

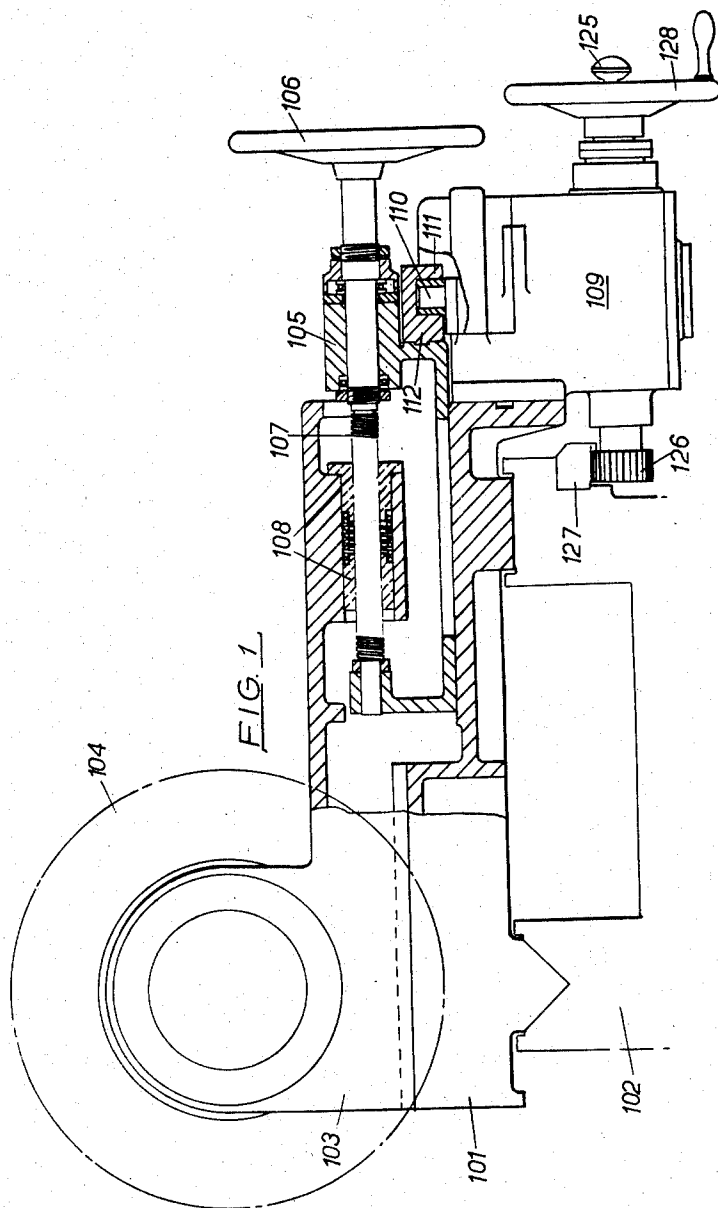
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S. W. DRONSFIELD
CAMBER GRINDING MACHINES

2,904,935

Filed Feb. 13, 1956

3 Sheets-Sheet 1



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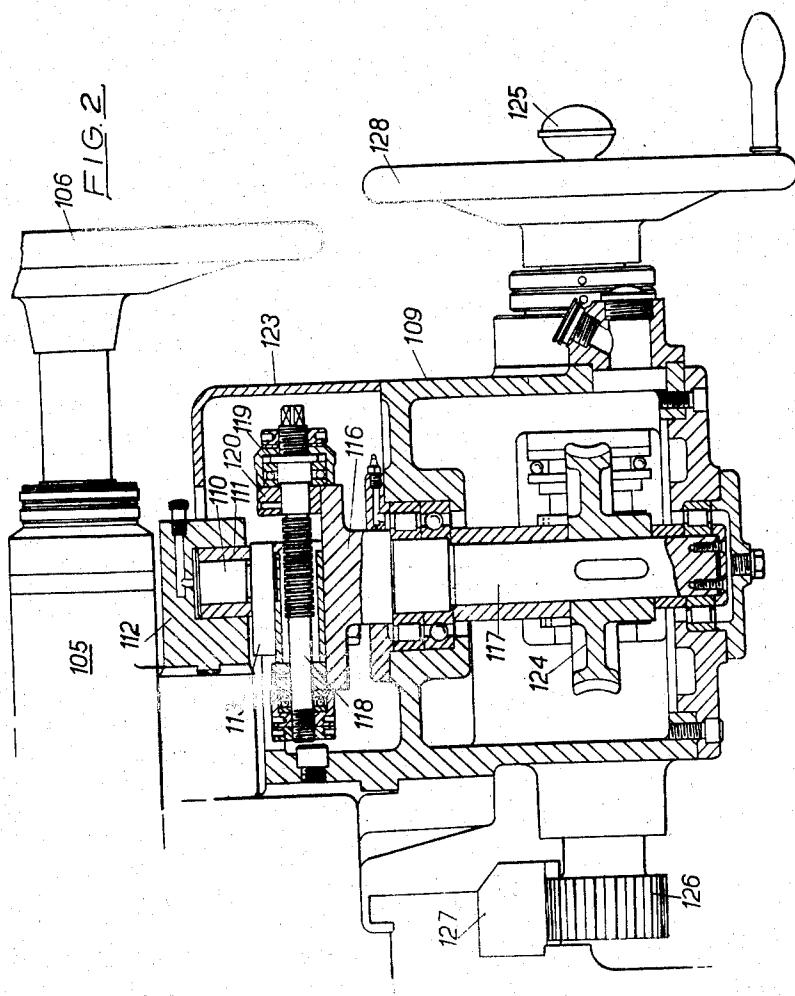
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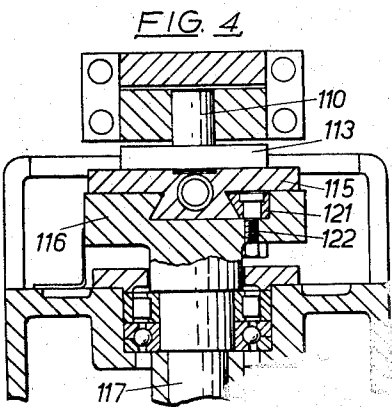
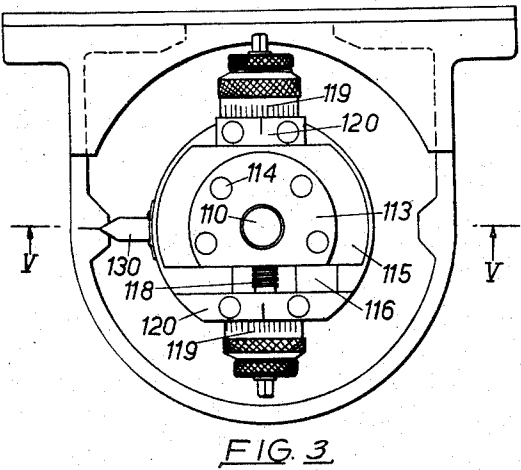
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CAMBER GRINDING MACHINES

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8 Claims. (Cl. 51—49)

The present invention relates to camber grinding machines for imparting to a generally cylindrically body, such as a calender roll, a slightly convex contour in the lengthwise direction.

Such a convex contour is generally referred to as a "camber" and will be so referred to herein and in the appended claims.

In machines adapted for cambering rolls as aforesaid it is known for a grinding head to follow a stationary contoured track in the form of a template extending parallel with the roll to impart the required camber to the roll. The length of the template corresponds with that of the roll and it is therefore difficult and expensive to prepare.

In some more modern camber grinding machines a template is dispensed with and the transverse position of the grinding head relatively to the work is controlled by a rotatable control element which is driven by virtue of the relative traversing movement of the grinding head and the work as the grinding operation proceeds. In such machines the camber feed is usually achieved by an automatic tilting or angular movement of a grinding head table which is mounted on a slide which may itself be manually adjusted transversely of the work. The drawback with such an arrangement is that the rate of automatic transverse camber feed is not directly proportional to the rate of angular displacement of the grinding head and will in part be a function of the grinding wheel diameter which decreases with use thereof. Thus the calculations involved in setting up a machine to grind a given camber are rather complicated.

A camber grinding machine has been proposed in which the work is traversed past the grinding head, the grinding head being linearly slidable transversely of the work. This machine involves two linearly guided slides, namely an upper grinding head slide which can be manually adjusted relatively to an intermediate slide which is automatically adjusted by a rotatable control element to afford a camber feed. Even though this machine has the advantage that the camber feed is linear instead of angular it suffers from the disadvantage of an intermediate slide between the grinding head slide and the machine bed, producing a cumulative inaccuracy resulting from two sets of slide clearances of such magnitude that the use of a tilting grinding head table has in practice usually been preferred.

An object of the present invention is to produce a grinding machine in which the required camber grinding accuracy may be obtained using a linearly fed grinding head whose camber feed towards the work is automatically controlled by relative traversing movement of the grinding head and the work.

A further object of the invention is the provision of a camber grinding machine in which the degree of camber to be imparted to a roll may be rapidly and easily changed, and yet accurately controlled.

Other objects and features of the present invention will appear more fully below from the following detailed de-

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scription considered in connection with the accompanying drawings which disclose one embodiment of the invention. It is to be expressly understood, however, that the drawings are designed for purposes of illustration only and not as a definition of the limits of the invention, reference for the latter purpose being had to the appended claims. In the accompanying drawings:

Fig. 1 is an end sectional view illustrating a grinding machine according to the invention,

Fig. 2 is an enlarged sectional view of a portion of Fig. 1,

Fig. 3 is a plan view of a detail of the machine of Figs. 1 and 2 and

Fig. 4 is a fragmentary sectional view on the line V—V of Fig. 3.

In the embodiment illustrated a carriage 101 is mounted on guides of a machine bed 102. The grinding head slide 103 is directly supported on the carriage 101 for sliding movement transversely of the work. A grinding head including a grinding wheel 104, indicated by broken lines, is mounted on the slide 103. The grinding head slide 103 can be adjusted relatively to a connecting block 105 by means of a handwheel 106 and its associated feed screw 107. The position of the connecting block 105 transversely of the bed 102 is controlled by the camber mechanism. The feed screw 107 co-operates with two spring separated nuts 108 in the slide 103. The spring separation eliminates back-lash between the feed screw and the slide.

The camber mechanism is mounted in a housing 109 which is attached to the carriage 101. This mechanism which is shown in detail in Fig. 2 has an eccentric 110 of variable throw which engages a bearing opening in a slide block 111 which is slidably mounted in a downwardly directed guideway comprising a slot in an inverted channel member in the form of a fixed block 112 attached to the connecting block 105. The blocks 111 and 112 are capable of relative movement only in a direction parallel to the bed. The rotation of the eccentric thus displaces the connecting block 105 and the grinding head slide 103 relatively to the carriage 101. Thus the screw and nut mechanism 107, 108 and the connecting block 105 form a manually adjustable coupling through which the grinding head slide 103 is actuated by the control element or eccentric 110.

The eccentric is formed integrally with a base flange 113, shown more particularly in Figs. 3 and 4, which is mounted by means of bolts such as 114 on a slide 115. Figs. 1 and 4 are sections on mutually perpendicular planes. The slide 115 is mounted in V slide-ways in a table formed as the head 116 of a shaft 117. The position of the slide 115 relatively to the table 116 may be accurately adjusted by means of a micrometer screw 118 provided at either end with graduated thrust collars 119 whose graduations cooperate with index marks on bearing blocks 120 mounted on the table 116. A locking strip 121 with locking bolt 122 enables the slide 115 to be locked in an adjusted position. The micrometer screw 118 is provided with squared ends which enables it to be turned by a key when a cover 123 of the housing 109 is removed.

The shaft 117 is vertically mounted on suitable bearings within the housing 109. It carries towards its lower end a wormwheel 124 which is engaged by a worm which may be optionally engaged, by means of a clutch knob 125, with a pinion 126 engaged with a rack 127 fixed to the bed. The clutch is of a conventional type incorporating sliding dogs. On engaging the clutch and traversing the carriage along the bed by means of a lead-screw which is not shown, the shaft 117 and eccentric 110 are rotated to vary the transverse position of the grinding wheel 104.

The worm engaging the wormwheel 124 is mounted on a common shaft with a handwheel 128. When the clutch controlled by the knob 125 is disengaged the eccentric 110 can be freely turned by the handwheel 128.

The table 116 carries a pointer 130 which co-operates with an index mark on the housing 109. When the pointer is so aligned the slide-ways extend at right angles to the bed, as shown in Figs. 3 and 4.

In the position of the slide 115 shown in Fig. 4 the innermost end of the slide 115 abuts the adjacent bearing block 120. In this position the eccentric 110 is accurately centered relatively to the head 116. With this adjustment the machine will grind parallel irrespective to the angular position of the shaft 117. For grinding a camber the slide 115 is adjusted by means of the graduations of the collars 119 to give the required throw of the eccentric. The shaft 117 is turned by means of the handwheel 128 until the pointer 130 is aligned with the index mark. As the slide-ways for the slide 115 are now disposed at right angles to the bed the eccentric will be in its outermost or outer dead-center position for the adjustment chosen. The carriage is positioned so that the grinding wheel is aligned with the section of the roll at which the crown of the camber is to occur. This will normally be the center. The clutch is now engaged so that movement of the eccentric will be dependent upon the traverse of the carriage 101. Finally the carriage is traversed to the point on the roll at which grinding is to be commenced, the desired cut is set by the handwheel 106 and grinding commenced.

The worm and wheel gear driving shaft 117 is chosen so that the shaft 117 undergoes a half revolution of 180° when the carriage is traversed through its normal maximum range, that is the maximum length of roll which the machine is intended to grind. When grinding a roll of this length the camber, in terms of the difference in radius between the central crown and the end of the roll, will be equal to the eccentricity of the eccentric 110. When grinding shorter rolls less than half a revolution of the shaft 117 will be obtained with a complete traverse. In this case the eccentricity of the eccentric 110 must be calculated in accordance with the desired camber and the actual rotation of the shaft 117 which occurs in a complete traverse of the roll being ground.

The feed screw 107 and the nuts 108 form a manually adjustable coupling between and in series with the grinding head slide 103 and the automatic control element or eccentric 110. The adjustable coupling takes part in and transmits the automatic camber adjustments of the eccentric 110 whilst providing for independent manual adjustment of the grinding head slide 103. The invention thus provides for both manual and automatic adjustment of the grinding head without recourse to an intermediate slide between the grinding head slide and the carriage.

Although the machines herein described are applicable primarily to camber grinding, that is to say, to the grinding of convex contours, they can nevertheless with suitable adjustment equally be used for reverse camber grinding, that is to say, for the grinding of concave contours and the scope of the appended claims is to be interpreted to include machines according to the present invention when used for reverse camber grinding.

Obviously many changes and modifications may be made without departing from the spirit of the invention, and all such changes and modifications are intended to be included within the scope of the appended claims.

I claim:

1. A camber grinding machine comprising a machine bed, a carriage capable of being slidably traversed along the bed, a grinding head slide mounted directly on the carriage and capable of being slidably adjusted relatively thereto in a direction transverse of the bed, said grinding head slide having fixedly associated therewith a downwardly directed guideway which extends in the

longitudinal direction of the bed, a gear transmission mechanism including an upstanding rotatable shaft supported by the carriage and traversible therewith, a toothed rack fixed to the bed and extending over the normal maximum traversing range of the carriage along the bed, a pinion supported from the carriage and in mesh with said rack, clutch means for drivably connecting and disconnecting said pinion to and from said shaft, a substantially horizontal table located at the upper end of said shaft and rotatable therewith, said table being provided with a slideway running thereacross, a slide guided by said slideway, an upstanding pin mounted on said slide, means for adjusting said slide relatively to said slideway to adjust the eccentricity of said pin relatively to the shaft, and a slide block slidably along said downwardly directed guideway and having a bearing opening therein in which said pin is received to enable rotational movement of said pin about the axis of said shaft to effect transverse adjustment of said grinding head slide.

2. A camber grinding machine comprising a machine bed, a carriage mounted on the bed for traversing movement therealong, a grinding head slide mounted on the carriage so as to be linearly adjustable transversely of the bed, manual control means for linearly adjusting the slide transversely of the bed, an automatic control means for linearly adjusting said slide transversely of the bed arranged in series with said manual control means and embodying a rotatable eccentric pin, and means for rotating the eccentric pin proportionally with the traversing movement of the carriage.

3. A camber grinding machine according to claim 2, comprising means for adjusting the eccentricity of said eccentric pin.

4. A camber grinding machine comprising a machine bed, a carriage mounted on the bed for traversing movement therealong, a grinding head slide mounted on the carriage so as to be linearly adjustable transversely of the bed, manual control means for linearly adjusting the slide transversely of the bed, an automatic control means for linearly adjusting said slide transversely of the bed arranged in series with said manual control means and embodying a rotatable eccentric pin mounted on the carriage for automatically adjusting the slide through said manual control means, and means for rotating the eccentric pin proportionally with the traversing movement of the carriage at a rate such that the control element is turned through not more than 180° as the carriage moves through its normal traversing range along the bed, and means for adjusting the eccentricity of said eccentric pin.

5. A camber grinding machine comprising a machine bed, a carriage mounted on the bed for traversing movement therealong, a grinding head slide mounted on the carriage so as to be linearly adjustable transversely of the bed, manual control means mounted on the slide for linear adjustment thereof transversely of the bed, a rotatable control element mounted on the carriage in series relationship with said manual control means, and means for rotating the control element proportionally with said traversing movement so as to produce an automatic camber feed of the slide transversely of the bed.

6. A camber grinding machine according to claim 5 comprising a rotatable turntable which is mounted on the carriage and driven by movement of the carriage along the bed, and an eccentric pin adjustably mounted on the turntable and forming said rotatable control element.

7. A camber grinding machine according to claim 6 comprising a micrometer screw and a co-operating graduated scale for accurate adjustment of said eccentric pin on said turntable.

8. A camber grinding machine comprising a machine bed, a carriage mounted on the bed for traversing movement therealong, a toothed rack fixed to the bed extending over the normal maximum traversing range of the

carriage along the bed, a grinding head slide mounted on the carriage so as to be linearly adjustable transversely of the bed, a rotatable eccentric mounted on the carriage for automatic linear adjustment of the slide transversely of the bed, a pinion supported from the carriage in mesh with said toothed rack, a gear transmission between the pinion and the rotatable eccentric so that the latter will be rotated proportionally with the traversing movement of the carriage, and a manually adjustable coupling between and in series relationship with the slide and the rotatable eccentric to provide for manual adjustment of the slide transversely of the bed.

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861,016
1,485,258
1,609,217
1,742,736
2,108,310
2,297,093

290,942

References Cited in the file of this patent

UNITED STATES PATENTS

Brown ----- July 23, 1907
Dzus ----- Feb. 26, 1924
Stoner ----- Nov. 20, 1926
Taylor ----- Jan. 7, 1930
Griffing ----- Feb. 15, 1938
Wigglesworth ----- Sept. 29, 1942

FOREIGN PATENTS

Great Britain ----- May 24, 1928