Dec. 18, 1956 O. BRETSCHER 2,774,197

MEANS FOR FEEDING A GRINDING WHEEL OF A PERIPHERAL GRINDING ATTACHMENT INTO A WORKPIECE

Filed Aug. 9, 1954 2 Sheets-Sheet 1

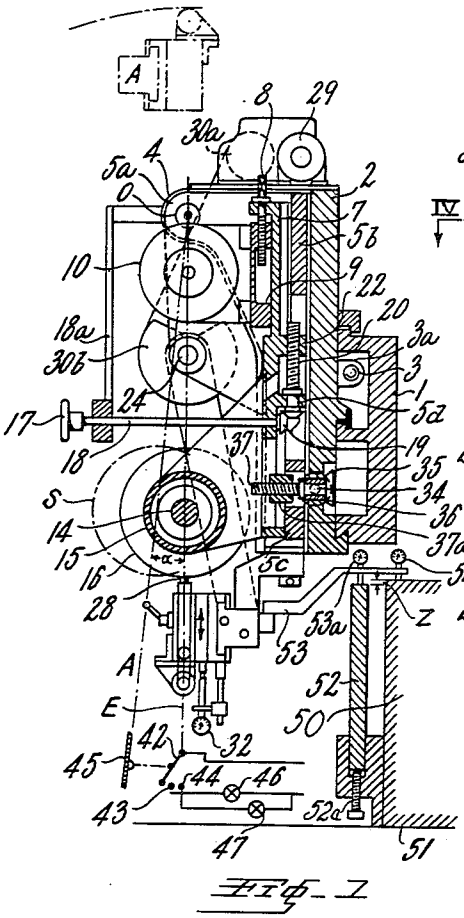

Fig. 1

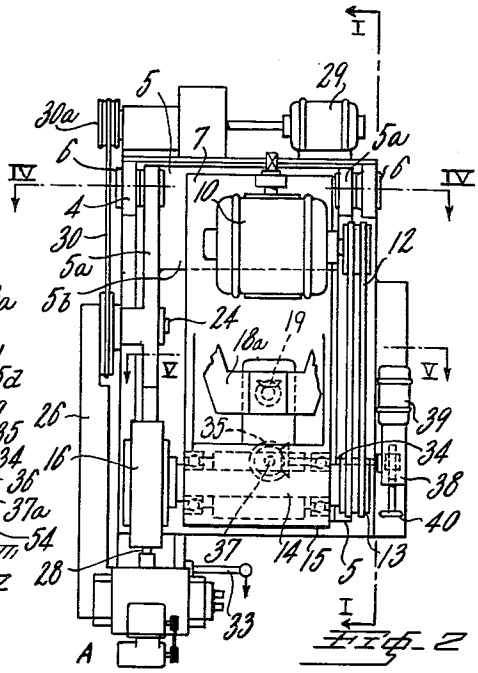

Fig. 2

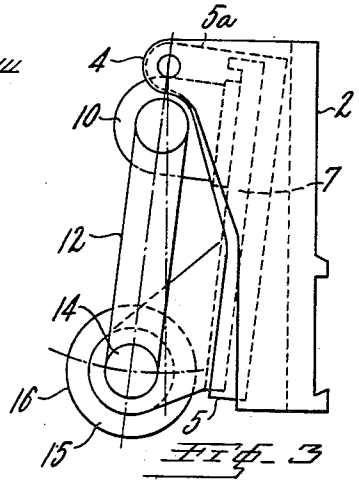

Fig. 3

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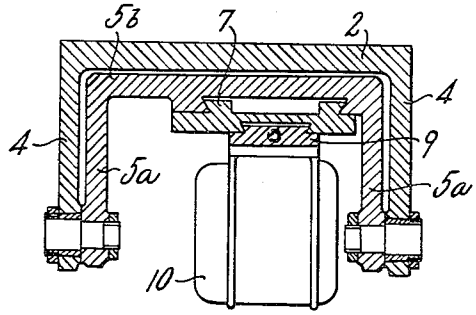

Fig. 4

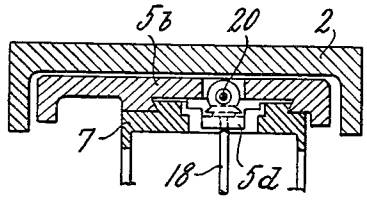

Fig. 5

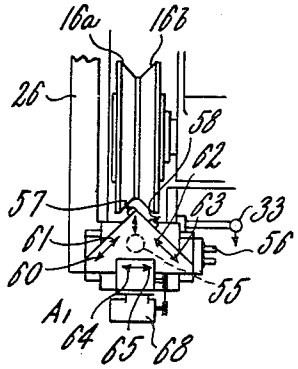

Fig. 6

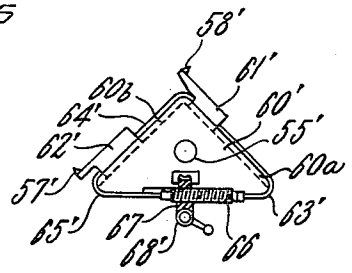

Fig. 7

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MEANS FOR FEEDING A GRINDING WHEEL OF A PERIPHERAL GRINDING ATTACHMENT INTO A WORKPIECE

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7 Claims. (Cl. 51—165)

The present invention relates to grinding wheel attachments, and in particular to means for feeding in toward a workpiece the grinding wheel of a peripheral grinding attachment.

In known grinding attachments of this type the grinding wheel shaft is supported in a vertical rest which has to be guided without play in slide bars. It is obvious that the setting of such a rest to an accuracy of a hundredth of a millimetre is difficult since, owing to inertia and friction, tensions arise, to overcome which far greater power is required than would be necessary to displace the rest, with the result that too great a feed is easily produced.

The present invention aims at eliminating this drawback in order to enable the grinding wheel to be smoothly fed in and the grinding to be slowed down, as well as to achieve an extremely accurate and clean ground surface.

The procedure according to the invention consists in the fact that the grinding wheel is fed in a circular arc into the work piece in such a way that, the travel of the grinding wheel axis being uniform, the feed travel of the grinding wheel is, in accordance with the sine function, reduced to zero and the nominal dimension attained in this zero position.

This procedure is carried out with the aid of an attachment which is characterized by the fact that on a horizontally adjustable slide there is suspended after the fashion of a pendulum a swivel member on which is arranged a vertically adjustable grinding wheel bearing, the grinding wheel spindle of which is mounted parallel to the suspension arbor, means to move the swivel member being provided, and that furthermore articulated or flexibly attached to the swivel member is an arm, on the end of which a compound slide rest with a diamond dresser is secured, which in its operative position is shiftable in the plane including both said spindle and said arbor.

These and other objects of the invention will become further apparent from the following detailed description, reference being made to the accompanying drawings showing preferred embodiments of the invention.

In the drawings:

Fig. 1 is a cross-section taken along the line I—I in Fig. 2 and through the grinding attachment constructed in accordance with the present invention.

Fig. 2 is a front view of said grinding attachment,

Fig. 3 is a side view of the swivel plate and grinding wheel slide employed in said attachment,

Fig. 4 is a section along line IV—IV in Fig. 2,

Fig. 5 is a section along line V—V in Fig. 2,

Fig. 6 shows an alternative embodiment of the compound slide rest to which the diamond dresser is secured, and

Fig. 7 shows still another alternative embodiment of the compound slide rest.

Referring now to the drawings, a cross-bar or horizontal, transverse support 1 of a grinding machine supports a slide 2, which forms the basis of the grinding attachdent and can be displaced transversely to the grinding table by means of the threaded spindle 3 which is rotatably mounted on the support 1 and extends through one or more threaded bores formed in a corresponding number of lugs or projections 3*a* fixed to the side of the slide 2. Thus, rotation of the spindle traverses the slide 2 across the support 1. Secured to the slide 2 are two lugs 4 in which the swivel plate 5 is supported. The swivel plate 5 is formed by the arms 5*a*, which are interconnected by transverse connecting members 5*b* and 5*c*, 5*d*, and is swivelly supported in the lugs 4 by means of the bolts 6. On the transverse connecting member 5*b* guides or guide tracks are provided in which a slide 7 is moved up and down. This slide 7 carries the bearing plate 9 of the grinding motor 10, which plate is likewise shiftable and adjustable relative to the slide 7 with the aid of the screw 8. The grinding motor 10 drives via the V belt 12 the V belt pulley 13 which is supported on the arbor 14. The latter is mounted in the bearing 15 and carries on its other end the grinding wheel 16. The bearing 15 is so secured to the bottom end of the slide 7 that the arbor of the grinding wheel can reach a position vertically below the axis of the swivel or pivot bolts 6 on which the swivel plate 5 is mounted. By means of the handwheel 17, arranged on the shaft 18 which is guided in the stirrup 18*a*, the threaded spindle 20 is turned via the pair of bevel gears 19. The spindle 20 engages the threaded nut 22 of the slide 7 so that said slide, together with the motor 10 and the grinding wheel 16 can be vertically adjusted. The spindles 18 and 20 are mounted in the cross piece or transverse member 5*d*. Swivelly secured to the left arm 5*a* of the swivel plate 5 by means of the bolt 24 is furthermore an arm 26, to which is attached the grinding wheel dresser constituted by the compound slide rest A and the diamond 28. As the compound rest A with the diamond 28 is in the way during grinding, it can be swivelled by means of a small motor 29 via the wire rope or cable 30 into the position indicated by broken lines in Fig. 1. To this end, one end of the rope or cable is connected to a drum 30*a*, while the other end is connected to a plate 30*b* mounted on the bolt or axle 24, whereby the plate 30*b* is fixedly connected to the arm 26. Upon operation of the motor 29, the cable is either wound onto or unwound from the drum 30*a* so as to move the arm and the dresser either to the broken line position or to the full line position, respectively, shown in Fig. 1.

The dial gauge micrometer 32 on the compound rest A serves to measure the height at which the diamond or other dressing element should be set. The compound rest A must be clamped in the grinding position by means of a locking screw 33. Mounted in the slide 2 is a spindle 34, by means of which the threaded spindle 37 is rotated via the bevel gears 35 and 36. The threaded spindle 37 engages the threaded nut 37*a*, which is flexibly or resiliently articulated to the swivel plate 5, whereby the swivel plate 5 and thus the grinding wheel may be swung out of the vertical plane into the dotted position S and vice versa. The spindle 34 is connected via a reduction gear 38 to the motor 39 which effects the automatic feeding-in of the grinding wheel toward the workpiece 50. A hand-operated drive 40 (Fig. 2) also enables the grinding wheel 16 to be fed in and withdrawn manually. The vertical position of the swivel plate 5 is the zero position. Here the grinding wheel spindle axis is located in the same vertical plane as the swivel axis of the plate 5, i. e., it is located vertically below the axis of swivel O constituted by the bolts 6 and thus is in its lowest position. The diamond, when dressing the grinding wheel, moves in the plane E formed by the two

axes. This plane swings out of the zero position by the angle α.

The feed-in motor **39** is controlled by a switch **42**, which has two contacts **43** and **44**. The switch **42** is actuated by a stop **45** which is secured on the swivel plate **5** so that it moves along with the grinding wheel **16**. Connected to the circuit, which is first closed by the switch **42**, is a signal lamp **46** which shines red for instance, while a green lamp **47** is switched in by means of the contact **44**.

As may be seen from Fig. 1, the workpiece **50** is clamped to the worktable **51**, and arranged beside the latter is the template **52** which is vertically adjustable, as by means of a screw **52***a*. Two dial gauge micrometers **53***a* and **54** are arranged on the arm **53** which is swivelly attached to the slide **2**.

Figs. 1 and 2 illustrate a peripheral grinding wheel **16** by means of which wheel horizontal grinding surfaces are machined. If profile surfaces, in which two surfaces are at right angles to each other, have to be ground, two grinding wheels arranged side by side and a compound rest with two diamonds are used.

As is shown schematically in Fig. 6, secured to the arm **26** is the compound rest A_1 which is swivelly mounted on the pivot **55** and can be locked at a predetermined position. The diamonds **57** and **58** are arranged at right angles to one another and are shiftable in the already mentioned plane E. The arrows show the paths along which the diamonds **57** and **58** can be moved. When one of the diamonds is shifted in the direction of arrows **60** and **61**, the wheel **16***a* will be dressed at an angle of 45°, and when the other diamond is shifted in the direction of arrows **62** and **63** the grinding surface of the wheel **16***b* will be dressed at right angles to the wheel **16***a*.

Fig. 7 shows a possible embodiment of the compound rest according to Fig. 6. The triangular block **60'** is rotatably mounted on the bolt **55'** and can be locked in the desired position by any suitable means. Two sides of the block **60'** have slide guides **60***a* and **60***b* in which the slides **61'** and **62'** are shiftably mounted. These slides, which carry diamond dressers **58'** and **57'** respectively, are connected via belts **63'**, **64'**, and **65'** with each other and with a non-rotating screw **66** on which is arranged a worm gear **67** shaped as a threaded nut. The gear **67** can be rotated via a worm **68'**. The belts move both slides **61'** and **62'** simultaneously in the same direction and at the same time cover the slide guides **60***a* and **60***b* not occupied by the slides **61'** and **62'**, respectively.

When the compound rest A_1 is rotated about the pivot **55** (or bolt **55'**) and locked in such a way that one of the diamond dressers, say **57** (or **57'**), moves in a horzontal plane, i. e. in a direction substantially parallel to or coincident with the arrows **64** and **65**, shown in Fig. 6, a grinding wheel can be dressed horizontally as shown in Figs. 1 and 2. A small motor **68** (Fig. 6) may be provided for connection to the worm **68'** to move the slides of the compound rest.

The procedure is as follows:

The workpiece **50** is clamped to the grinding table **51**. The template **52** is arranged beside the said workpiece. The height of the template is set at the finished dimension of the workpiece. The swivel plate **5** is brought into the zero position, $\alpha=0°$. Then the diamond dresser **23** is brought, with the aid of suitable adjustment means, to the template height as read on the dial micrometer **32**, whereupon the grinding wheel **16** is dressed with the diamond in the manner already described. The grinding wheel is now accurately set at the template height, i. e. at the finished dimension of the workpiece. The grinding allowance Z is determined with the aid of the two dial micrometers **53***a* and **54** and the swivel plate is swung out of the vertical plane E through an angle α, the size of which corresponds to the feed-in travel required to remove the grinding allowance Z. The grinding process is now carried out, the slide **2** moving horizontally past the workpiece **50**. The speed of the feed-in motor and thus the time of the feed-in travel is controlled by means of a potentiometer (not shown). The swivel plate now moves uniformly into the zero position, while the feed-in travel of the grinding wheel is, in accordance with the sine function, reduced to zero and the nominal dimension is attained in this position. When the swivel plate **5** has almost reached its zero position, the stop **45** closes the contact **43** so that the red lamp **46** lights up, indicating that the grinding wheel has practically completed its work. The operator now checks whether the grinding wheel needs to be dressed for the last turn. If this is so, he swivels the compound rest A into the dressing position and trues the wheel **16**, it being possible for him to feed the grinding wheel into the diamond dresser **28** by means of the handwheel **17**. Then, the compound rest A is raised once again and the grinding process continued until the green lamp lights up and the feed-in motor is switched off.

The grinding of profile rails is effected in a similar manner, except that a template, whose shape is adapted to the profile rails, is used for the setting of the two diamond dressers.

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. In a grinding machine having a grinding wheel, means supporting said grinding wheel and arranged for pendular swinging movement about a first axis to move said grinding wheel toward and away from a workpiece, respectively, and dresser means for trueing said grinding wheel; a first arm swingably attached at one end thereof to said supporting means for movement about a second axis, and rest means attached to the other end of said arm and carrying said dresser means, said first and second axes being disposed in said supporting means and in a common plane with the axis of rotation of said grinding wheel.

2. In a machine according to claim 1, means operatively connected to said first arm for swinging the latter through an angle of approximately 180° about said second axis, whereby in one terminal position of said arm said dresser means is located in said plane with said first and second axes and said axis of rotation of said grinding wheel, while in the other terminal position of said arm said dresser means is disposed out of the region of said workpiece.

3. In a machine according to claim 1, a second arm operatively connected to said supporting means for swinging movement relative thereto about a third axis disposed substantially at right angles to said first and second axes, template means arranged to be positioned adjacent said workpiece upon grinding of the latter by said grinding wheel, the height of said template means corresponding to the final dimensions to be imparted to said workpiece, and a pair of dial micrometers supported by said second arm and operatively engaging said template means and said workpiece, respectively, whereby the nominal dimension of said template means is indicated by one of said dial micrometers while the actual dimensions of said workpiece are indicated by the other of said dial micrometers.

4. In a machine according to claim 3, said one dial micrometer being positioned on said second arm at a predetermined distance from said third axis, whereby said one dial micrometer may be swung over said dresser means.

5. In a machine according to claim 1, said rest means

comprising a triangular block, pivot means on said first arm and supporting said block for rotation about an axis substantially perpendicular to said axis of rotation of said grinding wheel, said block being provided with a peripheral guide track, and a pair of slides movably arranged in said guide track, said dresser means comprising a pair of diamonds mounted in said slides, respectively.

6. In a machine according to claim 5, two of the sides of said block being arranged at right angles to each other, said slides being arranged on said sides of said block, respectively, and belt means interconnecting said slides, whereby the latter may move jointly and in the same direction about said block during trueing operations.

7. In a machine according to claim 6, said belt means being substantially coincident with and covering those portions of said guide track not occupied by said slides.

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