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MULTI-SPINDLE AUTOMATIC LATHE WITH SPINDLES HORIZONTALLY REVOLVABLE IN THE SPINDLE BOX

Filed Oct. 24, 1940

Serial No. 362,654

3 Sheets-Sheet 1

Fig. 1

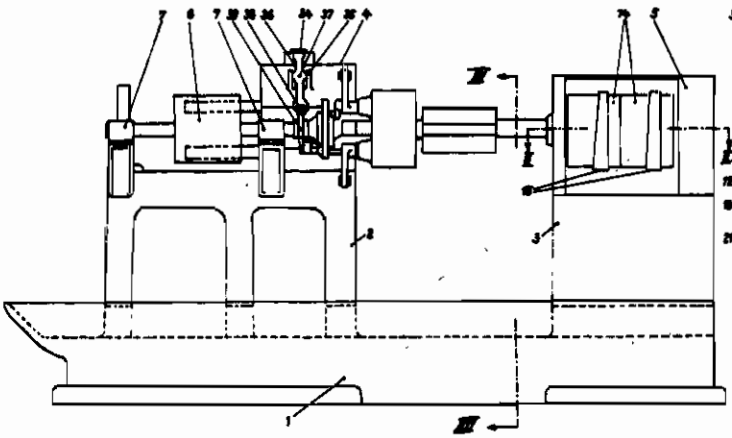

Fig. 3

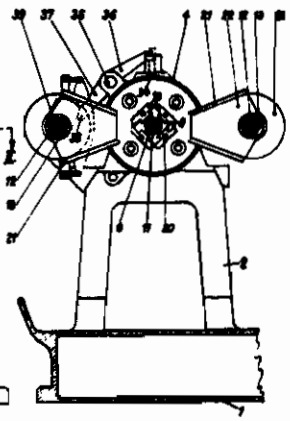

Fig. 2

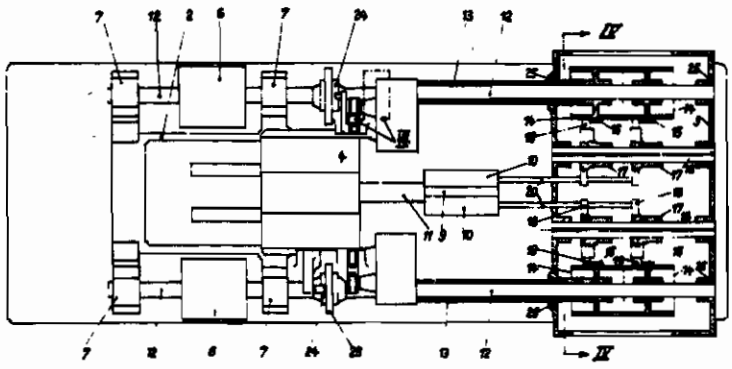

Fig. 4

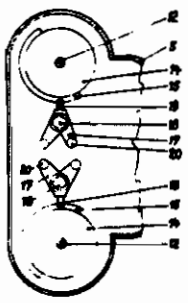

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Fig. 5

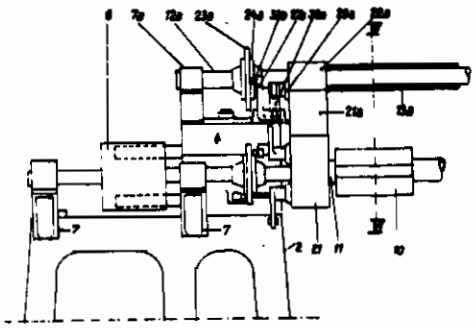

Fig. 6

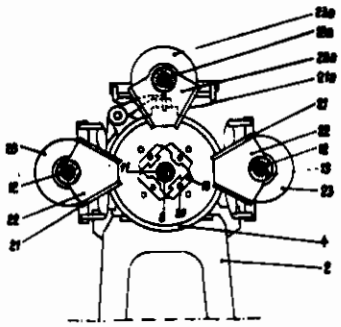

Fig. 7

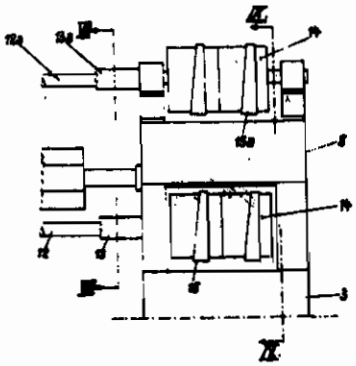

Fig. 8

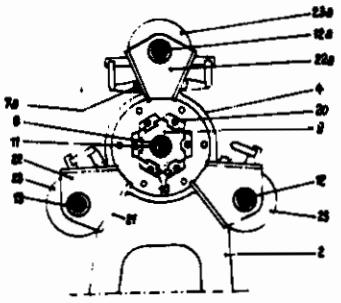

Fig. 9

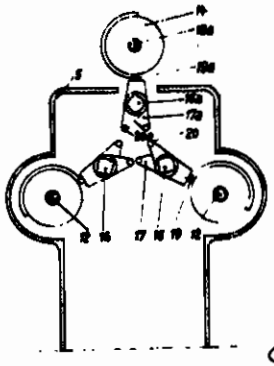

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Fig. 10

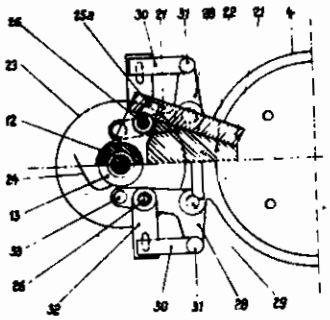


Fig. 11

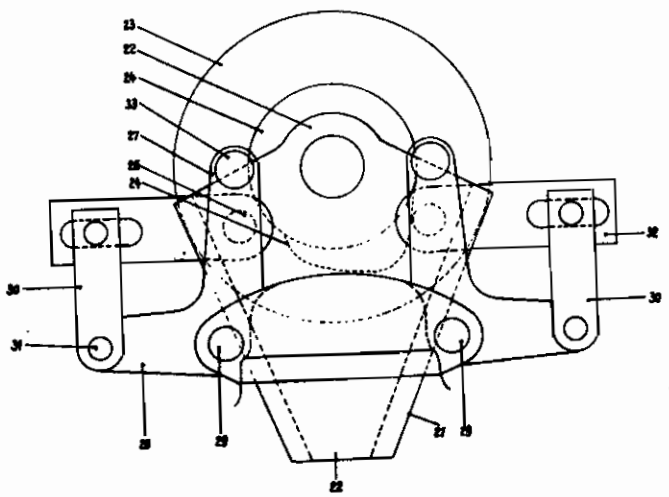
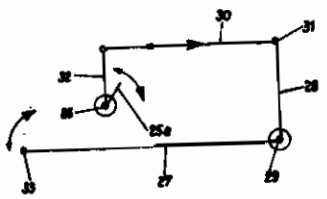


Fig. 12



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ALIEN PROPERTY CUSTODIAN

MULTI-SPINDLE AUTOMATIC LATHE WITH SPINDLES HORIZONTALLY REVOLVABLE IN THE SPINDLE BOX

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Application filed October 24, 1940

The invention relates to a multi-spindle automatic lathe with spindles horizontally revolvable in the spindle box, and with a block shiftable in horizontal plane but secured against turning during this shifting as carrier for the clamping faces and tools corresponding as regards number to the number of spindles.

In the multi-spindle automatic lathes of the above mentioned known type the horizontally shiftable tool carrier which will hereinafter be called shortly "longitudinal carriage," was moved forward and backward only as a whole by cam drive, the cam path preferably acting upon a roller, the pins of which were mounted in a slide arranged on the under side of the longitudinal carriage. The adjusting of this slide was effected in order to bring the longitudinal carriage into an initial position corresponding to the length of the work by means of a screw spindle, whereas the guiding and supporting of the longitudinal carriage was effected at several, locally separated points between spindle and gear box, in order to obtain sufficient security against tendencies of the carriage to give way, when it was submitted to high stressings by the tools. By this at least twofold guiding and supporting of the lonigtudinal carriage an arrangement or a distribution of position and tool movement of the transverse carriage and carrier blocks controlled each by a single cam, was necessary for the carrier blocks or put up with as a lesser inconvenience from which resulted not only singly or pairwise an alteration of shape of the transverse carriages, their carrier blocks and bearing points, but also of the actual directions of movement of the tools carried by the transverse carriage and also unsymmetrical distribution of the transverse carriage carriers.

By the arrangement of the cam drive of the longitudinal carriage underneath the path for guiding and movement, and further thereby that in most of the known multi-spindle automatic lathes also the movement of the individual transverse carriages on their corresponding carriers is effected by cams and levers also from points located under the tracks of the machine frame, none of the control elements actuating these carriages could completely get out of the range of the dropping cuttings. A dropping of the cuttings as unimpeded as possible and an accessibility, free from machine- and tool carrier elements or not easy to survey, to that space in which the operation of the tools on the work and the drop of cuttings takes place is, however, of the utmost importance just for automatically operating multi-spindle machines.

If therefore it can be attained, that all the control elements influencing the tool-carriages, especially their control cams and rollers are located completely outside the said ranges of working and drop of cuttings, but are otherwise arranged as near as possible to the carriages to be moved in their corresponding shafts above the tracks, so that they can be easily examined, adjusted and exchanged, not only the whole building up of the machine and of the tool carriage carriers of the same would be influenced in the best manner, i. e. simplified, symmetrised and rendered more easy to survey and free from disturbances of the service, but even cheapened for the reason that it is no longer necessary to use very complicated, numerous hinges and transmission elements which require many bearing- and guiding-points to bring nearer and transmit the movement from considerable distances.

Under the above suppositions the efficiency of individual kinds of multi-spindle automatic lathes, for instance of the four-spindle lathes, can be effectively increased by addition of a fifth and sixth transverse carriage, as then these additional transverse carriages might carry tools, which otherwise could be accommodated only on the normal transverse carriages of the four-spindle lathe without, however, disturbing by these additional transverse carriages the effect of important and absolutely necessary tools on the normal transverse carriages. In the four-spindle lathes of known construction the transverse carriages shiftable on the tracks of the machine frame served for instance often for accommodating building-up tools, and especially these tools often blocked the surveying of the operation of the tools and also the free flow of cuttings. As they required often another travel than those tools which further had to mounted on the observed two lower transverse carriages, also the efficiency of the machine is hereby accordingly hampered.

If under the above mentioned suppositions an additional fifth and sixth transverse carriage can be mounted on the four-spindle lathe, this addition enables for instance to easily accommodate on the same, magazine-arrangements, chaser-arrangements, patting- and edge breaking-tools and so forth, whereas the shape working tools can be clamped in the usual manner in the remaining four transverse carriages. In this manner more operations could be carried out and higher efficiencies could be attained.

This aim can be attained according to the invention in that each block face, which serves for holding tools operating in the longitudinal direction of the machine, is made movable forward and backward singly and directly by means controlled each by a cam.

If it is desired to attain all these advantages, every carrier block serving for carrying a pair of transverse carriages is, according to the invention, arranged in its position relative to the longitudinal carriage body radially and at such distance to the central line of the guide of the longitudinal carriage, that the distances of all bearing points of the blocks carrying the transverse carriages remain similar for the common guiding of the carriers of longitudinal carriages.

In Figs. 1 to 12 of the accompanying drawings several embodiments of the invention are illustrated by way of example illustrating multi-spindle automatic lathes.

Figs. 1–4 show a four-spindle lathe,

Fig. 1 is a side elevation,

Fig. 2 a top plan view partly in horizontal section on line II—II of Fig. 1,

Fig. 3 a cross section on line III—III of Fig. 1, and

Fig. 4 a cross section on line IV—IV of Fig. 2.

Figs. 5 and 6 show a four-spindle lathe with six transverse carriages:

Fig. 5 shows in end view a part of the machine viewed from the left,

Fig. 6 is a section on line VI—VI of Fig. 5.

A third form of construction of a six-spindle lathe is shown in Figs. 7 to 9,

Fig. 7 shows the right hand part of the machine in side elevation,

Fig. 8 is a cross section on line VIII—VIII of Fig. 7, and

Fig. 9 is a vertical section on line IX—IX of Fig. 7 and shows a casing enclosing the control cam.

Figs. 10–12 show on larger scale several constructional details.

In all forms of construction designates 1 the frame-like under part with oil catching cup, 2 and 3 the box-like upper parts of the machine frame on the lower part, 4 the covering box enclosing the spindle drum, 5 designates a casing which encloses the drums 14 having cam paths 15 mounted on the two shafts 12 located in the same horizontal plane at 7 and 25. 8 designates the main driving shaft which is enclosed by a sleeve-like guide body 11 on which the polygonal carrying block 9 for the longitudinal carriages 10 is mounted. 13 designates traverses profiled like tubes and serving for ensuring the distance between the carrier blocks 22 for two transverse carriages 21 mounted on each carrier block 22 and the protecting box 5 and embracing the shafts 12 in leaving free an annular gap of suitable width. 16 designates two axles mounted between and parallel to the shafts 12 and having a number of uniformly distributed longitudinal grooves, each axle carrying two-armed hub bodies 17 adapted to be shifted on the axles but cannot be turned relative the one to the other owing to the key and groove like connection between axle 16 and hub body 17, this movement being caused by the coordinated control cam 15 sliding along a roller 19 by one of the arms of the hub body 17 and transmitted by a connecting rod 20 engaging on the other arm 18 upon the corresponding longitudinal carriage 10. 23 designates the control discs which have each one a cam path 24 for the corresponding transverse carriage 21, each control disc being mounted between the carrier 22 of the transverse carriage and the clamping- and shifting curved drum 6 on the shaft 12. 25*a* designates the element of a system of hinged rods 27 to 33 mounted at 26 and causing the radial shifting of the transverse carriage 21. A roller 33, influenced by the cam 24 of the control disc 23, transmits, in the manner shown in the diagrammatical view in Fig. 12, the movement of the roller 33 upon the carriages 21.

The carrier 9 of the longitudinal carriages, if desired and necessary, can be moved to and fro as a whole with all its carriages or relative to certain longitudinal carriages controlled for themselves. In the first instance it would be necessary only to lock all carriages 10 on the block 8, so that the movement of this block could then be effected by one or several rods 20 through the intermediary of the control elements 14 to 18, or in the latter instance, of a single carriage 10 having locks on the block body 8 and this body being moved by the rod 20 of the locked longitudinal carriage, whereas the other carriages might be moved each one alone by its corresponding control element. There is finally nothing in the way, to arrange in the casing 5 a separate control shaft with cam, to revolve this shaft by suitable means and to transmit the revolving movement by the block 8 in a similar manner and by similar means as illustrated for the carriage 10.

In order to produce a four-spindle automatic lathe of special efficiency, constructed and operated according to the invention, a third shaft 12*a*, as shown in the form of construction illustrated in Figs. 5 and 6 and about which a third carrier block 22*a* for a fifth and sixth transverse carriage 21*a* is mounted can be provided and this shaft can be journalled at one end at 7*a* above the spindle box 4 and at the other end on the side wall of the protecting case 5 which is the left one in the Fig. 5, so that also the distance between 4 and 5 is again bridged over by a transverse 13*a* for stiffening. The movement of the carriages 21*a* is effected in a similar manner as the movement of the carriages 21 of the four-spindle lathe hereinbefore described.

In the six-spindle automatic lathe illustrated in Figs. 7 to 9 the third shaft 12*a* is not displaced relative to each one of the two shafts 12 by an angle of 90°, but by an angle of 120°. All three shafts 12, 12*a* are in the six-spindle automatic lathe of the same length and their corresponding bearing points and their relations to the control means for the longitudinal and transverse carriages do not differ at all. The carrier 9 for the longitudinal carriage, in the six-spindle automatic lathe, is of hexagonal cross section and has six longitudinal carriages 10 each one directly (positively) controlled by its own cam. Also the transverse carriages mounted pairwise on the three carriers 22—22*a* of transverse carriages are controlled directly and in closest proximity by its own cam.

Owing to the radial arrangement of all longitudinal carriages and transverse carriages and of their carriers relative to the central line of the guide 11 for the carrier of the longitudinal carriage and owing to the similar size of all distances of the bearing points 12 of the carriers 22—22*a* of the transverse carriages from this central line and of the accurately radial travel of all transverse carriages, an extremely simple, symmetrical, compact and notwithstanding easily

accessible building together of all important machine elements is ensured with absolute freedom of dropping of cuttings. Underneath the spindle-stock and the range in which the tools operate, there is not situated any driving element which might disturb the drop of cuttings. The almost ideal arrangement of two respectively three cam shafts in the longitudinal direction of the machine frame and of the tracks permits in the four-spindle automatic lathe selectively:

(a) clamping of the material and the feed on one spindle (simple four-spindle automatic lathe),

(b) clamping of the material and the feed on two spindles (double two-spindle automatic lathe),

(c) clamping of the material and the feed on four spindles (fourfold one-spindle automatic lathe),

whereas in the six-spindle automatic lathe it enables

(a) clamping of the material and the feed on one spindle (simple six-spindle automatic lathe),

(b) clamping of the material and the feed on two spindles (double three-spindle automatic lathe),

(c) clamping of the material and the feed on three spindles (triple two-spindle automatic lathe).

The arrangements described and shown make it also possible, to carry out the bolting of the spindle drum in the casing 4 after every feeding proceeding by only one bolt 34 aeting wedge-shaped in vertical direction to the central line of the spindle stock and to thereby attain the great advantage that besides omission of a second bolting point necessary in the known multi-spindle automatic lathes, the pair of bolts shiftable in a horizontal plane has to be provided diametrically the one opposite the other, the bolting effect is assisted by the total weight of the spindle-stock pressing on the bottom 4 of the casing. The movement of the bolting wedge 34 is effected by the double lever 36, 37 mounted at 35 on the spindle-stock casing 4, a roller 38 mounted on the arm 37 being moved downwards respectively upwards at each feeding by a cam 39 mounted on the shaft 12.

ERNST GOTHE.