April 12, 1932. F. MULKA 1,853,074

CONTROLLING MEANS FOR AUTOMATIC LATHES

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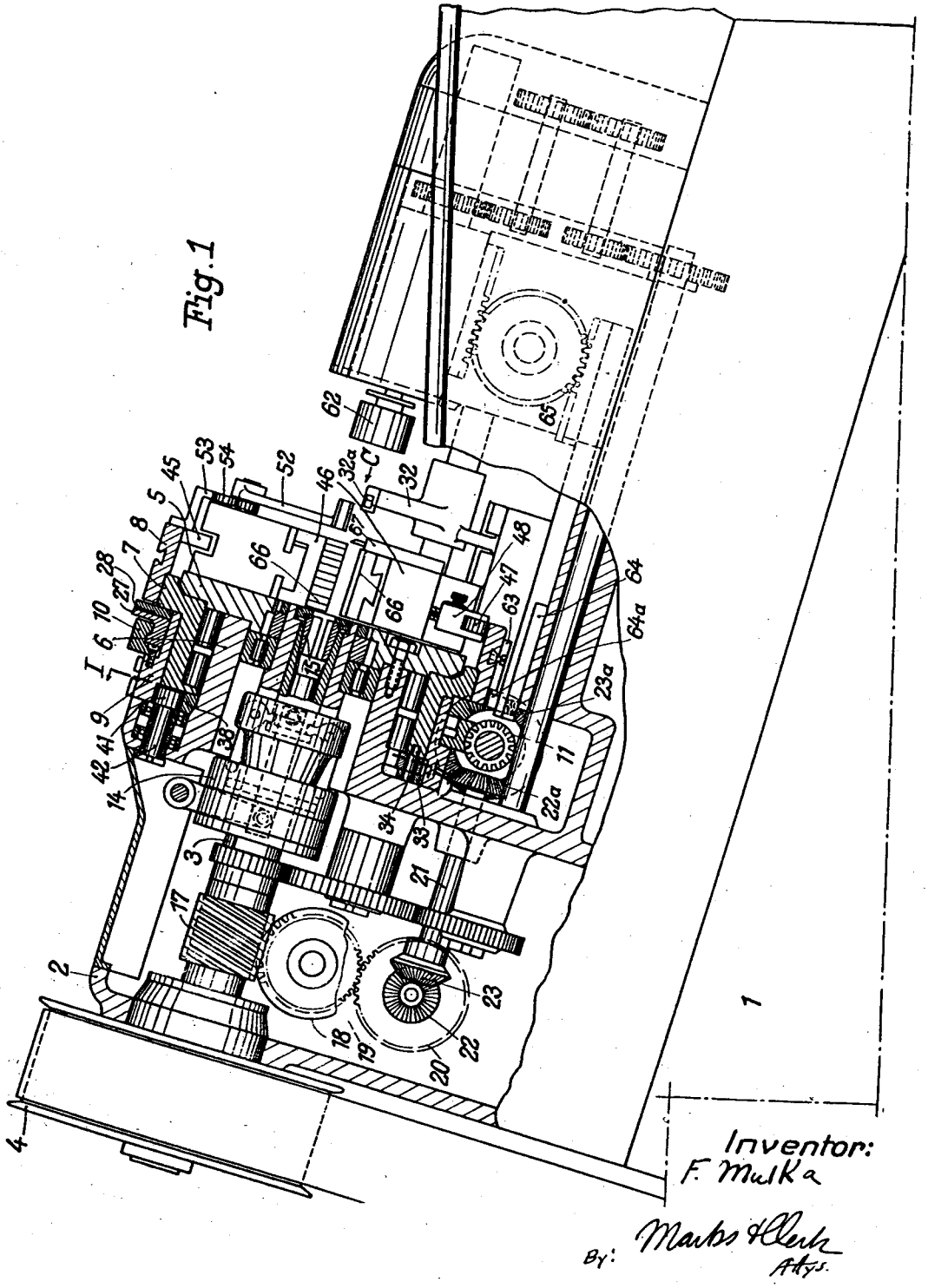
Fig. 1



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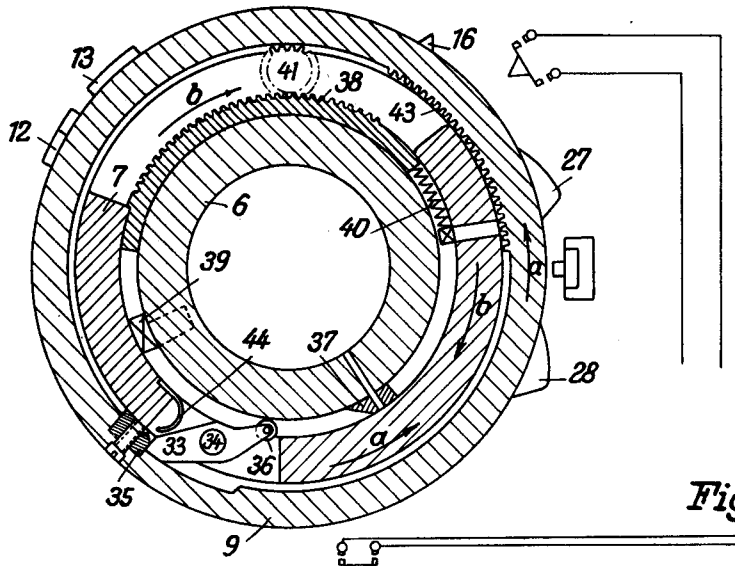
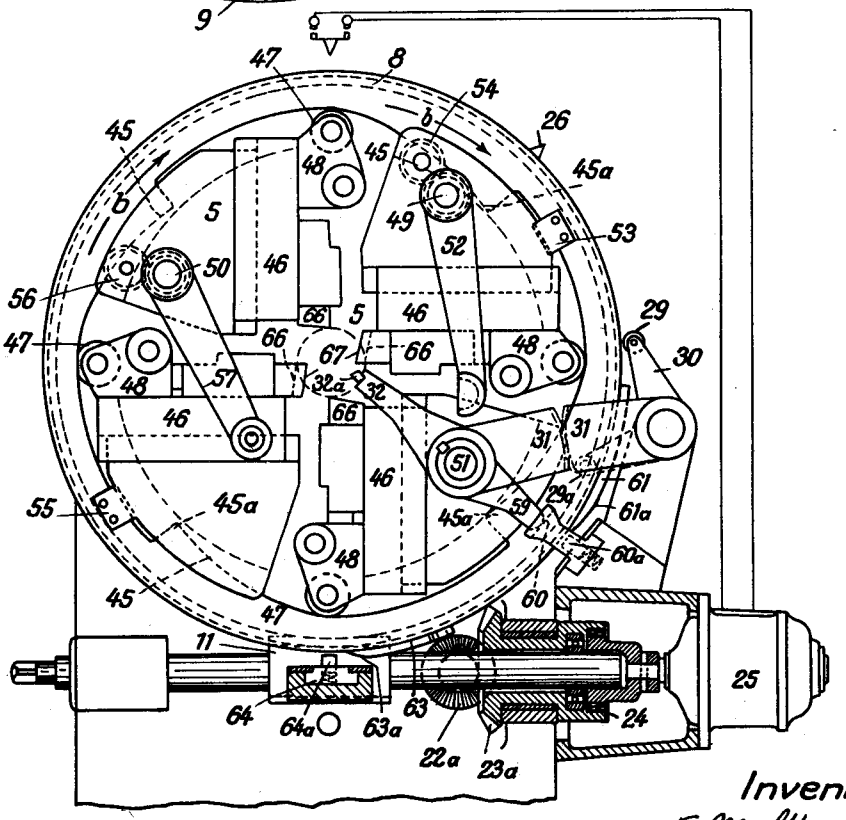


Fig. 2
(I–II)

Fig. 3 (←C)



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Patented Apr. 12, 1932 1,853,074

UNITED STATES PATENT OFFICE

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CONTROLLING MEANS FOR AUTOMATIC LATHES

Application filed October 13, 1930, Serial No. 488,469, and in Germany November 21, 1929.

Multiple-spindle automatic lathes are known, in which the controlling of the cross slides is effected by means of a reciprocating control ring arranged in the axis of the head stock.

A control has furthermore also been proposed in which all the automatic movements are effected by a continuously revolving control drum coaxial with the material spindle.

The present invention relates to a control which is particularly suitable for automatic screw-cutting and profiling lathes. According to the invention the controlling of all the automatic movements is effected by means of two control rings arranged at the front end of the head stock coaxially with the material spindle, of which one executes a reciprocating movement, while the other revolves continuously. The reciprocating ring effects primarily the feeding movement of the cutting-removing tools, and therefore deserves the name of "main control ring". The continuously revolving ring effects a positive to-and-fro rotation of the main control ring and also executes the displacements which the main control ring, in consequence of its reciprocating movement, either cannot execute at all or can only execute inconveniently. The continuously revolving ring is therefore to be regarded as an auxiliary control ring.

The invention presents the following very important advantages for screw-cutting and profiling lathes:

(1) The control by means of a reciprocating ring and a revolving ring enables all the parts that occur to be produced with constant curves in an equally advantageous manner.

(2) The adjustability of the machine is so improved that only a single cam on the auxiliary control ring has to be adjusted in order to limit the working and idle times for the most varied members.

(3) The adjusting of the feeds for circularly swinging tools like that of the gripper and of the stop, is no longer necessary. The alternately fast and slow running auxiliary control ring effects a positive to-and-fro rotation of the main control ring, which may take place partly fast and slow in both directions of rotation. The reversal of the direction of rotation of the main control ring is effected after the termination of one working operation and before the commencement of the ensuing operation. Now since after the termination of one period of treatment the gripper must come into action and before the commencement of the ensuing period the stop must be actuated, the alternating movements of the main control ring are utilized for these displacements.

(4) The superstructure of the lathe is considerably simplified, because the displacements of the displaceable tools and devices are executed with a control ring located in the working range, directly and without the assistance of transmission levers.

(5) The working spindle may be arranged obliquely in consequence of the novel superstructure of the lathe, as a result of which an advantageous removal of cuttings is obtained, and the forward feed can be effected by means of the intrinsic weight of the bar of material.

(6) The controlling of a plurality of cross slides by the main control ring, with the employment of suitable turning processes, enables cutting outputs to be obtained which are many times as great as those of the best known high-power machines.

The invention is illustrated by way of example in the accompanying drawings and is hereinafter described in detail.

Figure 1 shows a longitudinal section through an automatic screw-cutting and profiling lathe;

Figure 2 shows a section on the line I—II in Figure 1, and

Figure 3 shows a view of the head stock from the front, certain parts being in section.

Upon an inclined underframe 1 rests the head stock 2. A working spindle 3 carries at its rear end a driving pulley 4. To the front end of the head stock is secured in a known manner a cross-slide carrier 5. Upon an extension 6 of the head stock is rotatably mounted the main control ring 7, to which is secured a detachable cam ring 8. Upon the main control ring is rotatably mounted

an auxiliary control ring 9. The auxiliary control ring 9 is rotated fast or slowly alternately by means of a worm wheel 10 and worm 11 in the direction of the arrow *a* in Figures 2 and 3. For the production of a workpiece one complete revolution of the auxiliary control ring is required. The auxiliary control ring has on its external surface cams 12 and 13, which serve for the displacement by known means, not shown, of the clamping sleeve 14 of a clamping chuck 15 for the material. A cam 16 on the external cylindrical surface of the auxiliary control ring is adjustably arranged and serves for switching on the slow rotation of the ring. The slow rotation of the auxiliary control ring is effected during the machining of the work. The worm 11 is then driven from the spindle by means of a worm 17, a worm wheel 18, change wheels 19 and 20, bevel wheels 22 and 23, a shaft 21, bevel wheels 22*a* and 23*a*, and a free-wheel coupling 24. The high speed of the worm 11 is obtained by switching on an electric motor 25 by means of a non-adjustable cam 26 on the main control ring. The free-wheel coupling 24 then throws the slow drive of the bevel wheels 22*a* and 23*a* out of action, as shown in Figure 3. The auxiliary control ring has also on its external surface cams 27 and 28, of which the cam 27 is non-adjustably secured, while the cam 28 is adjustably arranged. The non-adjustable cam 27 acts against a roller 29 on a lever 30, which, by means of a toothed segment 31, brings a circularly swinging long lathe tool 32 into the working position. The adjustable cam 28 serves for rocking back the long lathe tool, and in so doing acts against the roller 29 on the lever 30. The auxiliary control ring also serves the purpose of positively moving the main control ring to and fro, this being done in the following manner:—

The movement of the main control ring in the direction of rotation of the auxiliary control ring, namely the direction shown by the arrow *a* in Figs. 2 and 3, is effected by a tappet pawl 33, which is rotatably mounted upon a bolt 34, owing to the fact that an abutment 35 secured to the auxiliary control ring carries the pawl round with it. The movement of the main control ring in the direction of the arrow *a* is terminated when a roller 36 on the tappet pawl runs up an inclined surface on an abutment 37 secured to the extension 6, and in so doing releases the pawl from the stop 35. Before this releasing of the tappet pawl is effected a toothed segment 38 supported in the main control ring runs against a stop 39 secured to the extension 6. Since the main control ring is moved further in the direction of the arrow *a*, the toothed segment 38 is displaced therein and remains stationary relatively to the extension 6 of the head stock. This compresses a spring 40. The toothed segment 38 remains permanently in engagement with a pinion 41. The latter is mounted upon its pivot 42 (Fig. 1) in the head stock. If, as described above, the toothed segment 38 has run against the stop 39, the pinion remains in a definite position of rest until internal teeth 43 provided in the auxiliary control ring come into engagement. This engagement always takes place normally because the position of rest of the pinion is always the same when the toothed segment 38 is pressed against the stop 39. Upon the entrance of the internal teeth 43 into the pinion 41 a rotation of the toothed segment 38 takes place in the direction of the arrow *b* in Figure 2, while the main control ring is still being moved in the direction of the arrow *a*. The toothed segment 38 then moves away from the stop 39 and compresses the spring 40 still further. At the same time the roller 36 of the tappet pawl 33 passes on to the inclined surface of the stop 37 and releases the tappet pawl from the stop 35 in the auxiliary control ring. The rotation of the main control ring in the direction of the arrow *a* therefore ceases, and the main control ring is now carried round in the direction of the arrow *b* by the toothed segment 38 until the internal teeth 43 become disengaged from the pinion 41. Thereupon the main control ring stops in a position of rest until the auxiliary control ring continuing to revolve in the direction of the arrow *a* takes it round again in the direction of the arrow *a* with its stop 35. In order to ensure the tappet pawl reliably snapping in, a spring 44 presses the abutment end of the pawl against the internal surface of the auxiliary control ring.

The movement of the main control ring in the direction of the arrow *b* is effected constantly at the high speed, after the immovable cam 26 has switched on the high speed of the auxiliary control ring. The auxiliary control ring also takes the main control ring with it in the direction of the arrow *a* at the high speed, and through a variable distance, which is limited by the adjustable cam 16.

Since the object of the auxiliary control ring has now been explained, a detailed description of the cam ring 8 mounted on the main control ring will now be given.

The cam ring 8 has four parting cams 45, which impart the feeding movement to the four cross slides 46. The rise of the cams corresponds to the maximum parting depth. When the main control ring changes the direction of rotation into the direction of the arrow *a*, the parting cams have always arrived with their highest points 45*a* upon supporting rollers 47. A roller-holder 48 is slidably supported in the cross slides for the purpose of compensating for differences of diameter in the workpieces to be machined. Upon the pivot 49 is rotatably mounted a spring gripper 52, this member is a known

element in automatic lathes, the duty of which is to receive the finished piece of work falling off from the stock rod, for the purpose of depositing it in a suitable position or delivering it to some supplementary apparatus, for instance a slotting saw for the purpose of cutting a slot in a screw head. Before the cams 45 have arrived upon their point 45*a*, a toothed segment 53 passes into a pinion 54 connected with the gripper and rocks the gripper towards the centre point of the workpiece. Upon reversal of the direction of rotation of the main control ring the gripper is rocked back and the cross slide is returned. Upon the termination of the rotation of the main control ring in the direction of the arrow *b* a toothed segment 55 enters into a pinion 56 serving to actuate the stop and rocks a stop arm 57, which is mounted upon a carrying pivot, into the working position. The stop thereupon remains in a position of rest with the main control ring until the auxiliary control ring, continuing to revolve, has effected the gripping of the rod of material that has been fed forward, and carries the main control ring round again in the direction of the arrow *a*. By rotating the main control ring in the direction *a* the stop is rocked backwards.

Upon the carrying pivot 51 is mounted the long swinging lathe tool holder 32, carrying a tool 32*a*. With the rocking back of the stop the rocking in of the long lathe tool holder is commenced by means of the cam 27. An outward extension 59 of the long lathe tool holder moves in a circumferential groove in a slider 60. The slider 60 is moved longitudinally by a helical cam 61, the side of the said cam bearing against the roller 60*a* of the slider and thereby effecting the forward feed of the long lathe tool holder. The tool 32*a* is only intended to serve for the smooth-turning or finishing of the rough-turned workpiece. The rough turning is always done by the turning tools 66. The securing of the tool 32*a* in the oscillating arm 32 may be effected in any convenient manner, for instance the lathe tool 32*a* may be inserted in a bore in the oscillating arm 32, and secured therein by means of a clamping screw. A screw thread cutting tool 62 is moved longitudinally by a cam 63, by means of a slider 64, a roller 64*a* and a toothed wheel 65 (Fig. 1) in the same manner as the long lathe tool holder. The rollers 60*a* and 64*a* are so supported as to be axially displaceable and rotatable, in order that during the backward rotation of the main control ring in the direction of the arrow *b* the inclined surfaces 61*a* and 63*a* of the backs of the cams may be able to press the rollers back.

Some of the cams employed on this automatic lathe are made adjustable, in a manner well known and extensively employed in automatic machine tools. For instance it will be seen from Figure 1 that the cam 63 is clamped to the convex surface of the control ring 8 by means of bolts screwed into dovetail-shaped nuts which are slidable in an annular groove in the control ring. In other instances the means by which the cams are made adjustable have been omitted from the drawings in order to simplify the latter.

The invention may be applied within wide limits to automatic lathes. Thus according to the invention this control may also be employed in the case of semi-automatic lathes, and also in the case of multiple-spindle automatics. Then again instead of the screw thread cutting tool a revolving slide or a loose head stock or a simple longitudinal saddle may be employed. Instead of four cross slides, only three or even two may be provided. Furthermore the to-and-fro rotation of the main control ring may be effected in a manner different from that hereinbefore described, for instance the pinion 41 might be constructed as a friction roller in order that the internal teeth 43 and the teeth of the toothed segment 38 may be omitted, without thereby going outside the scope of the invention.

What I claim is:—

1. Controlling means for automatic and semiautomatic lathes, comprising a head stock, an outer control ring rotatably mounted at the front end of the head stock, means for rotating the outer control ring continuously in one direction at two different speeds alternately, a main control ring supported co-axially in the outer control ring, and transmission means by which the continuously revolving outer control ring imparts a to-and-fro rotation to the main control ring.

2. Controlling means for automatic and semiautomatic lathes as claimed in claim 1, the said transmission means comprising a tappet pawl pivotally mounted in the main control ring, and an internal abutment on the outer control ring adapted to engage with the said tappet pawl and thereby to constrain the main control ring to rotate with the outer control ring.

3. Controlling means for automatic and semiautomatic lathes as claimed in claim 1, the said transmission means comprising a row of teeth extending a certain distance round the internal periphery of the outer control ring, a pinion journalled in the head stock and capable of meshing with the said row of teeth, and an externally toothed segment on the main control ring permanently meshing with the said pinion.

4. Controlling means for automatic and semiautomatic lathes as claimed in claim 1, the said transmission means comprising a row of teeth extending a certain distance round the internal periphery of the outer control ring, a pinion journalled in the head stock and capable of meshing with the said

row of teeth, an externally toothed segment rotatably mounted on the main control ring and permanently meshing with the said pinion, a stop secured to the head stock and adapted to limit the movement of the externally toothed segment in one direction, and a spring tending to press the externally toothed segment against the stop.

5. Controlling means for automatic and semiautomatic lathes, comprising a head stock, four cross slides, an outer control ring rotatably mounted at the front end of the head stock, means for rotating the outer control ring continuously in one direction at two different speeds alternately, a main control ring supported co-axially in the outer control ring, transmission means by which the continuously revolving outer control ring imparts a to-and-fro rotation to the main control ring, a cam ring detachably secured to the main control ring, and four cams ninety degrees apart on the said cam ring, the said cams being adapted to act collectively, in a plane perpendicular to the axis of rotation, upon the rear ends of the cross slides and thereby to impart a feeding movement to the cross slides.

6. Controlling means for automatic and semiautomatic lathes as claimed in claim 5, further comprising a circularly swinging gripper, a toothed segment secured to the face of the cam ring, gear teeth on the gripper, a pinion meshing with the gear teeth on the gripper and adapted to be engaged and rotated by the toothed segment on the cam ring and thereby to rock the gripper inwards a short time before the termination of the feeding movement of the cross slides and to rock the gripper outwards again when the direction of rotation of the main control ring and the cam ring is reversed.

7. Controlling means for automatic and semiautomatic lathes as claimed in claim 1, further comprising a circularly swinging abutment arm, means for rocking the abutment arm inwards a short time before the termination of the reversed rotation of the main control ring, and means for rocking the abutment arm outwards while the main control ring is being carried round by the outer control ring in its own direction of rotation.

8. Controlling means for automatic and semiautomatic lathes as claimed in claim 1, further comprising a cam ring detachably secured to the main control ring, a circularly swinging abutment arm, means for rocking the abutment arm inwards a short time before the termination of the reversed rotation of the main control ring, means for rocking the abutment arm outwards while the main control ring is being carried round by the outer control ring in its own direction of rotation, a circularly swinging long lathe tool holder, a non-adjustable cam secured to the outer control ring, means adapted to be actuated by the said cam to rock the long lathe tool holder inwards during the outward rocking movement of the abutment arm, an adjustable cam mounted on the outer control ring and adapted to rock the long lathe tool holder outwards, and a circumferential cam secured to the cam ring and adapted to effect the forward feed of the inwardly rocked long lathe tool holder.

9. Controlling means for automatic and semiautomatic lathes, comprising a head stock, a clamping chuck for the material to be machined, an outer control ring rotatably mounted at the front end of the head stock, means for rotating the outer control ring continuously in one direction at two different speeds alternately, a main control ring supported co-axially in the outer control ring, transmission means by which the continuously revolving outer control ring imparts a to-and-fro rotation to the main control ring, leaving it stationary for a short interval between its movements in opposite directions, and cams secured to the outer control ring, the same cams being adapted to open and close the chuck during the intervals between the rotation of the main control ring in opposite directions.

In testimony whereof I have signed my name to this specification.

FRIEDRICH MULKA.