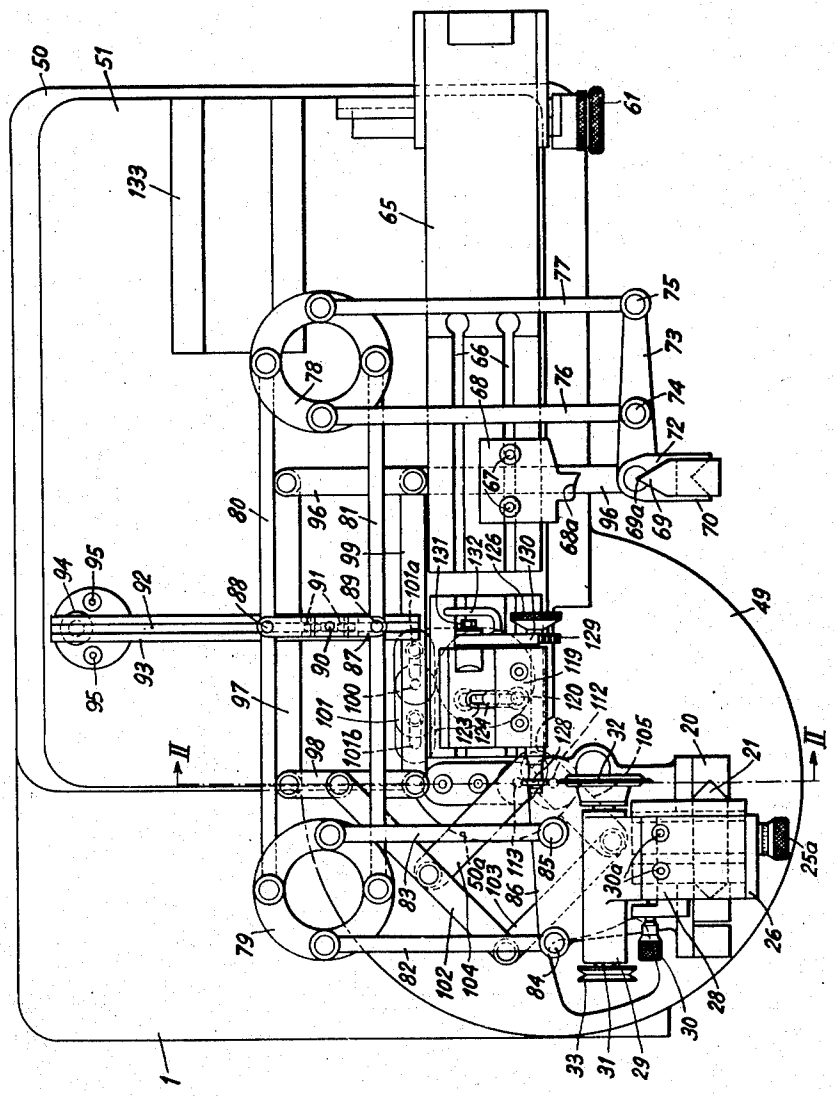
March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 1

Fig. 1



INVENTOR

JAKOB SENN

BY Young, Emery & Thompson

ATTYS.

March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 2

Fig.2

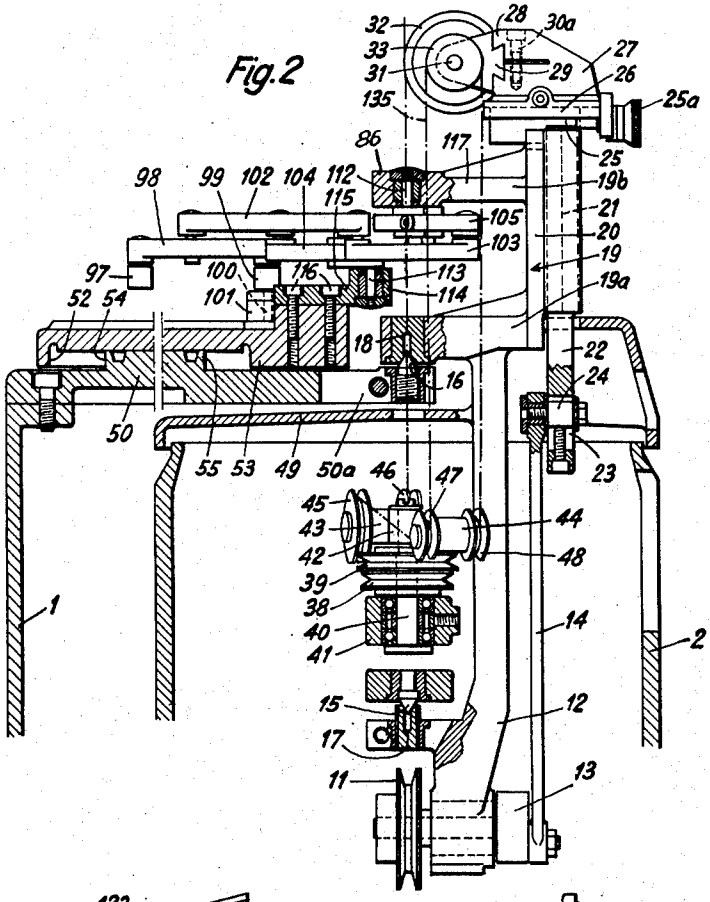


Fig.7

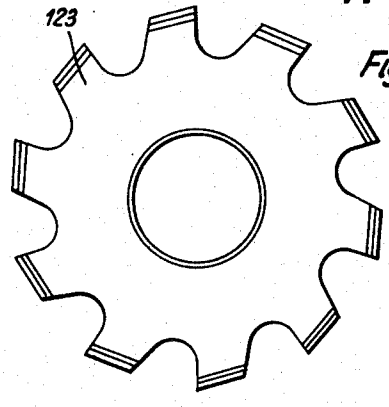
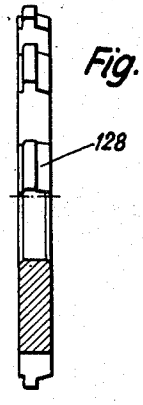


Fig.8



INVENTOR

JAKOB SENN

BY Young, Emery & Thompson

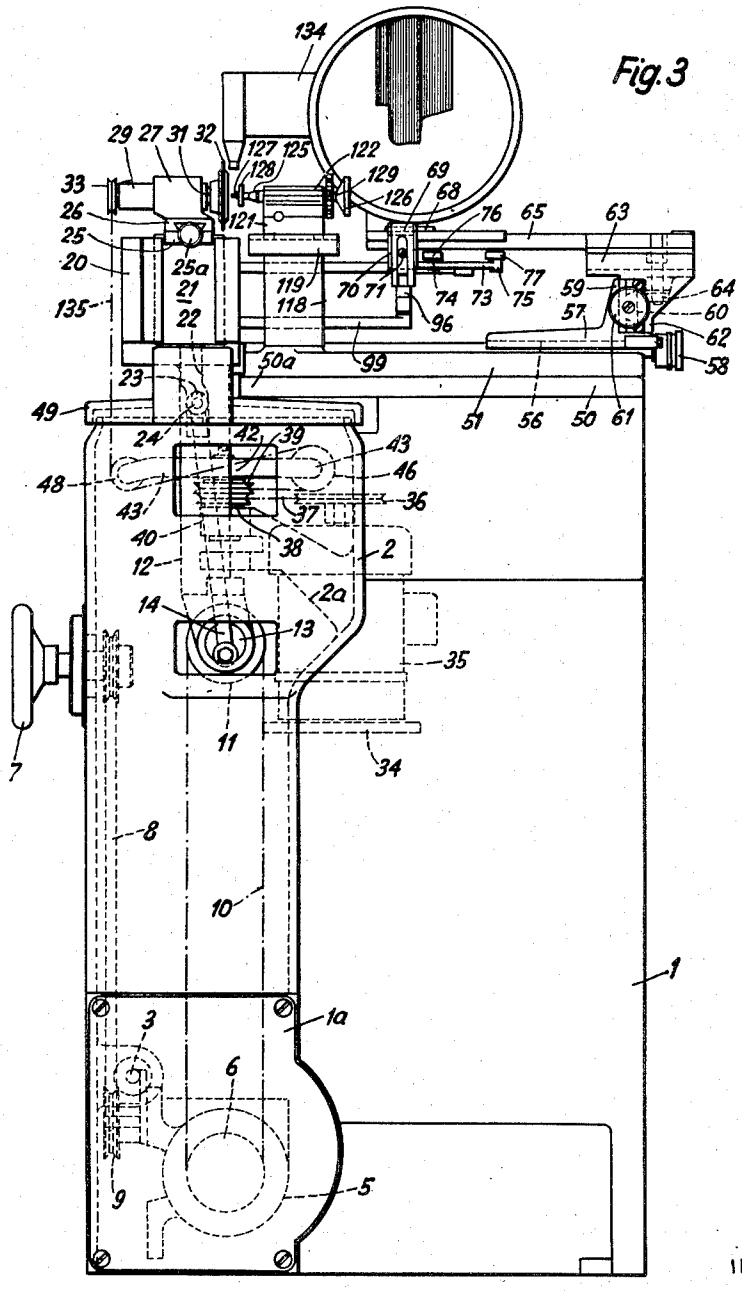
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March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 3

Fig. 3



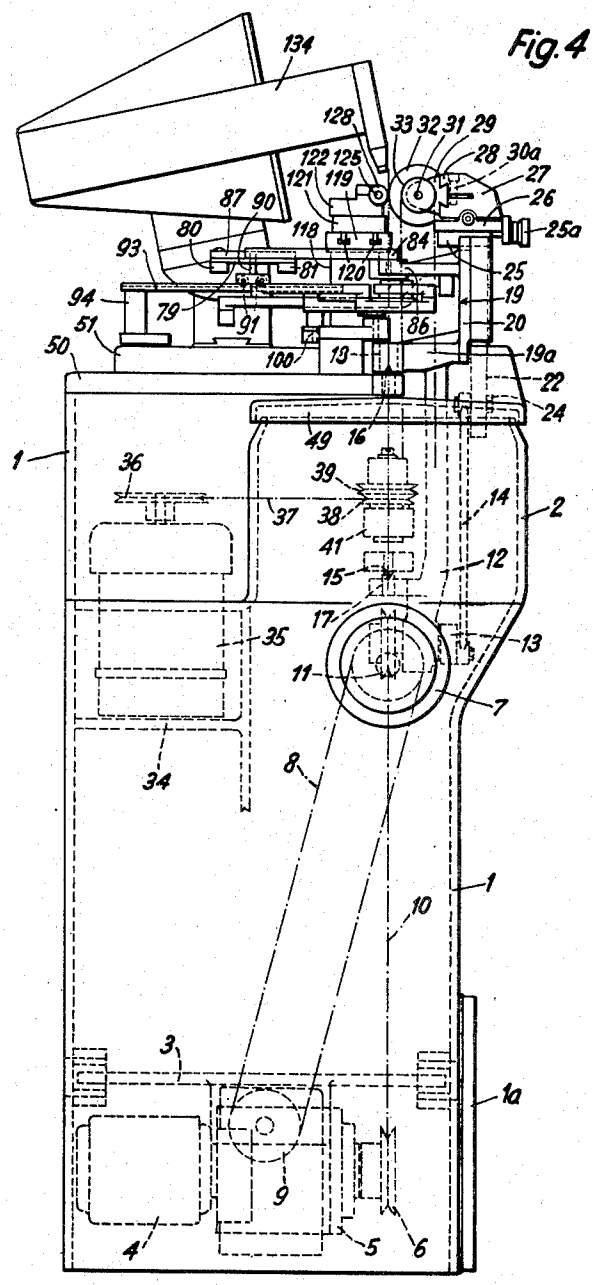
INVENTOR
JAKOB SENN
BY Young, Emery & Thompson
ATTYS.

March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 4

Fig. 4



INVENTOR

JAKOB SENN

BY Young Emery & Thompson

ATTYS.

March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 5

Fig. 5

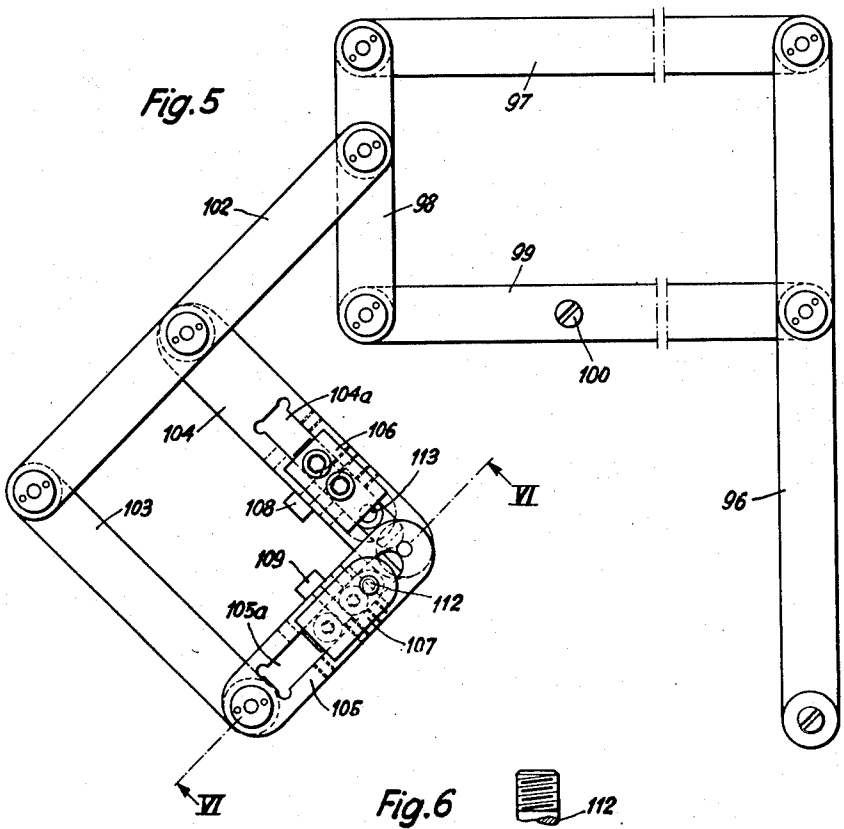
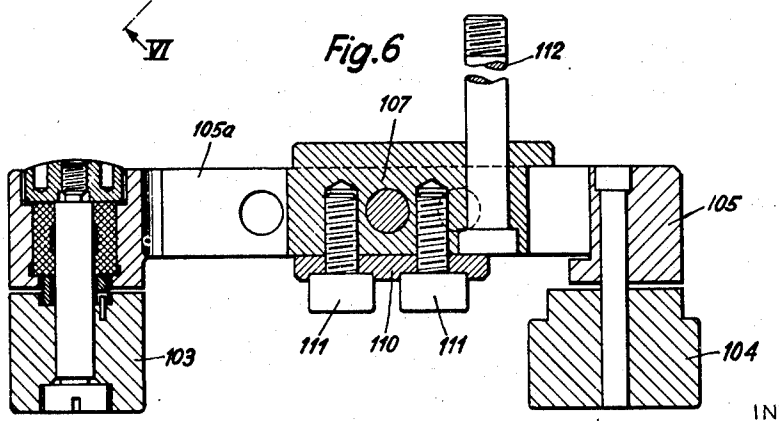


Fig. 6



INVENTOR
JAKOB SENN
BY Young, Emery & Thompson
ATTYS.

March 12, 1957 J. SENN 2,784,533

PROFILE GRINDING MACHINE

Filed Jan. 19, 1955 6 Sheets-Sheet 6

Fig. 9

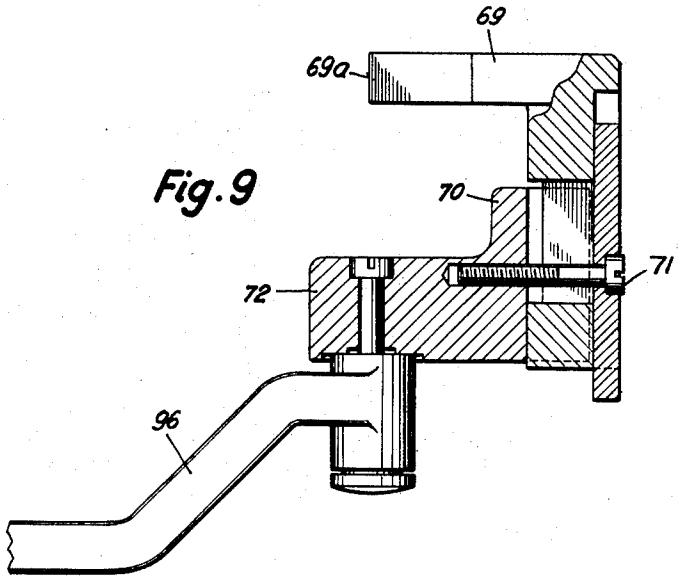
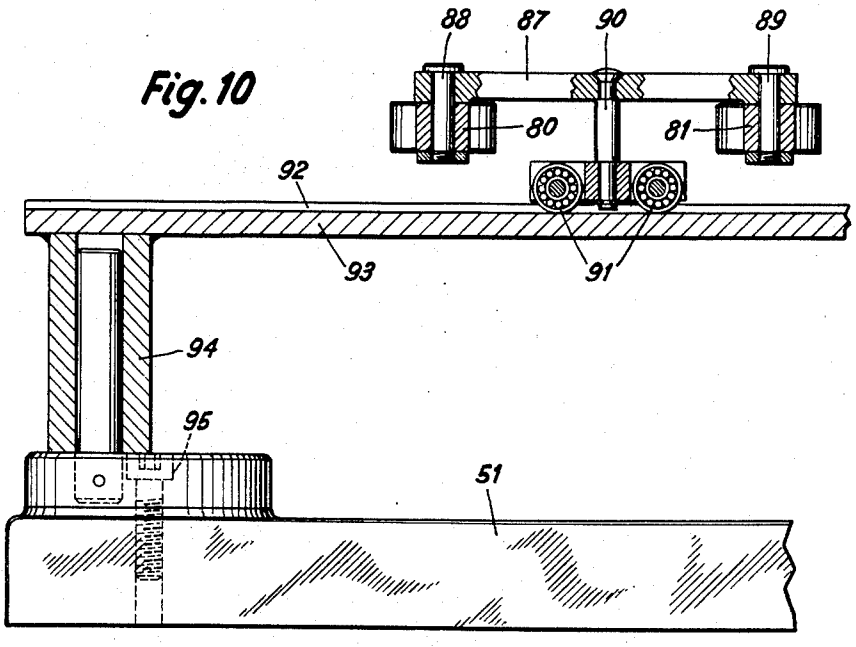


Fig. 10



INVENTOR
JAKOB SENN
By Young, Emery & Thompson
ATTYS.

United States Patent Office 2,784,533 Patented Mar. 12, 1957

2,784,533

PROFILE GRINDING MACHINE

Jakob Senn, Biel, Switzerland, assignor to Diametal A. G., Biel, Switzerland

Application January 19, 1955, Serial No. 482,843

Claims priority, application Switzerland February 5, 1954

2 Claims. (Cl. 51—100)

The present invention relates to improvements in profile grinding machines comprising a work holder and a tracer which is guidable along a former plate, and the profile grinding machine as disclosed herein is characterized by the provision of a control plate which is movable on the stationary machine frame and to which are secured said former plate and work holder.

The main objects of the present invention are to provide an arrangement which permits to grind a prescribed profile very accurately by relatively simple means, to make the overall height of the machine small, and to keep the space above the grinding disc free to permit, for example, of readily mounting an optical control means.

These and related objects are attained by the machine shown, in one form of invention and by way of example, in the accompanying drawings, in which:

Fig. 1 is a top plan view,

Fig. 2 is a section through the upper machine portion on the line II—II of Fig. 1, the parallel guiding means having been omitted,

Fig. 3 is a front elevation on a smaller scale,

Fig. 4 is a side view also on a smaller scale,

Fig. 5 shows a top plan view of a twin pantograph,

Fig. 6 shows a section on the line VI—VI of Fig. 5 on a larger scale,

Fig. 7 is a top plan view of the work,

Fig. 8 is a sideview, partly in section, of the work,

Fig. 9 is a detail elevational view of the tracer, and

Fig. 10 is a detail elevational view of another part of the mechanism.

The machine frame consists of a body 1 which at the same time serves as column, and a cylindrical head 2 which is disposed laterally and slightly offset forwardly. Within said frame, a drive motor 4 is suspended from a horizontal shaft 3, which via a reduction gear 5 drives a grooved pulley 6. Body 1 at this point is closed by a removable cover 1*a*. Reduction gear 5 is infinitely variable, and the degree of reduction may be adjusted through a handwheel 7 via a belt 8 and a pulley 9. The rotation of pulley 6 through a belt 10 is transferred on to a further grooved pulley 11 which is pivoted to an arm 12. To the pivot pin of pulley 11, which is fixed to the latter, is secured an eccentric 13 with a connecting rod 14. Arm 12, in contrast to the machine frame, belongs to the rotatable machine portion which is rotatable between the centers 15 and 16 of the stationary machine frame in bearing members 17 and 18 about a vertical axis which is the main axis of the machine. Said rotatable machine portion which is rotatable about the main axis relatively to the frame, further comprises a U-shaped yoke 19 in one leg 19*a* of which is held the bearing member 18 for center 16. The bearing member 17 is secured in the arm 2*a* which is integral with head 2.

The cross-web 20 of yoke 19 comprises V-ways on which the vertical slide 21 is movably mounted. Said slide comprises a lower extension 22 with an elongated hole 23 through which projects the pin 24 of connecting

rod 14, so that the latter and thus slide 21 are vertically reciprocated by motor 4. The vertical slide 21 has a head 25 provided with horizontal V-ways for a horizontal slide 26 which is movable by means of a screw 25*a*. Slide 26 again has a head 27 of which the side facing the machine main axis is provided with V-ways 28 in which is retained a tool holder 29 by a screw 30, said holder being also movable horizontally, but at right angles to slide 26. Screws 30*a* serve for stopping the tool holder within the V-ways 28. In tool holder 29 is rotatably mounted an axle pin 31 which carries a grinding disc 32 at the end facing the main axis, and a grooved roller 33 at the other end. Grinding disc 32 thus may be moved in the horizontal plane into any desired position by slide 26 and tool holder 29, and vertically by slide 21, connecting rod 14 and eccentric 13. In the operating position, the grinding disc is set so that its vertical tangent which is remote from tool holder 29, i. e. to the left in Fig. 2, coincides with the machine main axis, and the corresponding tangential point is the point of contact (working point) with the work.

Thus, the machine portion, which is rotatable about the main axis, essentially comprises the arm 12, yoke 19, the bearing members 17 and 18, the means for producing and transferring the vertical reciprocation of the tool holder, such as grooved pulley 11, eccentric 13, connecting rod 14, slides 21 and 26, and the tool holder with grinding disc 32.

A second drive motor 35 is secured to a column 34 of body 1, of which a grooved pulley 36 transfers the rotary movement of the motor via a belt 37 on to a second grooved pulley 38. The latter and a further grooved pulley 39 are fixed to an axle 40 which is rotatably mounted in a bearing 41 of body 1. In a manner not further shown, a bearing member 42 is rotatably held in the axis of shaft 40 and comprises two symmetrical arms 43 at the ends of which are disposed axles 44 at right angles thereto, and each axle 44 again carries at its ends two pulleys 45, 46 and 47, 48 respectively. An endless elastic belt 135 is trained from pulley 39 over pulleys 46 and 48, thence through an aperture of a cover 49, over the driving pulley 33 of grinding disc 32, through said aperture, over pulleys 47 and 45 and back to pulley 39. Such arrangement ensures operation of grinding disc 32 even when the latter, belonging to the rotatable machine portion, is swung about the machine main axis.

The upper portion of the frame is formed by a plate 50 of which an arm 50*a* carries the center 16, the rotatable machine portion being mounted for rotation on the centers 16 and 15. A control plate 51 is set freely slidable on plate 50, and its relative sliding movements are limited by its edges 52 and 53 which abut against corresponding shoulders 54 and 55 of plate 50. On control plate 51 is provided a first V-way 56 (Fig. 3) on which a slide 57 is mounted movable by a screw 58. Slide 57 comprises a lug 59 on the vertical outside face of which is provided a further V-way 60 in which a slide 62 is mounted movable by a screw 61, said slide 62 being movable at right angles to slide 57. Slide 62 carries a bracket 63 to which is secured a former-plate table 65 by means of a screw 64. Table 65 is provided with a groove 66 (Fig. 1) in which is secured a former plate 68 by means of screws 67. According to the size of the plate 68 one or two grooves 66 are provided. Opposite former-plate profile 68*a* is disposed a tracer 69 which is retained in a V-way 70 (Fig. 9) in vertically movable relation, the corresponding clamping screw being designated by 71. The V-way 70 is provided with an extension 72 which points towards former plate 68 and is fixed on a lever 73 to which, at 74 and 75, are pivoted two arms 76, 77 of a parallel guiding means. The latter further comprises,

in conventional manner, rings 78 and 79 and further arms 80 to 83. The connection and disposition of said rings and arms corresponds to the conventional arrangement of a parallel guiding means. The last arms 82 and 83 of the latter are pivoted, at 84 and 85, to a plate 86 which is continuous with V-way 20. Any and each rotary movement of tracer 69 thus is transmitted, via the parallel guiding means 76 to 83, on to the yoke 19 and, therefore, on to the grinding disc 32. Translatory movements, i. e. movements which do not provoke any angular movement of ring 78, do not bias the movable machine portion, as far as the transmission on to the parallel guiding means is concerned. The arms 80 and 81 of the latter are interconnected by a strap 87 of which the ends are pivoted to said arms at 88 and 89.

To strap 87 is rotatably secured a vertical pin 90 to the free end of which are pivoted two rollers 91 which run in a groove 92 of a rail 93. The latter is connected to control plate 51 via a pedestal 94 and screws 95, as shown in Fig. 10. The parallel guiding means thus is supported through said rollers on the control plate 51, without impairing the movability thereof.

To V-way 70 of tracer 69 is pivoted the long arm 96 of a first individual pantograph which comprises, in conventional manner, said long arm 96 and other legs 97 to 99 which are interconnected in pivotable relation. Leg 99 at 100 is rotatably mounted in a bearing 101 of control plate 51, whilst leg 98 is pivoted to the long arm 102 of a second individual pantograph. Bearing 101 is secured to control plate 51 by screws 101*a*, elongated holes 101*b* being provided in the control plate so that the point of articulation of pantograph 96 to 99 is movable on the control plate relatively thereto and may be screw-locked thereto again. Said second pantograph is fundamentally constructed similar to the first and comprises, besides leg 102, two parallel legs 103, 104 and a leg 105 which is parallel to long leg 102. The two hingeably interconnected pantographs 96 to 99 and 102 to 105 together form a twin pantograph. Each of the legs 104, 105 (Fig. 5) has a slot 104*a* and 105*a* respectively, and in each of these slots is movably mounted a sliding block 106 and 107 respectively. The latter may be fixed in their positions by screws 108 and 109 according to the desired reduction ratio. Each of the blocks 106, 107 comprises an underplate 110 which is secured in its position by screws 111, the edge of said plate securing the pivot pin 112 and 113 respectively. The two pins 112, 113 stand at right angles to the plane of the pantograph, pin 112 which is fixed to leg 105, pointing upwardly and pin 113 which is fixed to leg 104, pointing downwardly. Pin 113 is rotatably held in an eye 114 of an arm 115 which is secured to control plate 51 by means of screws 116. Pin 112 forms the fixed point of the pantograph, is situated in the machine main axis and is journalled in leg 19*b* of yoke 19 which, as known, belongs to the rotatable machine portion.

From the foregoing may be seen that each single pantograph at one point (100 and 113 respectively) is movably mounted in control plate 51, whilst the twin pantograph has a fixed point (112) situated in the machine main axis.

Control plate 51 further comprises a bracket 118 (Fig. 3) to the upper side of which is attached a plate 119. On the latter is secured by screws 120 a carriage 121 with respect to which the work slide 122 is movable, at right angles to slide 56, so far laterally as is permitted by a slot 123 of the work slide, said slot being traversed by a screw 124 for attachment to the carriage. A guide pin 123*a* serves for rectilinearly guiding such displacing movement. In work slide 122 is mounted a work spindle 125 which is rotatable by means of a handwheel 126. The work 128 is clamped to spindle 125 by means of a screw 127. For the sake of clarity, the work slide in Fig. 3 has been moved to the right so that the work

becomes visible next to grinding disc 32, whereas in reality the latter and the work are situated in the same vertical plane. The work spindle 125 carries an indexing wheel 129 which coacts with two pawls of which only the upper one is visible in the drawing. These pawls are pivoted at 131 (Fig. 1) and are disengageable from index wheel 129 by means of a lever 132.

On the control plate 51 is provided a guide means 133 on which may be mounted an optical control device 134 of known construction and which is schematically shown in Figs. 3 and 4.

Optical control device 134 may be of the kind described and shown in Patent No. 2,313,639, which presents an enlarged view of the workpiece and grinding disc on a ground glass screen.

The mode of operation of the machine described briefly is as follows:

For carrying out the grinding operation, tip 69*a* of tracer 69 is guided along the profile 68*a* of former plate 68. The rotations of the tracer are transferred on to grinding disc 32 by the parallel guiding means 74 to 83 so that the angle between tracer and former plate corresponds to that between grinding disc and work after the latter and the former plate have been rigidly mounted on control plate 51. The twin pantograph of which the exclusive function is to reduce the translatory movements of the tracer in the desired ratio and to transmit same on to the control plate on account of the disposition of its fixed point 112 in the machine main axis and its connection with the movable control plate by the pivot pins 100 and 113, causes a translatory displacement of the entire control plate and of the parts secured thereto, in particular of the former plate and work. From this it follows that if the tracer is rotated, for the purpose of letting the grinding disc operate under the most appropriate cutting angle, these rotations are transmitted to the grinding disc by the parallel guide. The translatory movements of the tracer while the same is guided along the former plate, are transmitted, over the double-pantograph and according to the reduction ratio chosen, to the control plate, and thereby to the workpiece, so that the movements between the grinding disc and the workpiece, in consideration of the reduction ratio, correspond to the movements of the tracer with regard to the former-plate. By the twin-pantograph the translatory movements of the tracer guided along the former-plate are transmitted to the control plate. As already pointed out, the twin-pantograph is connected with the machine frame only by the pin 112 situated in the machine main axis about which it is rotatably mounted, whereas the pivot pins 100 and 113 serve for connecting the pantograph with the movable control plate, i. e. for the transmission of the movements of the corresponding leg of the pantograph to the control plate. The dimensions of the single pantograph leg as well as the choice of the bearing of the pins 100 and 113 on the pantograph legs 99 and 104 are thereby so chosen that by any translatory movements of the tracer the pins 100 and 113 are moved parallelly to the path of the tracer, the path of the two pins being equally directed and equally long, and in the desired reduction ratio to the path of the tracer. The grinding disc is rotated by belt 135 and, at the same time, vertically reciprocated by the connecting rod 14. The grinding operation may be controlled with the aid of the optical control device, an enlarged image of the profile to be ground suitably being projected on to the projection screen.

I claim:

1. A profile grinding machine comprising a base, a control plate slidably mounted on said base for universal slideability in a plane, a vertical grinding disc mounted on said base for pivotal movement about a vertical axis, said axis being tangent to said grinding disc, a former plate secured to said control plate, a first pantograph having one arm pivotally attached to said control plate, a second

pantograph having a first arm pivotally attached to a second arm of said first pantograph, a second arm of said second pantograph being pivotally attached to said control plate and a third arm thereof being pivotally attached on said axis, a tracer disposed in juxtaposition to said former plate and being pivotally attached to a third arm of said first pantograph, parallel guiding means connected to said tracer and said grinding disc to transmit pivotal movements of said tracer to said disc, and means on said control plate for carrying a workpiece adapted to be contacted by said disc at said axis.

2. A profile grinding machine comprising a base, a control plate slidably mounted on said base for universal slideability in a plane, a vertical grinding disc mounted on said base for pivotal movement about a vertical axis, said axis being tangent to said disc, a former plate carried

by said control plate, a twin pantograph system having an arm of each pantograph pivoted on said control plate, one arm of one pantograph pivoted on said axis and one arm of the other pantograph pivotally supporting a tracer, parallel guiding means interconnecting said tracer and said disc, and means on said control plate for carrying a workpiece, at a point spaced from the former plate, for contact by said disc at said vertical axis.

References Cited in the file of this patent

UNITED STATES PATENTS

1,377,481	Hodgson	May 10, 1921
2,038,455	Studer	Apr. 21, 1936

FOREIGN PATENTS

463,767	Great Britain	Apr. 6, 1937