Dec. 4, 1934. R. KÖLSCH 1,983,090

MACHINE FOR UNIVERSALLY MILLING, GRINDING, AND DRILLING WORKPIECES OF ALL KINDS

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Fig. 1.

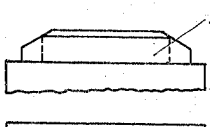


Fig. 2.

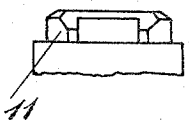


Fig. 3.

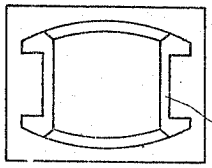


Fig. 4.

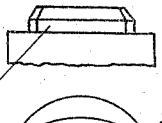


Fig. 5.

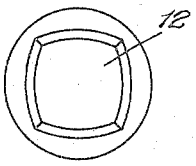


Fig. 6.

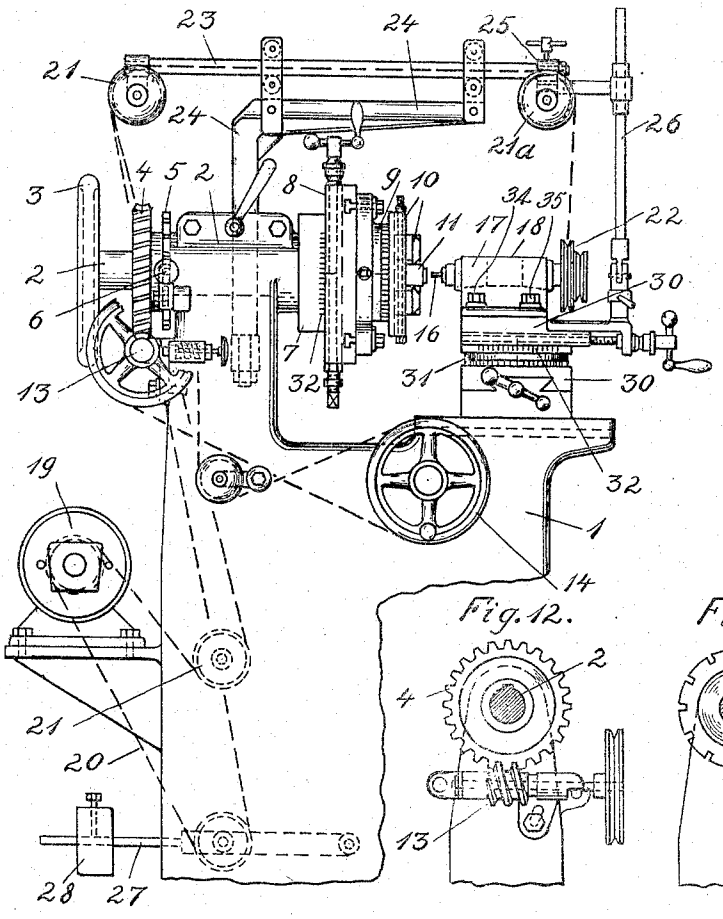
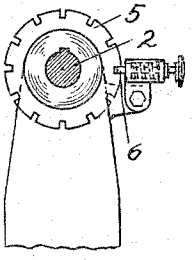


Fig. 12.

Fig. 13.



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Fig. 7.

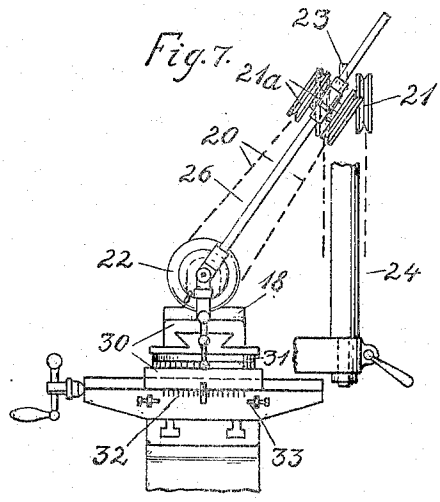
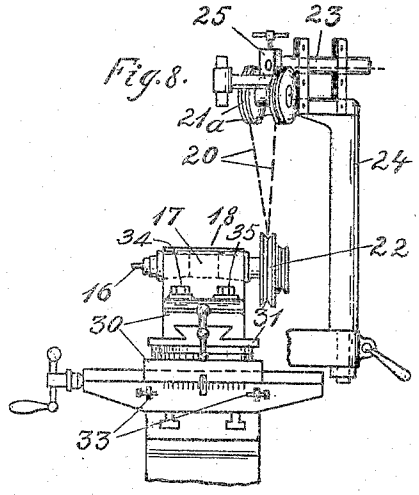


Fig. 8.



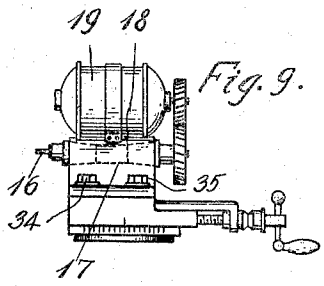


Fig. 9.

Fig. 10.

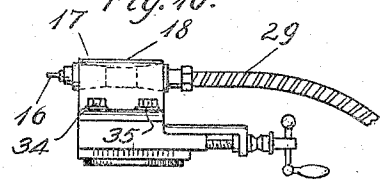
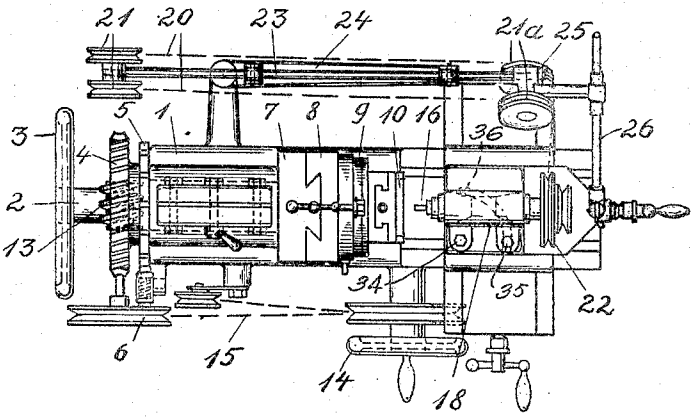


Fig. 11.



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UNITED STATES PATENT OFFICE

1,983,090

MACHINE FOR UNIVERSALLY MILLING, GRINDING, AND DRILLING WORKPIECES OF ALL KINDS

Reinhard Kölsch, Pforzheim, Germany

Application May 13, 1933, Serial No. 670,939
In Germany April 7, 1932

1 Claim. (Cl. 90—17)

This invention relates to a machine for producing dies, matrices, cutting tools and the like.

The object of the invention is to enable workpieces of different shapes to be worked to measurement without previous marking and repeated setting up. For this purpose both the workpiece and the spindle carrying the tool can be shifted, rotated, swung and approached. These movements can be carried out without interrupting the work, since such transmission element of the tool spindle stock participate in the movements. For this purpose the driving motor is either conducted to the tool spindle by yieldable movable or articulated driving and transmission elements such as equalizing links or rods or is directly coupled with the tool spindle and connected to the electricity supply main by flexible cables. The transmission elements are also mounted on rocking levers adapted to be locked in position so that the tool can rapidly be brought on to any surface to be worked. The length of the transmission elements is regulated by pivotally mounted weighted lever.

A further feature of the invention consists in that concentric or eccentric working surfaces of workpieces can be divided and worked in the sense of dividing head work without reclamping. In the first instance the machine is provided with a dividing device, the centre of which lies in the main axle of the machine. For eccentric division work the clamping device connected with the machine main axle has a dividing device which can be shifted out of the centre device of the main axle as desired. By this means and by the adjustability of the tool spindle stock it is possible, to accurately carry out differently situated, uniformly shaped angular cuts on the workpiece.

Another feature of the invention is the effect, that the material to be removed in straight or curved shape can be measured from a zero point as regards its depth, width and length, so that previous marking or the making of gauges is not necessary. This effect is attained in that all shifting movements of the clamped workpieces and also those of the tool are measured by means of scales. This also applies to curved working tracks.

In order to reliably obtain a uniformity of shape for regular and irregular shapes, it is possible, by means of a further feature of the invention, to stop all movements in their initial and final positions by means of adjustable stops. Such adjustable stops are fitted on the tool spindle stock and also on the chuck. This arrangement is particularly important when it is a question of making several similar workpieces which must be absolutely alike.

An embodiment of the invention and workpieces produced thereby are illustrated by way of example in the accompanying drawings in which:—

Figs. 1 to 3 and Figs. 4 to 5 show two kinds of workpieces 11 and 12 which may for example be worked with the machine according to the invention without re-clamping.

Fig. 6 shows the machine in front elevation.

Figs. 7 and 8 each show a part side elevation of Fig. 6, the latter with the tool spindle stock and the driving elements connected therewith rotated through 90°.

Fig. 9 shows the drive of the tool spindle by a directly coupled driving motor which can participate in every moment and oscillation of the tool spindle stock.

Fig. 10 shows the drive of the tool spindle with the aid of a flexible shaft.

Fig. 11 is a top plan view of Fig. 6.

Figs. 12 and 13 show elevations of adjusting means for the main axle of the machine.

The main axle 2 of the machine is rotatably and fixably mounted in the machine frame 1. A hand wheel 3, a worm wheel 4 and a division disc 5 with index pin 6 are detachably connected to the axle 2. On the front end of the axle 2 an exchangeable flange 7 is fitted on which a cross slide 8 is mounted. The upper carriage of the cross slide 8 carries a dividing device 9 which can be rigidly bolted on or connected with an exchangeable chuck 10, which in turn carries the workpiece 11. The main axle 2 and therewith the workpiece 11 can be rotated by a worm 13 with disengaging motion which is actuated by hand by means of a driving element 14, 15. The cross slide 8 with the dividing device 9 and the chuck 10 can be moved as desired beyond the centre of the main axle 2 of the machine, in order to enable large arcs, curves or surface work to be carried out.

The tool 16 is exchangeably connected with the tool spindle 17. The spindle 17 is rotatably mounted in the spindle stock 18. It can be driven by motor 19 with which transmission elements 20, 21, 21*a* and a driving pulley 22 cooperate. The motor 19 may, however, be also directly coupled to the spindle 17 in order to drive same (Fig. 9) or indirectly coupled therewith with the aid of a flexible shaft 29 (Fig. 10).

In order to allow the tool spindle stock 17, 18 to move into any desired places and working

positions without its drive being interrupted, for example by the transmission belt sliding off its pulleys 21, 21*a*, 22, these pulleys are arranged on a shiftable, partly prismatic bar 23 which is shiftably mounted in a pivotally mounted frame-like lever 24. On the cylindrical end of the bar 23, shown on the right of the drawings, a rotatable and fixable guide pulley carrier 25 is provided for the guide pulleys 21*a*, in order to enable the tool spindle stock to be also driven in the different working positions illustrated in Figs. 7 and 8. In Fig. 7 the tool spindle stock 17 is directed parallel to the main axle 2 of the machine, whereas in Fig. 8, it is oscillated through an angle of 90° towards the main axle 2 of the machine. The driving elements must be able to automatically follow as far as possible these movements and those, caused by the working feed, but it must be possible to adjust and reverse very rapidly and reliably by hand. For obtaining this object a control rod 26 is connected with the tool spindle stock 18 and the guide pulley carrier 25, by means of which rod the up and downwardly running belts 20 remain in reliable working connection with the guide pulley 21*a* and the driving pulley 22 during the feed. Lengthening and shortening movements of the transmission elements are equalized by the pivotally mounted weighted lever 27 with its weight 28. A constant tension of the transmission element in the different positions is effected by the weighted lever 27, 28.

The tool spindle stock 18 rests on a cross slide 30 with interposed turning and dividing device 31, by means of which the stock can be brought into any desired working position. Especially for milling spindles having surfaces inclined to the main machine axle, as shown in Figs. 1 to 5, it is advantageous to move the tool 16 towards and away from the work piece in a direction parallel to the main machine axle, although the longitudinal central axis of the work piece does not lie in this direction. In this case it is necessary for the tool spindle 16 to be pivotally mounted on the cross slide 30 independently of the mutual oscillation of its carriage. This pivotal mounting of the tool spindle 17 is effected by screw bolts 34 and 35 of which the screw bolt 35, after being unscrewed and after the spindle stock 18 has been swung into the desired position, can be retightened at any point of the slot 36 in which it is guided.

All values for the adjustment and stroke movements both of the workpiece and also of the tool spindle stock can be read on suitably arranged scales 32 or on the divisions of the dividing devices 9 and 31.

If necessary, the stroke can be limited by means of adjustable stops 33, as shown for example in Fig. 7.

I claim:

A machine for cutting workpieces, comprising in combination a rotatable main axle, a cross-slide mounted on said axle, a clamping device pivotally and fixably mounted on the head end of said cross slide and adapted to always centrally clamp the workpiece to enable the workpiece to be adjusted both eccentrically to said main axle and at any desired angle to the axis of said cross slide, a second cross slide, a carriage of said second slide, and a tool spindle pivotally mounted on said second cross slide in a plane at right angles to said first cross slide independently of the mutually oscillation of said carriage.

REINHARD KÖLSCH.