Oct. 8, 1935. H. BECKER 2,016,478

CENTERLESS CYLINDRICAL GRINDING MACHINE

Filed Nov. 12, 1930 4 Sheets-Sheet 1

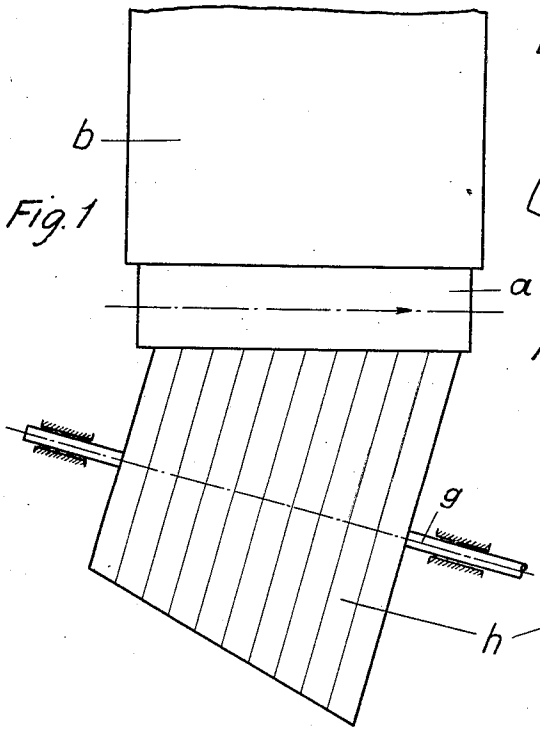


Fig. 1

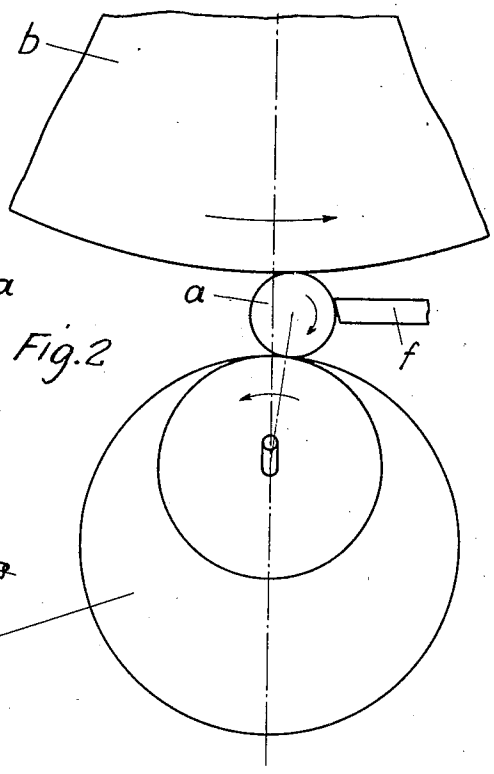


Fig. 2

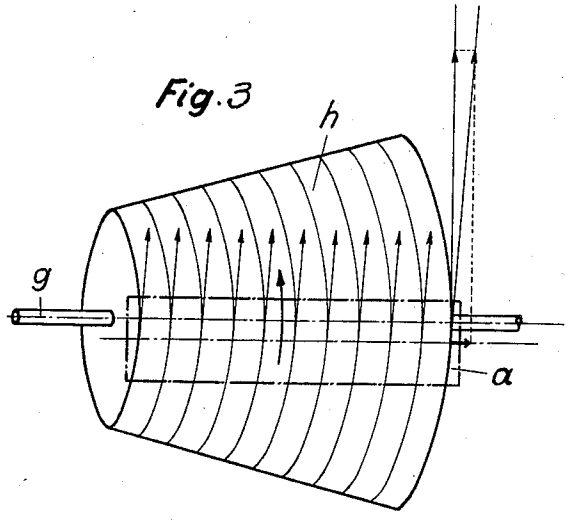


Fig. 3

Inventor
Heinrich Becker
By Bolinger, atty.

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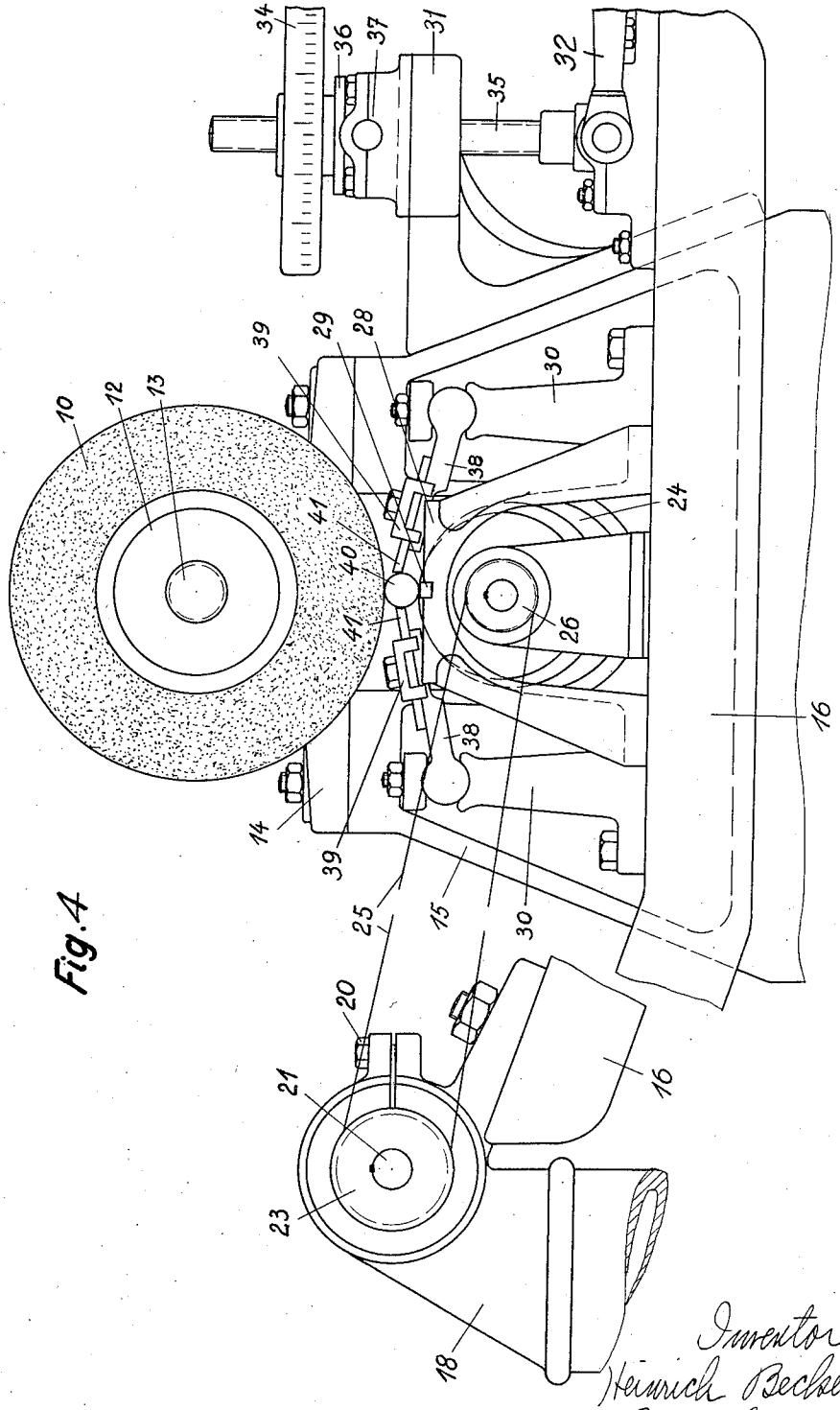


Fig. 4

Inventor
Heinrich Becker
By Bilinger, Atty

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CENTERLESS CYLINDRICAL GRINDING MACHINE

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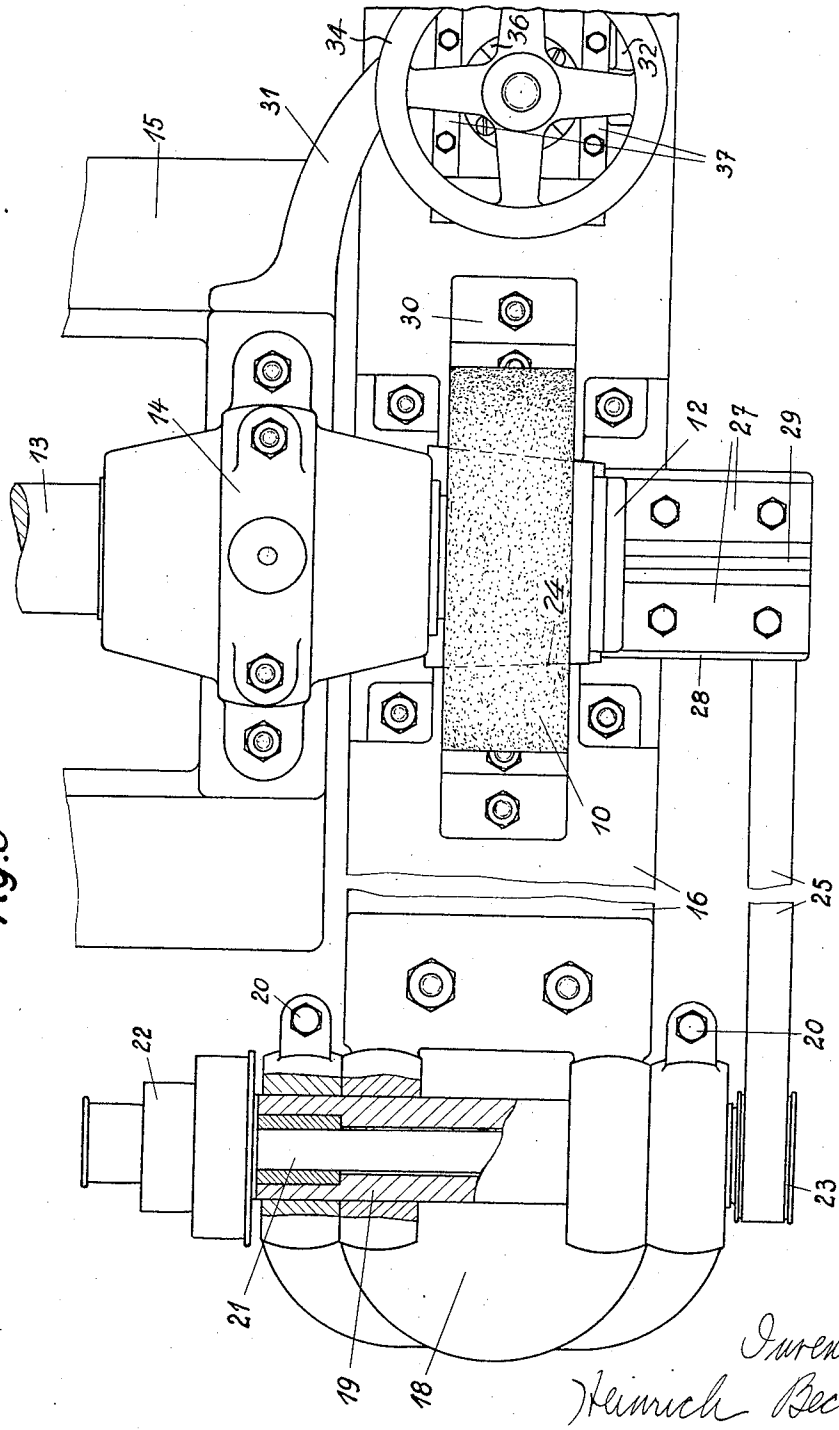


Fig. 5

Inventor
Heinrich Becker
By B. Singer, Atty.

Oct. 8, 1935. H. BECKER 2,016,478

CENTERLESS CYLINDRICAL GRINDING MACHINE

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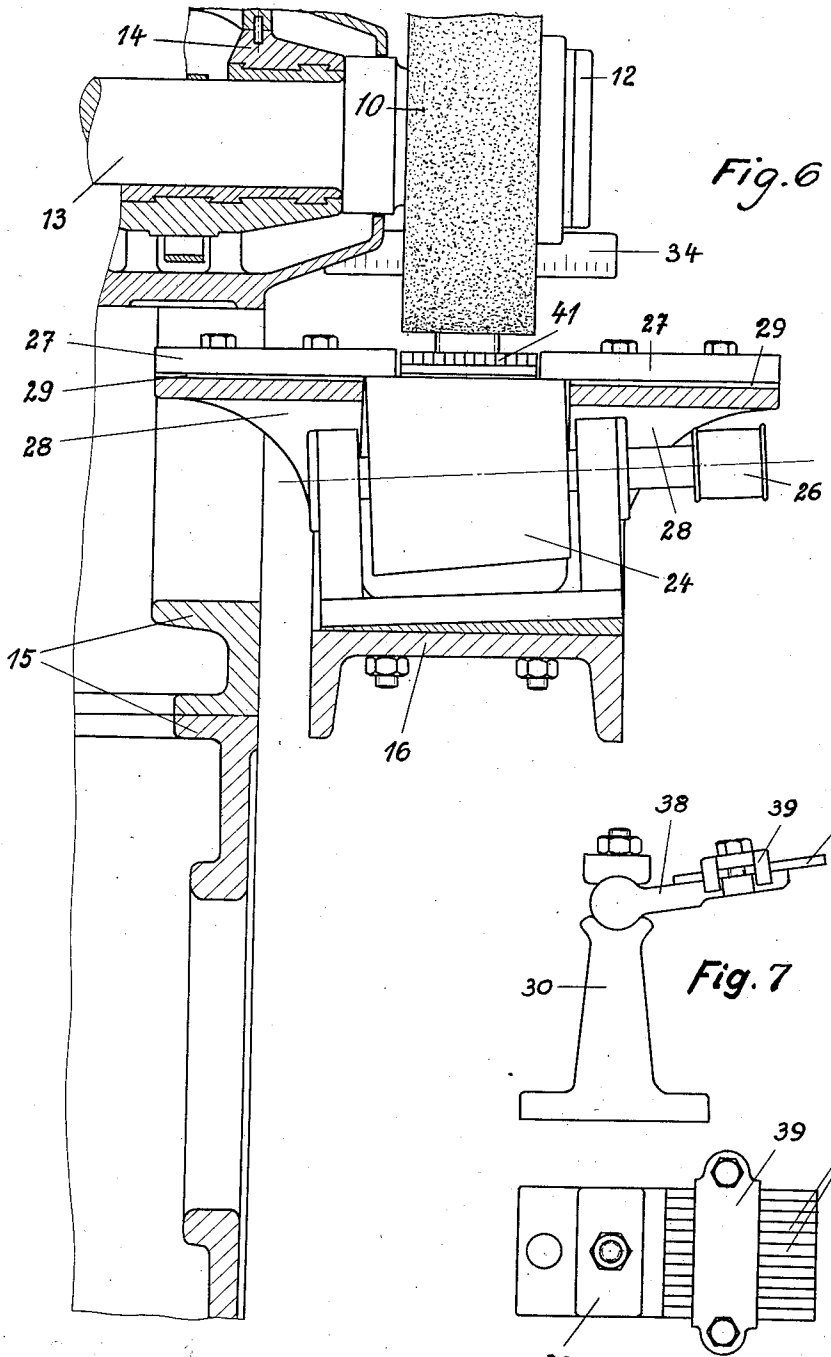


Fig. 6

Fig. 7

Fig. 8

Inventor
Heinrich Becker
By B. Singer, Atty.

Patented Oct. 8, 1935

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UNITED STATES PATENT OFFICE

2,016,478

CENTERLESS CYLINDRICAL GRINDING MACHINE

Heinrich Becker, Hattingen-on-the-Ruhr, Germany

Application November 12, 1930, Serial No. 495,217
In Germany November 19, 1929

1 Claim. (Cl. 51—103)

The invention relates to the known centerless cylindrical grinding machines in which the cylindrical body to be ground is rotated about its axis, whilst bearing against a lateral guide, between two rotary bodies revolving in opposite direction to each other, at least one of these bodies being a grinding wheel, and at the same time ground cylindrically in consequence of the relative speed to that of the grinding wheel, the latter revolving at a higher speed.

Special contrivances are hereby provided for obtaining the necessary feed motion of the body to be ground. According to one construction, the axes of the two rotary bodies are set at an angle, thus causing the bodies rolling between them to be fed forward similar to the known Mannesmann tube rolling process. Another construction provides for the feed motion being obtained through thin discs whose peripheral faces are given a flat, tapered or hyperbolic form and which move the body to be ground between the two revolving bodies in a similar manner to the discus or friction disc gearing.

In the accompanying drawings

Figure 1 is a diagrammatic elevation of the grinding element and the conical feeding roller of my improved grinding machine in operative relation to the work piece or body.

Figure 2 is a similar view of the same at right angles to Figure 1.

Figure 3 is a diagrammatic plan of the conical feeding roller.

Figure 4 is a side elevation of a grinding machine constructed in accordance with my invention.

Figure 5 is a plan of the same partly in section.

Figure 6 is a vertical transverse sectional view of the same on a plan disclosing the axis of the grinding element and conical feeding roller or drum.

Figure 7 is a detail elevation of the adjustable guiding mechanism for the work.

Figure 8 is a detail plan of the same.

The invention relates to a greatly simplified construction of the hitherto known machines, this applying more especially to the feed mechanism.

The feed mechanism of my improved grinding machine is preferably arranged as shown diagrammatically in Figs. 1, 2 and 3. A rotary body *h* rotates about the inclined axis *g*. The body *a* to be ground is positioned in front of the center plane of this cone *h* as shown in Fig. 2. According to Fig. 3, a similar effect is achieved in so far as both the rotation of the body *a* and the feed in axial direction is attained through the medium of the tangents which in plan lie in an inclined positon and are in agreement with the local direction of motion.

An example of a machine of this description is shown in Figs. 4 to 7, Fig. 4 showing an elevation, Fig. 5 a plan and Fig. 6 a sectional side elevation. Fig. 7 shows a detail.

The grinding wheel 10 is rigidly secured by nuts 12 to the shaft 13 which is so arranged in two fixed bearing brackets 14 that the grinding wheel 10 rotates overhung. The drive of the grinding wheel 10 is obtained either from a countershaft with cone pulley or an electric motor furnished with speed regulation. The machine frame 15 carries the bearings for supporting the grinding wheel 10. The grinding table proper 16 pivots on the supporting bracket 18 through the medium of the bush 19, the latter being clamped by the screws 20. The shaft 21 is likewise rotatably mounted in the connecting bush 19. At one end of the shaft 21 a cone pulley 22 is rigidly mounted and at the other end a belt pulley 23. The feed drum 24, which corresponds with the cone *h* shown in Figs. 4, 5 and 6, is rotatably mounted on the grinding bridge 16 and rotated accordingly by a belt 25 from the pulley 23 over the pulley 26. The roller 40 to be ground is guided by bearing strips 27 adjustably arranged on the guiding tables 28. The guiding bar 29 is replaceable on account of the heavy wear it is subjected to. In addition, two adjustable guiding brackets 30 are arranged on the guiding bridge 16 so that adjustment may be made to suit various diameters of the work to be ground.

A device for fine adjustment is provided at the free end of the grinding bridge 16, this device being mounted on the supporting bracket 31 bolted to the machine frame 15. The fine adjustment serves for raising the grinding bridge 16 into the desired working position to compensate for wear of the grinding wheel 10. The lever 32 actuates an eccentric which is rotatably mounted in this bearing of the fine adjustment. By correspondingly adjusting the lever 32, the grinding bridge 16 may be instantaneously lowered with the roller and the operation disengaged. This arrangement enables parts that cannot be ground throughout their length, owing to collars or shoulders, to be readily introduced and taken out at the grinding point. The hand wheel 34 is provided with an internal thread corresponding to the screw 35; a scale provided on its periphery allows the grinding bridge 16 to be accurately adjusted to about a hundredth part of a milli-

metre without backlash. The nave of the hand wheel 34 rests on a swivel 36 which in its turn is movable in the bearing 37.

To prepare the machine for grinding, the work 40 to be ground is introduced between the grinding wheel 10 and the feed roller 24, rotation of the work being effected by their rotation in opposite direction, the guiding bar 41 bearing against the work. Owing to the fact that the peripheral speed of the grinding wheel 10 is considerably higher than that of the feed drum 24, the grinding action takes place at this speed and at the same time as a consequence of the relative movement. Due to the above-mentioned fundamental conditions, the gradual feed of the work 40 is effected across the two rotary bodies 10 and 24. Furthermore, the roller 40 is always parallel to the axis of the grinding wheel 10. The speed of the feed may also be regulated by using the cone pulleys 22.

The novel grinding arrangement possesses in the first instance the following advantages: Apart from the work having to be advanced an amount, which in practice is infinitesimally small, in front of the center plane determined by the axes of the grinding wheel and the feed drum, and the taper of the feed drum, which is likewise slight, the axes of the three bodies are practically situated approximately in the same plane and also approximately parallel to one another. The grinding wheel is in contact with the roller to be ground across its entire width, grinding being likewise accomplished across this width, with the result that the wear of the grinding wheel is likewise evenly distributed. This represents an important advantage over the grinding wheels of the hitherto used cylindrical grinding machines, the grinding wheels of which wear irregularly and have on this account to be correspondingly narrow from the outset, or have to be given a particularly complicated shape, such as the form of a hyperboloid. This also applies to the feed drum proper which from the outset is formed with a plain, slight taper which it retains when in use. In contrast to the aforementioned feed discs operating with their flat front face similar to discus gearing, the speeds at all points of the surface are here practically equal; at any rate, the difference is so slight that it has no influence either on the operation or on the wear of the feed disc itself. As, owing to the simplicity and reliability of the feed mechanism, the fundamental arrangement of the machine is so simple and at the same time so insensitive to slight faulty adjustments, adjustment of the working pressure, on the one hand, and adjustment of the bodies required to be rolled to different diameters, on the other hand, can be effected in such a simple manner, as already described, by suspending the grinding bed support proper to allow it to pivot. As the grinding wheel itself can be formed as a cylinder—as already pointed out—which form it retains during the operation, it is of no account if in its pivoting motion the grinding bed support naturally comes in contact with the grinding wheel slightly outside its center plane in case the diameters of the roller to be ground vary. This pivotal bearing is again of the greatest importance for the rapid termination of the grinding process by lowering the bridge.

Fig. 7 shows an elevation view and Fig. 8 a plan view of a grinding plate 38 which possesses advantages over the hitherto used rigid guide bars, the guiding plate being furnished with a plurality of single narrow, hardened steel strips 41, similar to a comb, which are accurately adjustable to the profile to be ground and are arranged between the grinding disc 10 and the feed drum 24 as shown in Fig. 6, so that they engage the work at the points where the work is subjected to the action of the disc and drum so that the machine is adapted for grinding pieces of work which are short and the length of which does not exceed the width of the grinding disc. When these steel strips 41, which are subjected to the greatest stress from the outside periphery, get worn, they can at any time be moved forward afresh into the required position by loosening the comb bridge 39 and then firmly securing them by the clamping bridge 39.

What I claim is:

A centerless grinding machine for grinding cylindrical work, comprising a revoluble cylindrical grinding disc, a revoluble conical feeding and guiding drum for the work to be ground, means to rotate said disc and said arm in reverse directions, and with the peripheral speed of the grinding disc greater than that of the said guiding drum, the axis of said guiding drum being coplanar with that of the grinding disc and converging toward that of the grinding disc in one direction and being at such an angle thereto that the opposing peripheral surface of the disc and drum are parallel to each other, and spaced apart a distance less than the diameter of the work, and means arranged between said disc and said drum to hold the work to be ground between the said disc and said drum with its axis spaced from the common axial plane of the disc and drum and parallel to said common axial plane.

HEINRICH BECKER.