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DEVICE FOR GRINDING THE SLIDEWAYS OF MACHINE TOOLS

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Fig.1

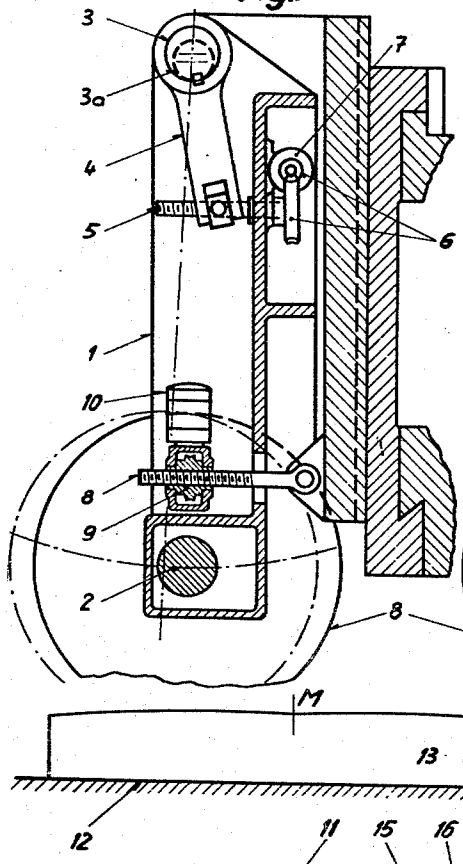


Fig.2

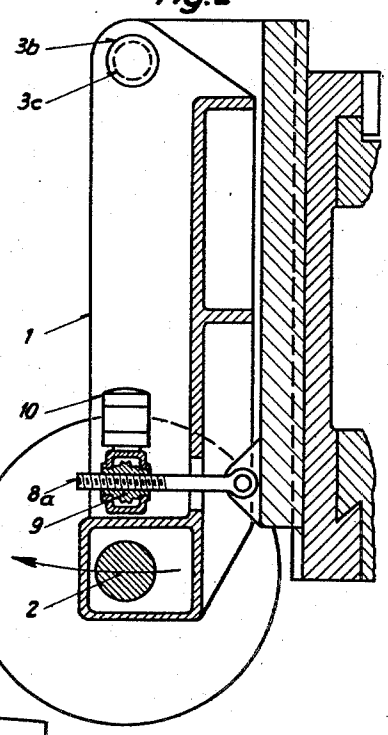
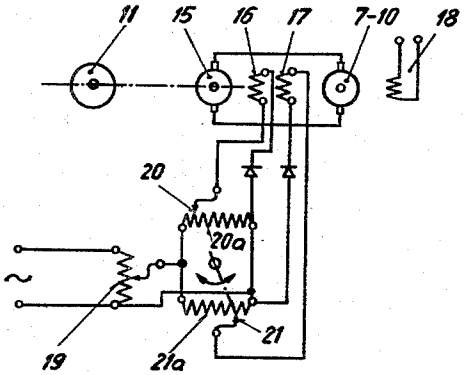


Fig.3



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DEVICE FOR GRINDING THE SLIDEWAYS OF MACHINE TOOLS

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The present invention relates to a device for grinding the slideways of machine tools, particularly lathe beds, as well as the table beds of grinding, milling and planing machines. These beds do not as a rule bear on the foundation along their entire length with the result that between the surfaces bearing on the foundation bridges are formed which may sag under the operating load. Even if this sag is relatively small, there is still the possibility that the workpiece handled on the machine is not sufficiently accurate.

To eliminate this drawback, the suggestion has been made to machine the slideways under an initial bending stress in such a way that the slideways are curved in their longitudinal direction when unloaded and linear when loaded, i. e. in the operating condition. It is, however, difficult to achieve by means of this curved tensioning of the slideway an arch which will be flattened out at a certain load.

The present invention aims at providing a device by means of which an arch of the slideways, which is accurately determinable in advance, can be ground in their longitudinal direction. The invention consists in the fact that means are provided to raise and lower the grinding wheel during its travel across the slideway in such a way that the said wheel describes an arc, the chord length of which corresponds to the length of the slideway to be ground and the rise of which corresponds to the sag required.

Two embodiments of a device according to the invention are illustrated, by way of example, in the attached drawing, in which:

Fig. 1 is a lateral partly sectional view of a device for grinding slideways, wherein a grinding wheel support is arranged to oscillate on eccentric journals of a rotatable shaft which is turned by a motor in order to move the grinding wheel up and down;

Fig. 2 is a partly sectional view of the same device in which the upward and downward motion of the grinding wheel is produced by the latter's infeed motor; and

Fig. 3 is a circuit diagram for the control of the motor which causes the upward and downward motion of the grinding wheel.

Referring now more particularly to Fig. 1 of the attached drawing, a grinding attachment is shown in which the support **1** of the grinding wheel spindle **2** is suspended on eccentric journals **3***a* of a rotatable shaft **3**. Secured to the shaft **3** is the lever **4** which, by means of the motor **7** acting via a threaded spindle **5** and the worm gearing **6**, turns the shaft **3** a few degrees to either side out of its central position, in which the axis of the eccentric journal **3***a* is vertically beneath the axis of the shaft **3**, so that the grinding wheel **8** is moved a little towards or away from the workpiece **13** according to the position of the lever **4**. The speed of the table driving motor **11** (Fig. 3), serving to provide the longitudinal motion of the table **12**, on which the workpiece **13** rests, and the speed of the motor **7** bear a certain relationship to each

other which can be electrically or mechanically adjusted. This ratio determines the rise of the slideway arch on the workpiece **13**. Reversing the direction of table **12**, also changes the direction of rotation of the motor **7** and thus of the lever **4**, as described in conjunction with Fig. 3. The selective transmission ratio between the table driving motor **11** and the motor **7** can also be replaced by a fixed ratio. In this case the length of the effective arm of the lever **4** can be altered by sliding the driving unit **5** to **7** up or down, thus also making it possible to adjust the rise of the workpiece's slideway arch.

The spindle **8***a*, the gearing **9** and the infeed motor **10** serve merely to swing the support **1** in and out in order to feed in the grinding wheel **8** in accordance with the amount of stock to be removed.

A second embodiment of the device for obtaining a longitudinally arched slideway is illustrated in Fig. 2. In this embodiment the swivelling of the support **1**, which is used to feed in the grinding wheel automatically for the purpose of removing stock, also serves to raise and lower the grinding wheel for the purpose of producing the arc. As in Fig. 1, the support **1** is arranged to rotate about the shaft **3***b*, the journals **3***c* of which are not disposed eccentrically. In the device shown in Fig. 2 the spindle **8***a*, the gearing **9** and the infeed motor **10** serve not only to feed in the grinding wheel in accordance with the amount of stock to be removed, but at the same time to raise and lower the wheel **8** during grinding and to produce an arched way.

To produce an arched slideway, the infeed motor **10** is so controlled in the case of this device that the support **1** is swung out about the shaft **3***b* via the gearing **9**, whereby the grinding wheel **8** is raised, thus producing the difference in the rise of the arch of the surface to be ground.

While the workpiece **13** is displaced beneath the grinding wheel **8**, which is driven by the motor **11**, until the workpiece centre M is vertically below the grinding wheel axis, the grinding wheel **8** is raised and lowered by swivelling as the table is moved to its terminal position at the initial height. During the reciprocal motion the infeed motor is simultaneously lowered to the zero position, at which the theoretical size is attained.

The wiring diagram (Fig. 3) shows the control of the table driving motor **11** and of the infeed motor **10** or **7**. A direct-current generator **15** with two exciting windings **16** and **17** is coupled to the table driving motor **11**. The excitation of the infeed motor **10** or of the motor **7** is set at an adjustable direct-current voltage applied to winding **18**. The transmission ratio between the table motor **11** and the motor **7** or **10** can be adjusted with the aid of the regulating transformer **19** by altering the generator exciting voltage. If the regulating transformer is still further adjusted via a cam disk, independently of the table motion, by means of the same device as the regulating transformers **20***a* and **21***a*, the shape of the grinding curve can be influenced by the shape of the cam disk. This could also be effected by a mechanical or infinitely variable gear. The current collectors **20** and **21** of the regulating transformers **20***a* and **21***a* are adjusted together from zero to maximum or from maximum to zero for the grinding length by the table motor **11** or, mechanically, by the motion of the work-table **12**. By means of an adjustable coupling the central position of the two current collectors can be brought into register with the centre of the grinding length. At the start of the traverse of the work-table **12** the current in the exciting winding **16** is at its maximum and in the other winding **17** at zero. The generator voltage is thus at its maximum and therefore the speed of the motor **7** or **10** as well. In the middle of the traverse the exciting current in both coils is equal. As, however, the current flows through these coils in op-

posite directions, the generator excitation is zero and thus the generator voltage and the speed of the motor **7** or **10** are also zero. When the work-table continues its travel, the current in the exciting winding **17** is preponderant. Thus the direction of the rotor current in the generator **15** and motor **7** or **10** has been reversed and the motor **7** or **10** runs in the opposite direction and again attains its maximum speed in the terminal position of the work-table. Now, as the direction of the table motion changes, the direction of rotation of the generator is also reversed and thus the motor **7** or **10** also runs at maximum speed in the opposite direction and the cycle begins again in this direction.

The device described can be employed wherever a motor is used for feeding in the grinding wheel.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

1. A device for grinding substantially flat workpieces so as to arch said workpiecs in at least one direction, comprising a rectilinearly reciprocal work table for supporting a workpiece, a grinding wheel, a support located above said table and rotatably carrying said grinding wheel, means mounting said support for angular reciprocal movement about an axis for adjustment of the elevation of said grinding wheel above said work table, reversible electric motor means operatively connected to said support for angularly moving the same to effect said adjustment of elevation of said grinding wheel, and an electrical control system responsive to displacement of said work table and connected to said electric motor means for regulating the elevation-adjusting operation of the latter in dependence on the motion of said work table, whereby each workpiece may be ground with a high degree of precision.

2. A device according to claim 1, the perpendicular distance between said axis and the workpiece-supporting surface of said table being invariable.

3. A device according to claim 1, said control system including means for changing the speed of rotation and the direction of rotation of said electric motor means in accordance with said motion of said work table.

4. A device according to claim 1, further comprising additional reversible electric motor means operatively connected to said work table for reciprocally displacing the same, and a D. C. generator coupled to said additional electric motor means and connected in circuit with said first-named electric motor means for energizing the latter in accordance with the operation of said additional electric motor means.

5. A device according to claim 4, said control system including an energization circuit for said generator, and means operated by said table during displacement thereof for controlling the electric current flow in said energization circuit.

6. A device according to claim 1, further comprising a rotatable shaft provided with at least one eccentric bearing portion, said grinding wheel support being pivotally carried by said eccentric bearing portion, a lever fixed to and extending at an angle from said shaft, and transmission means interconnecting said electric motor means with a part of said lever spaced from the junction of the latter with said shaft, whereby upon angular displacement of said lever and consequent rotation of said shaft the elevation of said support together with said grinding wheel relative to said work table is adjusted due to movement of said eccentric bearing portion about the axis of said shaft.

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