47. By these means, when the pulley 22 is shifted toward either end of the arc the pressure of the belt will be maintained as great as when in the central position indicated in Fig. 2.

A consideration of the mechanism will show that tilting of the grinding cylinder or roll and its spindle in the manner specified will in no way interfere with the operating mechanism of the spindle, or with the means for varying the speed of the spindle. So that the cylinder may be operated in the vertical position shown in Fig. 5, or may be inclined to the position shown in Fig. 6 in either direction from the vertical, and may be operated at any angle between the limits indicated.

In the use of grinding machines it has ordinarily been the practice to grind arcs, circles, and other curves, by first laying out the curve and then grinding to the line, or by using grinding cylinders with a radius equal to the radius of the curve to be ground. Curves ground by the latter method require necessarily a different grinding cylinder for every different radius which is to be ground. And curves ground by the former method not only require more time, both in laying out the work and in grinding to the lines drawn, but also necessarily the resulting curve is more or less inaccurate, depending upon the skill of the operator. To avoid these and other disadvantages we have provided special means to assist in grinding curves, particularly arcs and circles which have a radius unlike the radius of the grinding cylinder.

In the surface of the work support 11 a guide ring 48 is rotatably set in a circular groove 49. The work 50 to be operated on is attached to this ring, and any suitable means may be provided therefor. Herein we have provided holes 51 in which may be set sharpened pins 52. By pressing the work 50 to be ground onto the points of these pins

the work is non-slidably held in reference to the ring 48. Evidently, as the work support 11 is slidable with reference to the cylinder 13, the center of the ring 48 may be readily shifted with reference to the cylinder. And, by attaching the work to be ground to the ring 48 so that the surface to be formed is concentric with the ring and then sliding the support so as to bring the surface in contact with the cylinder, rotation of the work guided by means of the ring will cause the surface to be formed to be ground true by the cylinder, because the surface will at all times be in contact with and tangent to the grinding surface. Hence, in order to produce a true arc or circular surface, it is necessary only to form the surface roughly by means of a band saw or otherwise, to attach the work to the ring 48 so that the arc to be formed will be concentric to the center of the ring, to shove the work support until the surface to be ground comes in contact with the grinding surface and then to revolve the work around the ring center until the surface is completely ground. And it is evident that external parts as well as internal parts may be ground by the method already indicated.

The set screw 53 acts as a limiting stop to the movement of the work-table 11, so that when the surface is sufficiently ground the set screw will come in contact with the frame edge 54 and further movement of the work support 11 will be prevented. In order to use the device in grinding small pieces, a removable block 55 may be provided to fill the greater portion of the slot 15 so as to prevent the work from dropping into the slot.

Any suitable means may be provided for oscillating longitudinally the grinding cylinder as it rotates to prevent the grains of abrasive material from cutting grooves in the work. Herein we have provided a preferred means which comprises a collar 55 fixed to the spindle 14 and having thereon an inclined annular flange 56. Fingers 57 pivoted to the casing 25 project one above and the other below the flange 56. Evidently if these fingers are rigidly fixed to the casing, as the spindle 14 rotates it will be oscillated longitudinally by means of the inclined flange 56.

As it is necessary to rotate the spindle 14 with enormous speed, sometimes as high as twenty thousand rotations per minute, it has been found best to have the fingers yieldingly held in position, so that they may give more or less as the spindle rotates and thus prevent undue wearing and jarring of the mechanism. For this reason we not only pivot the fingers to the casing but also employ the springs 58 to hold them yieldingly in position against the surfaces of the flange, and thus, as the spindle rotates, the fingers

give so much as may be necessary to cause proper operation of the mechanism at the high speed required.

Preferably, the roll 13 is adjustable along the spindle, in order that the entire surface of the roll may be brought into use; and for the same purpose the roll may be removed from spindle, turned end for end, and replaced. The roll is secured in position by means of tapered nuts 59 turned upon the tapered hubs 60 of the roll, said hubs being slotted so that they may be clamped on the spindle by said nuts. In practice, rolls of various diameters may be provided and used upon the spindle 14.

Although we have described with some particularity the various details of the machine used to illustrate our invention, yet, it is evident that modifications therein may be made by those skilled in the art without departing from the scope of the following claims.

We claim as our invention:

1. In a grinding machine, a normally vertical grinding cylinder, manual means for inclining the axis of said cylinder, and means for rotating said cylinder, said inclining means comprising a casing, the spindle of said cylinder being journaled in said casing, a shaft connected to said casing, an arcuate rack fixed to the frame of said machine, a gear wheel fixed to said shaft and meshing with said rack, and means for operating said shaft.

2. In a grinding machine, a normally vertical grinding cylinder, means for inclining the axis of said cylinder, and manual means for rotating said cylinder, said inclining means comprising a casing, the spindle of said cylinder being journaled in said casing, a shaft connected to said casing, an arcuate rack fixed to the frame of said machine, a gear wheel fixed to said shaft and meshing with said rack, means for operating said shaft, and means for clamping said casing in its adjusted position.

3. In a grinding machine, a rotary grinding element, means for inclining said cylinder, and means for rotating said element, said rotating means comprising a driving shaft journaled in the frame of said machine, a drive pulley fixed to said shaft, two idle pulleys rotatably mounted in said frame and symmetrically placed with reference to said element, a fourth pulley operatively connected with the spindle of said element and positioned within the triangular space formed by said other pulleys, a belt-tightening pulley yieldingly fixed to the frame of said machine, and a belt running on all of said pulleys.

4. In a grinding machine, a grinding element, means for tilting said element, and means for rotating said element, said rotating means comprising a driving pulley and

two idle pulleys rotatably mounted in the frame of said machine, a casing tiltably mounted in the frame of said machine, the spindle of said element being journaled in said casing, a shaft journaled in said casing, a disk fixed to one end of said shaft, a disk fixed to said spindle and frictionally in contact with said other disk, a pulley on the other end of said shaft, and a belt adapted to run on all of said pulleys.

5. In a grinding machine, a rotary spindle, and means for reciprocating the spindle, said means comprising a collar on said spindle, an annular flange on said collar, the axis of said flange being inclined to the axis of said spindle, and a finger projecting on each side of said flange and connected to the frame of said machine.

6. In a grinding machine, a rotary spindle, and means for reciprocating the spindle, said means comprising a collar on said spindle, an inclined annular flange on said collar, and a finger projecting on each side of said flange and pivoted to the frame of said machine, and yielding means normally holding said finger in contact with said flange.

7. In a grinding machine, a casing, a grinding-cylinder spindle rotatably journaled in said casing, an annular flange fixed to and concentric with said spindle, the axis of said flange being inclined to the axis of said spindle, a yielding member connected with said casing and projecting above said flange, and a yielding member connected with said casing and projecting below said flange.

8. In a grinding machine, means for grinding inclined curved surfaces, comprising a horizontal support, a rotary grinding cylinder projecting above said support, means for inclining said cylinder, and means on said support for confining the movement of work to be ground to a complete circle concentric with the surface to be formed.

In testimony whereof we affix our signatures in the presence of two witnesses.

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FREDERIC E. GARDNER.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."