Nov. 18, 1924.

J. KELLER

1,516,103

GRINDING MACHINE

Filed Sept. 2, 1922

4 Sheets-Sheet 1

Fig. 1.

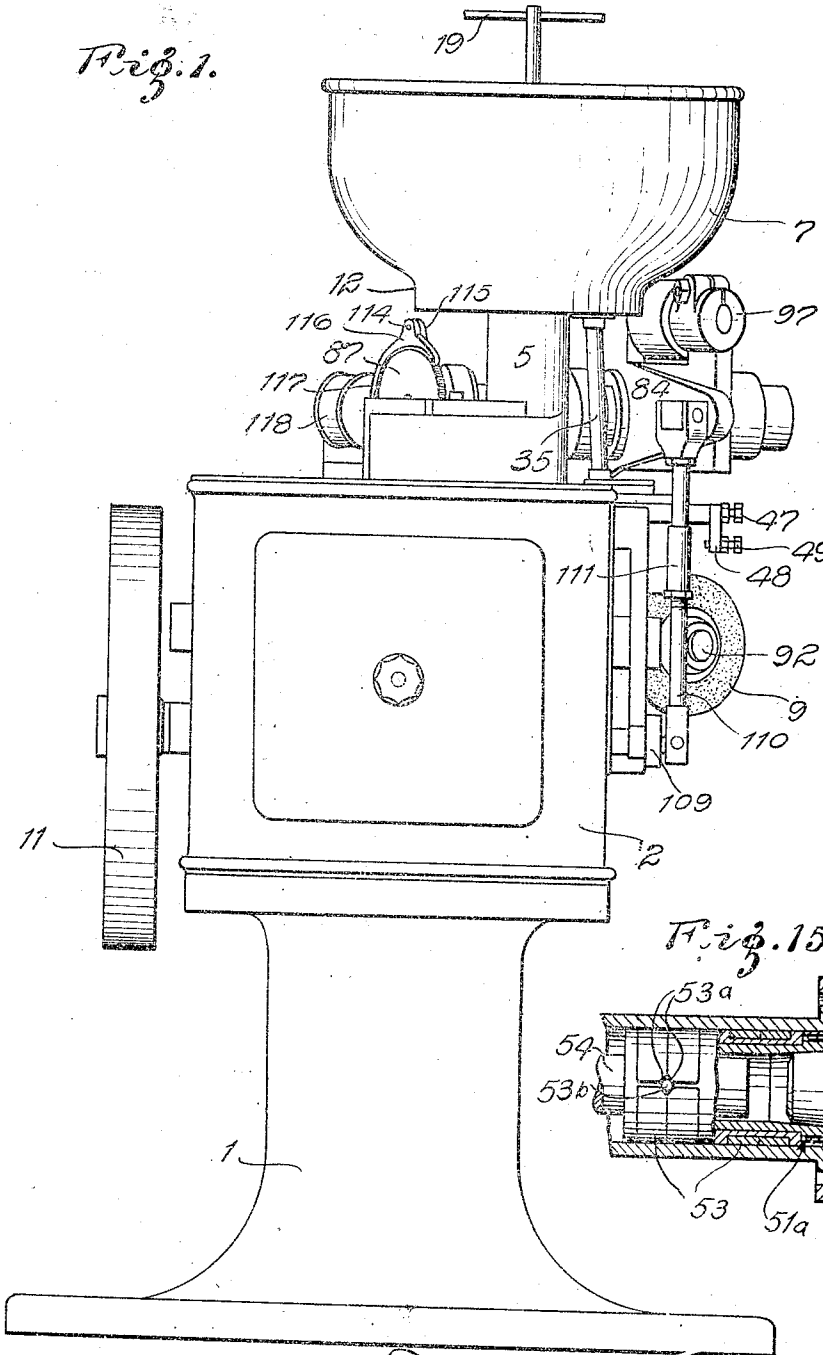


Fig. 15.

Inventor.

by

his Attorneys.

Nov. 18, 1924. 1,516,103

J. KELLER

GRINDING MACHINE

Filed Sept. 2, 1922 4 Sheets-Sheet 2

Fig. 2.

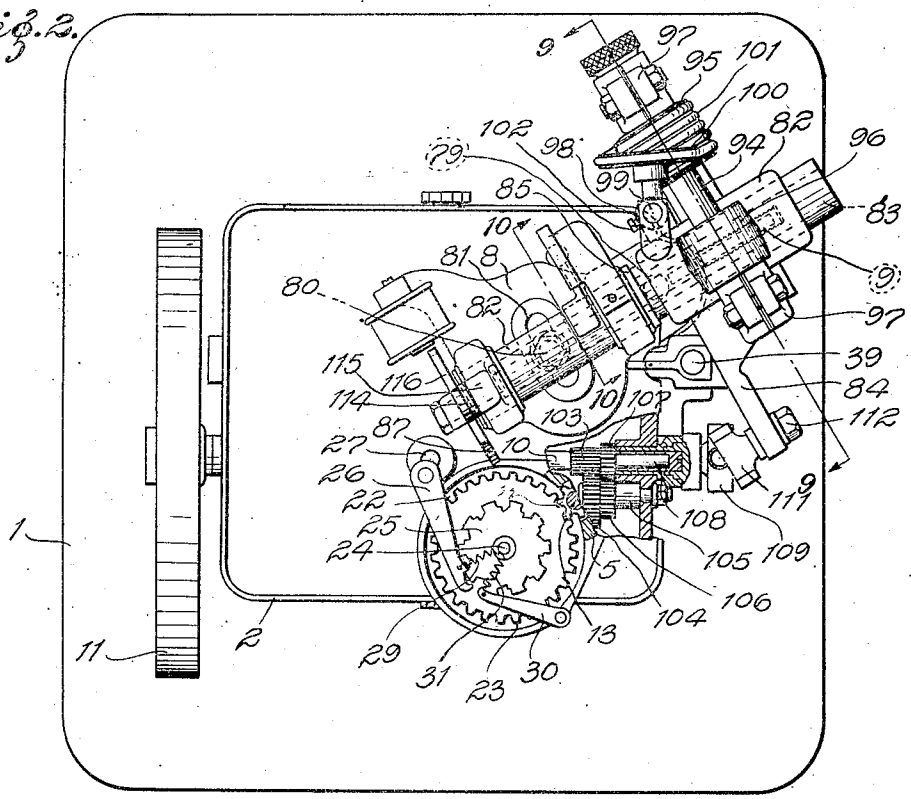


Fig. 8.

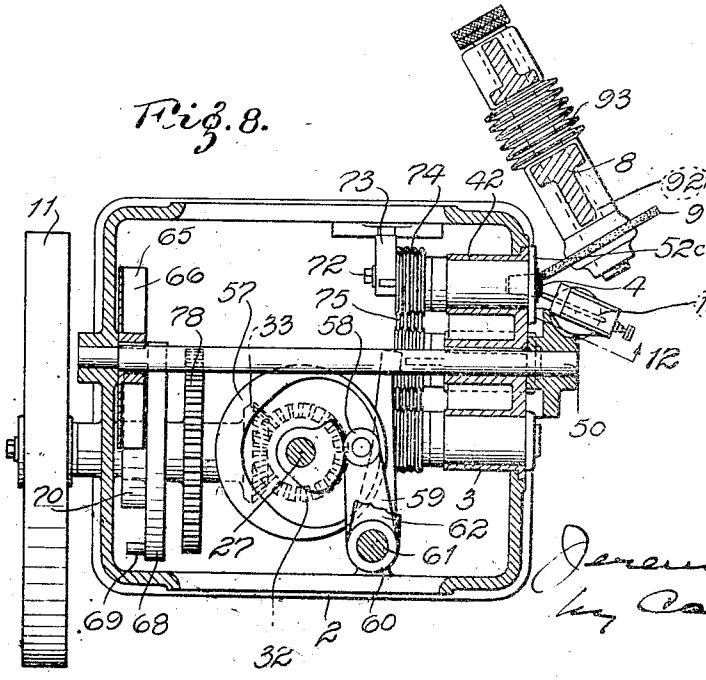
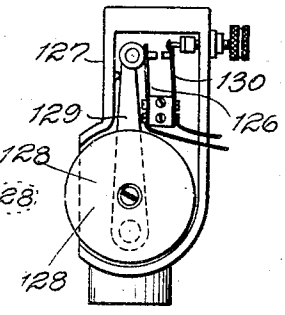


Fig. 12.



Inventor:
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Nov. 18, 1924. 1,516,103

J. KELLER

GRINDING MACHINE

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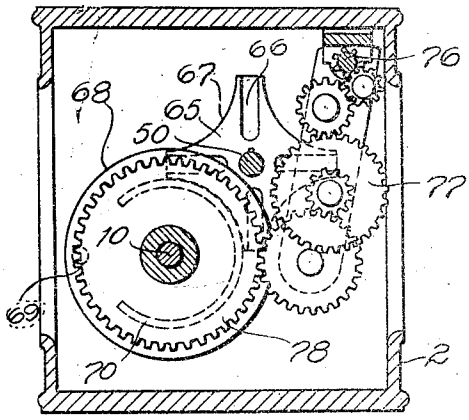


Fig. 4.

Fig. 3.

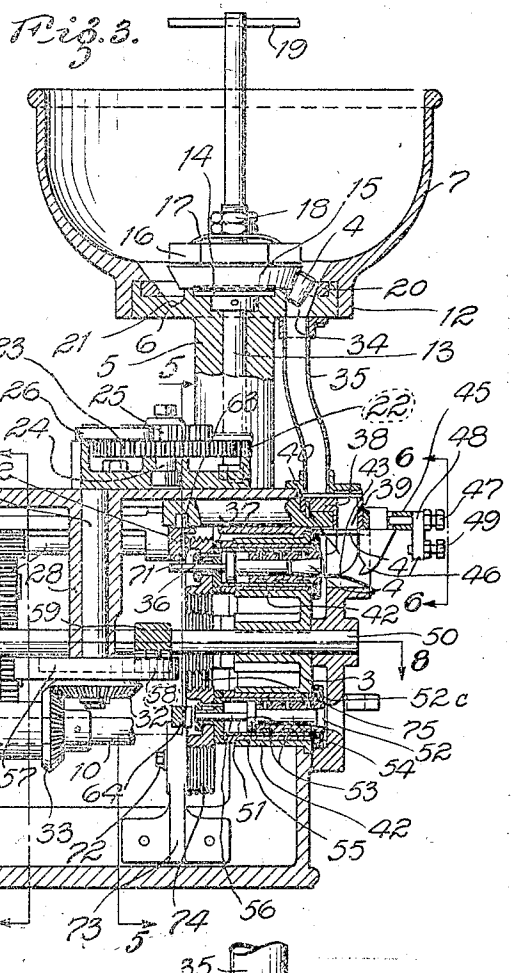


Fig. 7.

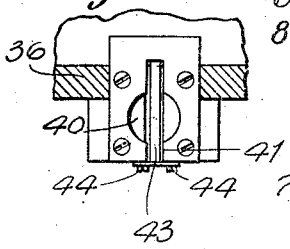


Fig. 5.

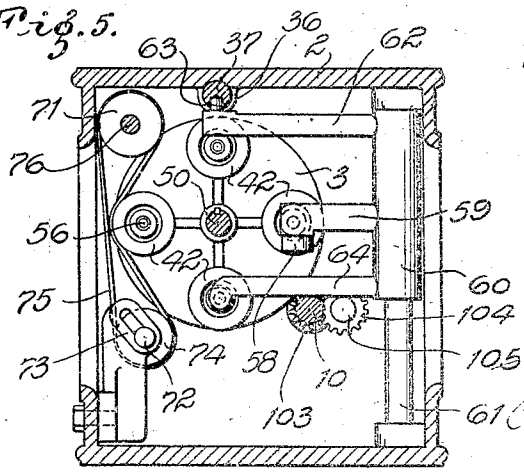
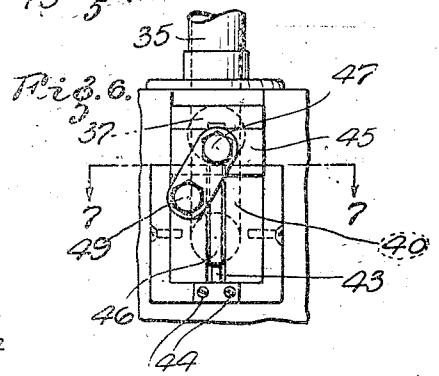


Fig. 6.



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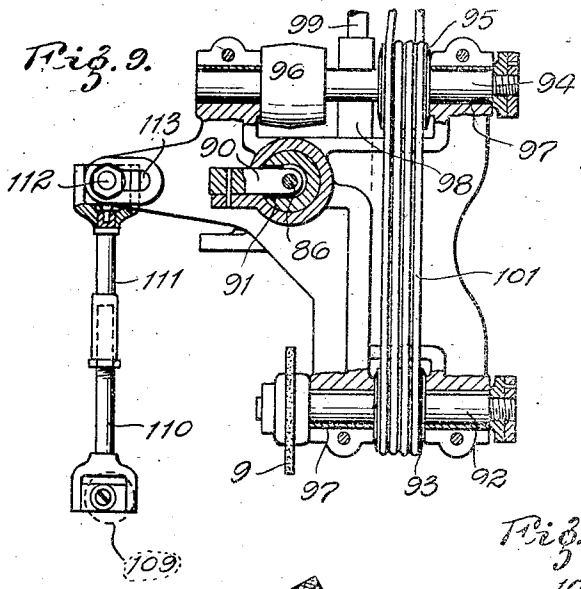
Nov. 18, 1924. 1,516,103

J. KELLER

GRINDING MACHINE

Filed Sept. 2, 1922 4 Sheets-Sheet 4

Fig. 9.



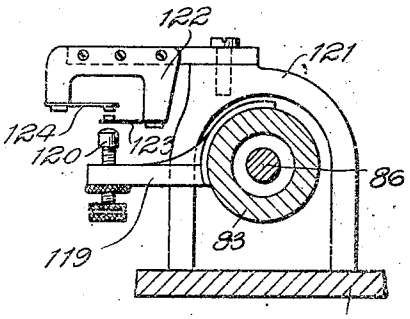


Fig. 10.

Fig. 11.

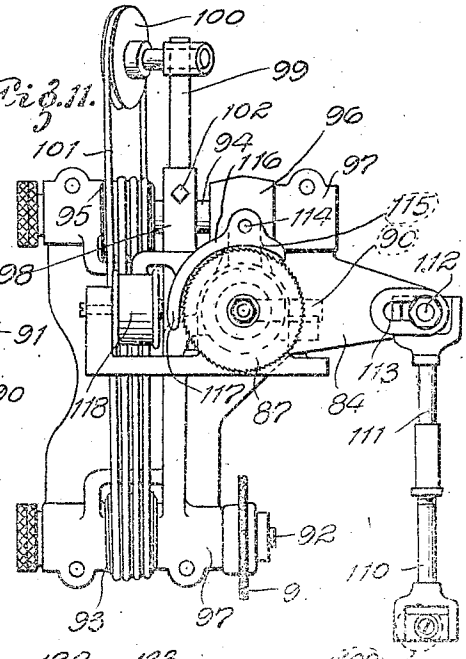


Fig. 13.

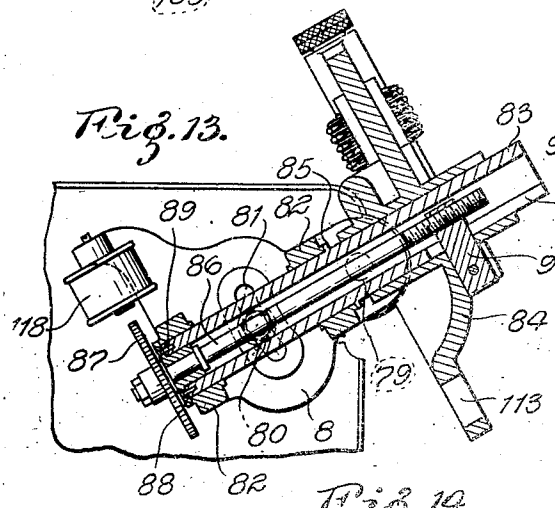
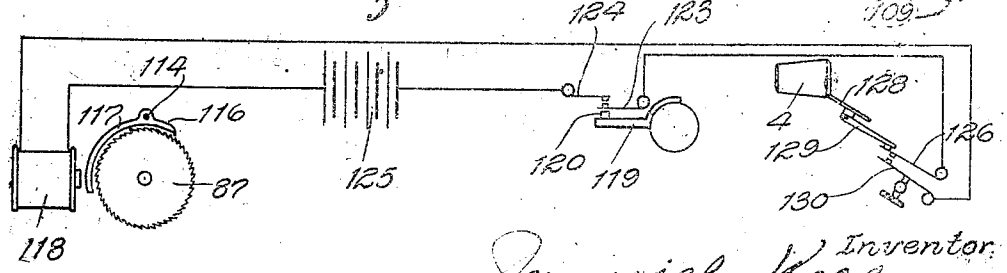


Fig. 14.



Inventor:
Jeremiah Keller,
by
his Attorneys.

Patented Nov. 18, 1924. 1,516,103

UNITED STATES PATENT OFFICE.

JEREMIAH KELLER, OF CANTON, OHIO, ASSIGNOR TO THE TIMKEN ROLLER BEARING COMPANY, OF CANTON, OHIO, A CORPORATION OF OHIO.

GRINDING MACHINE.

Application filed September 2, 1922. Serial No. 585,932.

To all whom it may concern:

Be it known that I, JEREMIAH KELLER, a citizen of the United States, and a resident of the city of Canton, county of Stark and State of Ohio, have invented a new and useful Improvement in Grinding Machines, of which the following is a specification.

My invention relates to grinding machines and particularly to machines for grinding the ends of rolls, for roller bearings. The principal object of the invention is to provide for automatically grinding the end edges of rolls for roller bearings.

The invention consists principally in mounting the oscillatably grinding wheel in automatic means for feeding the rolls into position to be ground, in means for ejecting the finished rolls, and in means for feeding the grinding wheel to compensate for wear. The invention further consists in the parts and combinations and arrangements of parts hereinafter described and claimed.

In the drawings which form part of this specification and wherein like characters indicate like parts wherever they occur:

Fig. 1 is an elevation of a grinding machine embodying my invention;

Fig. 2 is a top plan view thereof, the support for the roll hopper being broken away and certain parts being shown in section;

Fig. 3 is a vertical sectional view thereof;

Figs. 4 and 5 are sectional views along the lines 4—4 and 5—5 respectively in Fig. 3;

Fig. 6 is a fragmentary end view indicated by the line 6—6 in Fig. 3;

Fig. 7 is a sectional view along the line 7—7 in Fig. 6;

Fig. 8 is a horizontal sectional view along the line 8—8 in Fig. 3;

Fig. 9 is a sectional view along the line 9—9 in Fig. 2;

Fig. 10 is a sectional view along the line 10—10 in Fig. 2;

Fig. 11 is an elevation of the pawl and ratchet by which feeding of the emery wheel is accomplished, and of the emery wheel hanger;

Fig. 12 is a sectional view along the line 12—12 in Fig. 8;

Fig. 13 is a horizontal sectional view of the emery wheel supporting bracket showing the means for feeding the emery wheel forward;

Fig. 14 is a diagrammatic view showing the electric circuit governing the emery wheel feeding means; and

Fig. 15 is a fragmentary sectional view on a larger scale of a roll carrying member.

On a suitable base 1 is mounted a housing 2 containing the mechanism for operating the rotary indexing head 3 that contains the rolls 4, and for rotating a roll 4 being ground. Mounted on the top of said housing 2 is a pedestal 5 having an enlarged head 6 on which is mounted a hopper 7 or container that holds a supply of rolls to be ground. Also mounted on the housing 2 is a bracket 8 that supports the mechanism for supporting and operating an emery wheel 9 that is disposed alongside of the housing in position to grind the beveled end of a roller 4 held in the indexing head 3 and projecting from the housing. Rotatably mounted in the housing 2 is a main driving shaft 10, on whose projecting end is mounted a pulley wheel 11 or the like that may be driven from any suitable source of power.

Roll feeding mechanism.

The bottom of the hopper 7 has a tubular extension 12 that makes a snug fit with the head 6 of the pedestal 5 whereby the hopper is securely mounted on the pedestal. A shaft 13 is rotatably mounted in said pedestal 5 and a fiber disk 14 or the like is secured thereto. Resting on said fiber disk and mounted on the shaft is a conical disk 15 whose beveled edge is adapted to cooperate with rollers in the hopper. Secured on the vertical shaft 13 above said tapered disk 15 is a second fiber disk 16 that is pressed against said tapered disk by a spring 17 secured to the shaft by means of nuts 18 and bearing on said friction disk. The upper end of the shaft 13 projects above the top of the hopper and is provided with a handle 19 for turning it. Preferably a metal ring 20 having a beveled inner edge is mounted in the top of the head 6 of the pedestal and said pedestal is provided with a tapered groove 21 below said ring, a channel thus being formed that is adapted to receive conical rolls with their smaller ends down. The rolls in said channel are moved along in the channel by the frictional contact of the tapered disk 15.

Said disk 15 is rotated by said shaft 13, as above pointed out. In case of a jam, the

frictional mounting of the tapered disk 15 will permit it to slip on the shaft, thus avoiding damage to the machine.

The shaft 13 is provided with a gear 22 at its lower end, said gear 22 meshing with a gear 23 mounted on a suitable shaft 24 on top of the housing. Mounted on said shaft above said gear 23 and secured thereto is a ratchet gear 25 that is rotated by a pawl 26 that is pivotally secured to the end of a vertical shaft 27 mounted in a suitable bearing member 28 in said housing. A spring 29 is secured to the end of the pawl 26 and to the shaft. This spring 29 holds the pawl 26 against the ratchet gear 25 and on the back stroke of the pawl 26, the ratchet gear 25 is rotated backward a short distance by said pawl 26 riding over it. This backward rotation of the ratchet wheel 25 is limited by a second pawl 30 whose end is secured to the shaft 24 by a spring 31. This slight backward movement prevents jamming of the rolls in the hopper channel. Said shaft 27 is provided with a bevel gear 32 at its lower end that meshes with a bevel gear 33 on the main driving shaft 10 of the machine.

At one point, an opening 34 is provided in the bottom of the channel in the pedestal head 6. A tube 35 is secured to the pedestal, opening into said channel opening, the lower end of the tube being secured to the top of the housing 2 and opening into it. Slidably mounted on a suitable member 36 secured to the housing is a plunger 37 to which is secured a portion 38 having a hole 39 therethrough adapted to receive a roll 4 from the tube 35 and deliver it to a passageway 40 in said plunger-supporting member 36. Said member 36 is provided with a vertical slot 41 opening into said passageway. The passageway 40 curves from the vertical to the horizontal, so as to deliver a roll into the opening in a spindle 42 of the indexing head 3. A spring 43 is secured to the housing, as by screws 44 and projects into the horizontal portion of said passageway 40 to bear against a roll therein.

Secured to the end of the roll receiving portion 38 of the plunger 37 is a projecting lug 45 that is provided with a slot in which is mounted a depending finger 46. The shank portion of the finger 46 is secured in said slot by means of a suitable screw 47. The finger 46 is in alinement with the slot 41 in the roll receiving member 36 and when the plunger 37 moves to receive another roll from the tube said finger extends into said slot and presses a roll from the passageway into the hole in the spindle of the indexing head. Secured to the projecting member 45 of the plunger 37 is an arm 48 in which is mounted a screw 49 whose end abuts against the roll receiving member 36 and thus limits the stroke of the plunger 37. The screw 49 may be turned to adjust the stroke of the plunger, if required.

Indexing head.

The circular indexing head 3 is mounted on a suitable shaft 50 and is provided with four hollow spindles 42 in each of which is mounted a hollow piston 51, the outer end of whose bore 52 is conical to receive a conical roll 4 from the roll passageway 40. The end of each piston is provided with an annular slot 51^a in which is mounted a sleeve 51^b that has an outwardly extending and rebent flange 52^c at the end, this arrangement preventing dust from entering between the spindle and piston. Mounted in grooves on each of said pistons 51 is a plurality of split rings 53 or bushings that are preferably of bronze and that tend to prevent the piston 51 from turning in the spindle 42. Preferably two rings 53 are mounted in each groove, the combined width of the rings being equal to that of the groove. The meeting corners 53^a of each pair of rings are beveled and cooperate with the head of a pin 53^b that is fixed in the piston 51. Any rotary movement of the piston tends to spread the rings 53 so that the piston is frictionally held in its spindle. Mounted in the bore of each piston 51 is a plunger 54 that has an enlarged portion 55 that fits in the bore of the piston 51 and that has a reduced portion 56 projecting beyond the inner face of the indexing head 3. The plunger 54 is adapted to force a finished roll out of the piston, as will be described later. At the same time the enlarged portion 55 of the plunger 54 forces the piston 51 outwardly in the spindle 42. On the roll feeding stroke of the roll feeding plunger 37, the piston is forced inward the distance fixed by the limit screw 49.

Mounted on the vertical shaft 27 in the housing above the bevel gear 32 is a cam 57 in which rides a cam roller 58. Said cam roller 58 is secured to an arm 59 that is mounted on a hollow cylinder 60 that is sleeved on a suitable rod 61 in the housing 2. Secured to the top of said hollow cylinder 60 is an arm 62 whose end has a projection 63 that extends into an opening in the end of the roll feeding plunger 37. Secured to the other end of the cylinder 60 is an arm 64 whose end is in alinement with the extension 56 of the plunger 54 in one of the pistons. Thus, the rocking of the cam arm 59 moves both of the arms 62, 64 back and forth, to move the roll feeding plunger 37 and also to move the roll ejecting plunger 54 to eject a roll from one of the hollow pistons.

Mounted on the shaft 50 that supports the indexing head 3 is a star wheel 65 provided with radial slots 66 at angles of ninety degrees. The portions 67 of the star wheel between the slots 66 are arcuately curved.

Mounted on the main driving shaft 10 is a disk 68 or master wheel that is provided with a pin 69 that is adapted to extend into a slot 66 of the star wheel and rotate the star wheel through an angle of ninety degrees. The master wheel 68 is provided with an arcuate flange 70 that engages a curved portion 67 of the star wheel to prevent rotation thereof.

Mounted in the upper part of the housing 2 is a pulley 71 and adjustably mounted in the lower part of the housing, as by means of a screw 72 extending through a slotted member 73 secured in the housing, is a second pulley 74 that cooperates with said first mentioned pulley. Mounted on said pulleys 71 and 74 is a belt 75 that is adapted to contact with the projecting end of a hollow spindle 42, to drive the same while the roll therein is being operated on by the emery wheel 9. The upper pulley 71 is mounted on a horizontal shaft 76 that is driven through a suitable train of gears 77 by a gear 78 that is mounted on the main driving shaft 10 of the machine.

Emery wheel supporting and driving mechanism.

Pivotally mounted on a stud 79 on top of the housing 2 is the bracket 8. The bracket 8 is held in the desired position as by means of a screw 80 secured to the housing and fitting in an arcuate slot 81 in the bracket. Mounted in suitable bearings 82 on the bracket 8 is a hollow shaft 83 on which is mounted a hanger 84 or "reciprocating frame." The shaft is held against endwise movement as by means of a collar 85 that abuts against a bearing.

Mounted in the hollow shaft 83 is a feed screw 86 that is provided with a ratchet wheel 87 at the end that projects out of the hollow shaft 83. Mounted on the feed screw 86 loosely enough to be able to rotate relative thereto, is a collar 88 that overlaps the end of the hollow shaft 83 and is secured thereto as by screws 89. The threaded end of the feed screw 86 fits in a threaded hole in a member 90 that is secured to the hanger 84 and that projects into the hollow shaft 83 through a slot 91 therein. Thus, by turning the feed screw 86, the hanger 84 may be caused to move along the hollow shaft 83.

Mounted on a rotatably mounted shaft 92 disposed longitudinally in the lower end of the hanger 84 is the emery wheel 9. A multiple rope pulley 93 is fixed on said shaft 92 at about the middle thereof. A shaft 94 rotatably mounted near the top of the hanger has a pulley 95 that cooperates with the pulley 93 on the emery wheel shaft 92 and is also provided with a pulley 96 that may be driven from any suitable source of power. Said shafts 92, 94 are preferably mounted in split bushings 97. A hollow pedestal 98 projects upward from the hanger 84 and in the vertical bore thereof is mounted a rod 99 to whose upper end is secured a pulley 100. The rope 101 of the multiple rope pulleys 93, 95 is passed over the single pulley 100; and by adjusting the position of the single pulley, the tension of the rope may be adjusted. The rod 99 may be secured in the desired position by a set screw 102.

Emery wheel rocking mechanism.

A suitable gear 103 is formed on the end of the main driving shaft 10 and cooperates with a larger gear 104 on a horizontally disposed counter shaft 105 that is rotatably mounted in the housing 2 parallel with the main driving shaft. A second gear 106 on said counter shaft 105 cooperates with a gear 107 on a stub shaft 108 in alinement with the main driving shaft 10. Thus said shaft 108 is driven in the same direction as the main driving shaft but at a reduced speed. Said stub shaft 108 has a portion projecting from the housing and an eccentric 109 is secured thereto. A rod 110 extends upwardly from said eccentric and is threaded into a second rod 111 that is secured at its upper end to a projecting portion of the hanger 84, as by means of a bolt 112 fitting in a slot 113 in said hanger. Thus, as the main shaft 10 rotates, the eccentric 109 is rotated. This causes an up and down movement of the rods 110, 111 which, in turn, causes a back and forth rocking movement of the hanger 84 that supports the emery wheel 9. On each stroke of the hanger the emery wheel 9 passes a roll 4 and grinds the beveled edge thereof.

Emery wheel feeding means.

Mounted to cooperate with the ratchet wheel 87, as by a pivot pin 114 secured to a member 115 projecting upwardly from one of the hollow shaft bearings 82, is a pawl 116. The pawl 116 has an elongated arm 117 extending along the ratchet wheel 87. The weight of said arm tends to keep the pawl 116 out of engagement with the ratchet wheel 87. Mounted on the housing 2 is an electro-magnet 118 adapted to attract the free end 117 of the pawl 116 to force the other end thereof into engagement with a notch of the ratchet wheel 87. When said pawl 116 is in engagement with the ratchet wheel 87, the wheel 87 and screw 86 are prevented from rocking in one direction. Thus, when the hanger 84 rocks in that direction, it is fed along the hollow shaft 83, since said screw 86 is held stationary and the hollow shaft is held against endwise movement.

An arm 119 that is secured to the hollow shaft 83 (preferably near one of the bearings 82) is provided with a contact screw 120 at its end. Secured to the bearing cas-

ing is a support 121 to which is secured an insulated yoke 122 with its arms depending. Secured to one of said arms is an electrical switch member 123 whose free end is disposed above the contact screw 120 of the rocker arm 119. Secured to the other arm of the yoke 122 is a switch member 124 whose free end is above the free end of the first switch member 123. These switch members 123, 124 or contacts are brought together at the end of the clockwise rocking of the hollow shaft as shown in Fig. 10. One of said switch members is electrically connected with a source of electricity 125 which, in turn, is connected with the electro-magnet 118 and the other switch member is connected with a switch member 126 that is disposed near the roll being ground. Said switch member 126 is mounted in a suitable casing 127 that is secured to the housing 2. Rotatably mounted in said casing 127 is a disk 128 that is adapted to bear against the beveled edge of a roll 4 being ground. Said gaging disk 128 is pivotally mounted on a lever 129, the end of which is adapted to bear against said switch member 126 and make it contact with the other switch member 130 in said casing, which switch member 130 is electrically connected with the electro-magnet 118. The gaging disk 128 is so adjusted that when it bears against a roll whose end is not ground off enough, the switch members 126, 130 will be pressed together whereas, when the roll is sufficiently ground off the switch members will remain separated. It will thus be seen that for a circuit to be closed through the electro-magnet thus attracting the end of the pawl and causing feeding of the emery wheel supporting hanger, it is necessary that both sets of switch members be closed. An adjusting screw 130ª is mounted in said housing with its end engaging the switch member 130; so that the position of said switch member may be adjusted.

At the end of the clockwise rocking movement of the hollow shaft 83, the switch members 123, 124 governed thereby are forced together; and if, at that time, the roll that has just been ground is not sufficiently ground, the switch members 126, 130 governed by said roll will also be in contact, thus closing a circuit through the electro-magnet 118, attracting the end of the pawl 116, preventing rotation thereof and of the feed screw 86 and causing the hanger 84 to be fed along the shaft. This feeding will be repeated each time that an insufficiently ground roller is in contact with the gaging disk 128 when the arm of the hollow shaft forces its switch members 123, 124 together. When a sufficiently ground roller is in contact with the gaging disk 128, no circuit is closed through the electro-magnet even though the arm of the hollow shaft 83 closes its switch members.

The operation of the machine is as follows. A quantity of rolls is placed in the hopper and the power for driving the machine is turned on. In order to start the operation of the machine, the handle 19 is preferably turned by hand thus filling the channel with rolls and feeding a roll into the tube 35. The operation of the plunger 37 forces a roll into the roll receiving member 38 and thence into the piston of a spindle 42 of the indexing head. The piston is forced into the spindle so that the roll projects the proper distance from the spindle. The rotation of the indexing head brings a roll in position to be operated on by the emery wheel 9 and the oscillation of the emery wheel hanger forces the emery wheel across the beveled edge of the roll, grinding off said edge. If the parts are properly adjusted, the roll will be sufficiently ground and, as above described, no circuit will be closed through the electro-magnet 118, and the feed screw 86 will continue to rock with the hanger 84 and shaft. The indexing head will then be turned by the operation of the star wheel, and the ground roll will be in a lowermost position, where, on the stroke of the lower arm operated by the cam, the piston plunger 54 will be caused to eject said roll. In the fourth position of the indexing head, the spindle is empty and no work is done. On each stroke of the emery wheel, it grinds the edge of a roll.

The operation of the machine continues until the emery wheel is worn down so that it does not grind off a sufficient amount of the roll; and then the electric circuit above described will be closed to feed the emery wheel nearer to the work.

After the emery wheel is completely worn down, and is replaced with a new one, the ratchet wheel is turned back by hand to put the emery wheel in proper position.

The machine above described has numerous advantages. It provides automatic and accurate means for positioning the rolls to the ground and for operating the emery wheel. The operation of the machine is entirely automatic and it takes care of the wear of the emery wheel. Obviously, numerous changes may be made without departing from my invention and I do not wish to be limited to the precise construction shown.

What I claim is:

1. A grinding machine comprising a roll carrier, a rotatable grinding wheel disposed obliquely with relation to the axis of the roll carrier in position to bevel the end edge of a roll in said carrier, means for oscillating said grinding wheel and means for bringing a new roll into position to be beveled after

the grinding wheel has passed a roll, whereby the end of a roll is beveled on each swinging movement of the grinding wheel.

2. A grinding machine comprising a pivotally mounted arm, a grinding wheel rotatably mounted at the end of said arm and for rotating said grinding wheel, means for oscillating said arm, and a roll support rotatably mounted in such position that the end edge of a roll therein will lie in the path of oscillation of said grinding wheel, said grinding wheel being disposed obliquely with relation to the axis of the roll.

3. A grinding machine comprising a grinding wheel and means for rotating and oscillating the same, and a roll support having a plurality of chucks each adapted to contain a roll to be ground, said roll support being rotatably mounted in such position that the end edge of a roll in one of said chucks will lie in the path of oscillation of said grinding wheel, and means for rotating said roll support to bring a new roll into position to be ground after each oscillation of the grinding wheel.

4. A grinding machine comprising a grinding wheel and means for rotating and oscillating the same, a roll support rotatably mounted in such position that the end edge of a roll therein will lie in the path of oscillation of said grinding wheel, and means governed by a roll being ground for feeding said grinding wheel towards the roll support.

5. A grinding machine comprising a hopper, a grinding wheel, a rotatable head adapted and arranged to carry rolls into position to be ground by said grinding wheel, means for feeding rolls from said hopper to said head, said means comprising a channel of conical section in the bottom of said hopper, an opening in the bottom of said channel, means for feeding rolls along said channel to said opening, a plunger having an opening therethrough, a tube leading from said opening in said channel, and said plunger being movable to bring the hole therein into alinement with the end of said tube to receive a roll therefrom, a member having a passageway therethrough adapted to receive a roll from said plunger, means for transferring a roll from said passageway to said rotatable head, means for rotating said head at intervals, and means for ejecting finished rolls therefrom.

6. A grinding machine comprising a hopper, a grinding wheel, a rotatable head adapted and arranged to carry rolls into position to be ground by said grinding wheel, means for feeding rolls from said hopper to said head, said means comprising a channel of conical section in the bottom of said hopper, an opening in the bottom of said channel, means for feeding rolls along said channel to said opening, a plunger having an opening therethrough, a tube leading from said opening in said channel, and said plunger being movable to bring the hole therein into alinement with the end of said tube to receive a roll therefrom, a member having a passageway therethrough adapted to receive a roll from said plunger, said member having a slot opening into said passageway, means for transferring a roll from said passageway to said rotatable head, said means comprising a finger carried by said plunger and adapted to extend into said slot to abut against a roll in said passageway, means for rotating said head at intervals and means for ejecting finished rolls therefrom.

7. A grinding machine comprising a hopper, a grinding wheel, a rotatable head adapted and arranged to carry rolls into position to be ground by said grinding wheel, means for feeding rolls from said hopper to said head, said means comprising a channel of conical section in the bottom of said hopper, an opening in the bottom of said channel, means for feeding rolls along said channel to said opening, said means including a rotatable conical disk adapted to bear against the sides of rolls in said channel, a plunger having an opening therethrough, a tube leading from said opening in said channel, and said plunger being movable to bring the hole therein into alinement with the end of said tube to receive a roll therefrom, a member having a passageway therethrough adapted to receive a roll from said plunger, said member having a slot opening into said passageway, means for transferring a roll from said passageway to said rotatable head, said means comprising a finger carried by said plunger and adapted to extend into said slot to abut against a roll in said passageway, means for rotating said head at intervals and means for ejecting finished rolls therefrom.

8. A grinding machine comprising a hopper, a grinding wheel, a rotatable head, hollow spindles in said head adapted and arranged to carry rolls into position to be ground by said grinding wheel, means for feeding rolls from said hopper to said spindle, said means comprising a channel of conical section in the bottom of said hopper, an opening in the bottom of said channel, means for feeding rolls along said channel to said opening, a plunger having an opening therethrough, a tube leading from said opening in said channel, and said plunger being movable to bring the hole therein into alinement with the end of said tube to receive a roll therefrom, a member having a passageway therethrough adapted to receive a roll from said plunger, said member having a slot opening into said passageway, means for transferring a roll from said passageway to said rotatable head, said means comprising a finger carried by said plunger

and adapted to extend into said slot to abut against a roll in said passageway, to force it into the bore of a spindle, means for rotating said head and means for ejecting finished rolls from said spindles, said means comprising a plunger for each spindle and means for forcing said plunger against a roll in said spindle.

9. A grinding machine comprising a hollow shaft rotatably mounted, a hanger mounted thereon, a grinding wheel mounted in said hanger, a member secured to said hanger and extending into a slot in said shaft and provided with a threaded opening, a screw threaded rod disposed axially of said hollow shaft and extending into the threaded opening in said member secured to said hanger, means for oscillating said hanger and means for preventing rotation of said screw, whereby when said screw is free to rotate, it rotates as a unit with said hanger and hollow shaft and when said screw is held against rotation said hanger moves longitudinally of said shaft.

10. A grinding machine comprising a hollow shaft rotatably mounted, a hanger mounted thereon, a grinding wheel mounted in said hanger, a member secured to said hanger and extending into a slot in said shaft and provided with a threaded opening, a screw threaded rod disposed axially of said hollow shaft and extending into the threaded opening in said member secured to said hanger, means for oscillating said hanger, and means for preventing rotation of said screw, said means comprising a ratchet secured to the end thereof and a pawl adapted and arranged to cooperate with said ratchet whereby when said screw is free to rotate, it rotates as a unit with said hanger and shaft and when said screw is held against rotation, said hanger moves longitudinally of the shaft.

11. A grinding machine comprising a hollow shaft, a hanger mounted on said hollow shaft, a grinding wheel mounted on said hanger, a member secured to said hanger and extending into a slot in said hollow shaft and provided with a threaded opening, a screw threaded rod disposed axially of said hollow shaft and extending into the threaded opening in said member secured to said hanger, a ratchet secured to the end of said threaded rod, a pawl mounted to cooperate with said ratchet to hold said threaded rod and screw against rotation, means for oscillating said hanger, a roll support rotatably mounted in position to hold a roll in the path of oscillation of the grinding wheel and means controlled by a roll and said holder for moving said pawl into engagement with the ratchet, said means comprising an electro-magnet adapted and arranged to attract one end of said pawl to force the other end thereof into engagement with a notch of said ratchet, a switch adapted to close an electric circuit through said electro-magnet and a gaging member for controlling said disk, said gaging member being in contact with a roll, whereby when a roll is insufficiently ground a current is closed through said electro-magnet, rotation of said screw is prevented and the hanger is moved along said hollow shaft.

12. A grinding machine comprising a hollow shaft, a hanger mounted on said hollow shaft, a grinding wheel mounted on said hanger, a member secured to said hanger and extending into a slot in said hollow shaft and provided with a threaded opening, a screw threaded rod disposed axially of said hollow shaft and extending into the threaded opening in said member secured to said hanger, a ratchet secured to the end of said threaded rod, a pawl mounted to cooperate with said ratchet to hold said threaded rod against rotation, means for oscillating said hanger, a roll support rotatably mounted in position to hold a roll in the path of oscillation of the grinding wheel and means controlled by a roll in said holder for moving said pawl into engagement with the ratchet, said means comprising an electro-magnet adapted to attract one end of said pawl to force the other end thereof into engagement with a notch of said ratchet, a switch, a source of electricity connected with said electro-magnet and one member of said switch, a second switch having its members connected respectively with the electro-magnet and said first mentioned switch, a member secured to said hollow shaft and adapted to close said first switch at the end of the rocking movement of said shaft and a gaging disk in contact with a roll and adapted to close said second switch when in contact with a roll that is insufficiently ground.

13. In a machine of the kind set forth a rotatable head for supporting the work, comprising a plurality of hollow spindles and a hollow piston in each of said spindles, the end of the bore of each piston being adapted to receive an article, said pistons having frictional engagement with said spindles, whereby movement of each piston relative to its spindle is possible.

14. In a machine of the kind set forth a rotatable head for supporting the work, comprising a plurality of hollow spindles, a hollow piston in each of said spindles, the end of the bore of each piston being adapted to receive an article, said pistons having frictional engagement with said spindles, whereby movement of each piston relative to its spindle is possible and means for preventing dust or other foreign material from entering said pistons.

15. In a machine of the kind set forth, a rotatable head adapted to support conical

rolls, comprising a plurality of hollow spindles rotatably mounted, a hollow piston in each spindle, the end portion of the bore of each piston being conical to receive a conical roll, each piston fitting tightly in its spindle and being provided with grooves, and split friction rings mounted in said grooves, whereby each piston rotates with its spindle and is capable of endwise movement therein.

16. In a machine of the kind set forth, a rotatable head adapted to support conical rolls, comprising a plurality of hollow spindles rotatably mounted, a hollow piston in each spindle, the end portion of the bore of each piston being conical to receive a conical roll, each piston fitting tightly in its spindle and being provided with grooves, two split friction rings mounted in each of said grooves, the meeting corners of said rings being beveled and pins secured to the pistons and cooperating with the beveled edges of the rings to cause them to engage the spindle, whereby each piston rotates with its spindle and is capable of endwise movement therein.

Signed at Canton, Ohio, this 29th day of August, 1922.

JEREMIAH KELLER.

Certificate of Correction.

It is hereby certified that in Letters Patent No. 1,516,103, granted November 18, 1924, upon the application of Jeremiah Keller, of Canton, Ohio, for an improvement in "Grinding Machines," an error appears in the printed specification requiring correction as follows: Page 5, line 6, claim 2, for the word "and" read *means;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23d day of December, A. D. 1924.

[SEAL.]

KARL FENNING,
Acting Commissioner of Patents.