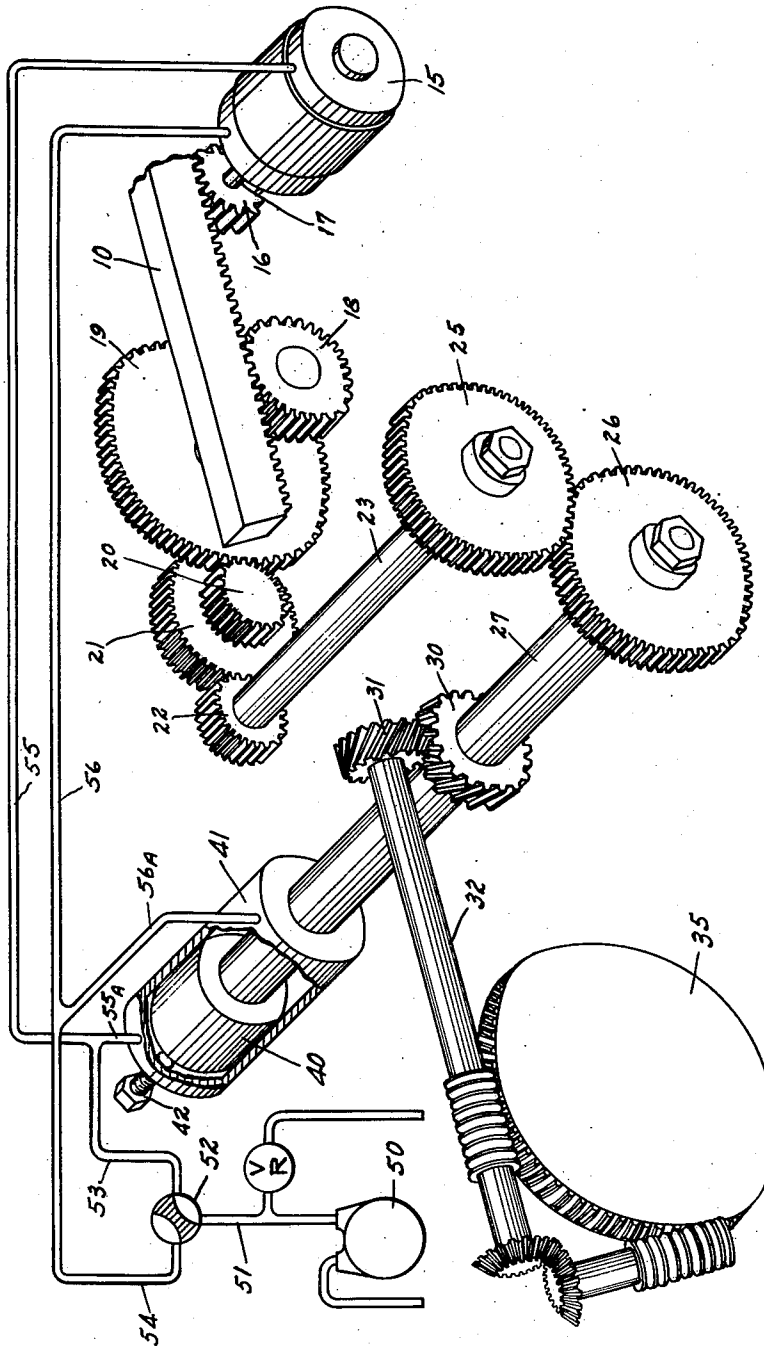
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BACKLASH ELIMINATING MECHANISM

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BACKLASH ELIMINATING MECHANISM

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This invention relates to a grinding machine, particularly a machine for grinding rolling mill rolls, and more particularly a machine of this type having a crowning mechanism for grinding rolls having convex or concave surfaces.

In grinding rolls having convex or concave surfaces, it is important that the traverse mechanism and the crowning mechanism be perfectly synchronized so that the relation between the grinding wheel and the surface being ground will remain the same regardless of the direction of traverse.

In the past, various types of mechanisms have been produced for compensating for backlash or for taking up backlash in a gear-driven apparatus. This invention represents an improvement on the previous backlash devices in that this device is power-operated and functions at each reversal of the traverse movement.

The drawing shows diagrammatically, essential elements in the traverse and crowning mechanisms. For further details of the crowning mechanism, reference is made to Patent No. 1,904,827, granted April 18, 1933. Details of the hydraulic motor for driving the traverse mechanism are disclosed in co-pending application 18,044, filed March 30, 1948. A work carriage of the type to be operated by this traverse mechanism is disclosed in Patent No. 2,007,351, granted July 9, 1935.

Numeral 10 indicates a rack which is attached to the work carriage of the machine (not shown). Traverse movement of rack 10 is effected by means of a reversible hydraulic motor 15 through gear 16 on shaft 17. A train of gears consisting of a pinion 18 engaging the teeth of rack 10, gears 19, 20 and 21 transmits movement of said carriage to gear 22. Gear 22 is mounted on one end of shaft 23. At the other end of shaft 23 is a gear 25 engaging a gear 26 on shaft 27 parallel to shaft 23. A helical gear 30 on shaft 27 engages a helical gear 31 on shaft 32, which extends transversely of shaft 27. Shaft 32 drives a crowning mechanism 35.

On the opposite end of shaft 27 from gear 26 is a piston 40, slidably mounted in cylinder 41. The extent of movement of said piston is determined by an adjustable stop 42 in the head end of cylinder 41.

Fluid under pressure from pump 50 is supplied through line 51 to reversing valve 52. Said reversing valve directs fluid through lines 53 and 54 and lines 55 and 55A and 56 and 56A to corresponding sides of motor 15 and cylinder 41.

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Operation

With reversing valve 52 in the position shown, fluid under pressure is directed through lines 53 and 55 to drive motor 15 in a clockwise direction. At the same time, fluid under pressure is directed through line 55A to the head end of cylinder 41. Piston 40 moves shaft 27 and helical gear 30 axially toward the right. The teeth on gears 30 and 31 co-act as cam surfaces so that gear 30 will begin to rotate until all backlash in the gearing between gear 26 and rack 10 has been taken up. Piston 40 will then have reached the end of its stroke. At this point the crowning mechanism and the rack 10 will begin to move simultaneously.

When reversing valve 52 is shifted to direct fluid through lines 54, 56 and 56A to the opposite side of motor 15 and cylinder 41, the above-described action is repeated in the reverse direction.

For most roll grinding jobs it is desirable that the crowning mechanism and the traverse mechanism be in perfect synchronism. However, in some cases it is necessary that these mechanisms be out of synchronism but by a predetermined amount. This has been accomplished by using the adjusting screw 42 to change the length of stroke of piston 40. By proper adjustment of the stroke of piston 40, it is possible to remove all or a predetermined part of the backlash in the traverse mechanism. It is even possible to effect this adjustment to a position beyond that at which all the backlash is taken up.

I claim:

1. In a grinding machine, a traverse mechanism, a hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism including transverse shafts, one of which drives said second mechanism, a helical gear on each of said shafts and means for starting said traverse mechanism and said second mechanism simultaneously after each reversal thereof, which consists in means for effecting axial movement of one of said helical gears in a direction corresponding to the direction of said traverse movement.

2. In a grinding machine, a traverse mechanism, a hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism including transverse shafts, one of which drives said second mechanism, a helical gear on each of said shafts, means for starting said traverse mechanism and said second mecha-

nism simultaneously after each reversal thereof, which consists in means for effecting axial movement of one of said helical gears in a direction corresponding to the direction of said traverse movement, and means for adjusting the extent of said axial movement.

3. In a grinding machine, a traverse mechanism, a reversible hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism and a backlash reversible mechanism in said gearing for taking up the backlash between said mechanisms at each reversal of said traverse mechanism in a direction corresponding to the direction of movement of said traverse mechanism.

4. In a grinding machine, a traverse mechanism, a reversible hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism and a backlash mechanism in said gearing for taking up the backlash between said mechanisms, and reversible power means for actuating said backlash mechanism automatically at each reversal of said traverse mechanism in a direction corresponding to the direction of movement of said traverse mechanism.

5. In a grinding machine, a traverse mechanism, a hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism including transverse shafts, one of which drives said second mechanism, a helical gear on each of said shafts and means for starting said traverse mechanism and said second mechanism simultaneously after each reversal thereof, which consists in effecting axial movement of one of said helical gears in a direction corresponding to the direction of said traverse movement.

6. In a grinding machine, a traverse mechanism, a reversible hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism and a backlash mechanism in said gearing for taking up the backlash between said mechanisms, and reversible means for actuating said backlash mechanism automatically at each reversal of said traverse mechanism in a direction corresponding to the direction of movement of said traverse mechanism.

7. In a reversing mechanism for machine tools, a rack and pinion for transmitting movement to a driven member, a motor, gearing connecting said motor with said rack and pinion, a backlash mechanism including a shaft geared to said driving mechanism, a helical gear on said shaft, a second shaft extending transversely of said first shaft, means on said second shaft to resist rotation thereof, a helical gear on said second shaft meshing with said helical gear on said first shaft, means for effecting endwise movement of said first shaft, the helical gear on said first shaft turning slightly due to the cam action between said gears resulting from said endwise movement whereby to take up backlash in said gearing and thus permitting initiation of rotation of said second helical gear and movement of said rack at the same time.

8. In a grinding machine, a traverse mechanism, a second mechanism operable in timed relation with said traverse mechanism, a motor for driving said traverse mechanism, connections between said traverse mechanism and said second mechanism including a pair of shafts, one of which is driven from the traverse mechanism, meshing gears in said shafts whereby said one shaft drives the other, said other shaft having a helical gear thereon engaging a second helical gear on said second mechanism, means for shifting said other shaft axially at each reversal of said traverse mechanism, said axial movement being effective to cause a slight turning of the helical gear thereon sufficient to take up all backlash between said traverse mechanism and said second mechanism, and means to adjust the extent of axial movement of said other shaft to conform to the amount of backlash in said first mechanism.

9. In a grinding machine, a traverse mechanism, a hydraulic motor for driving said traverse mechanism, a crowning mechanism, gearing connecting said traverse mechanism and said crowning mechanism including transverse shafts, one of which drives said crowning mechanism, a helical gear on each of said shafts, means for starting said traverse mechanism and said crowning mechanism in predetermined relation after each reversal thereof, which includes means for effecting axial movement of one of said helical gears in a direction corresponding to the direction of said traverse movement, and means for adjusting the extent of said axial movement whereby to effect a predetermined adjustment in angular relation between said crowning mechanism and said traverse mechanism.

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