

April 28, 1925.

J. A. R. BENNET

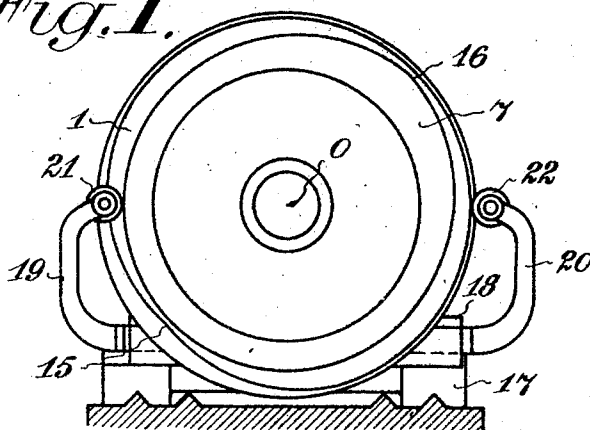
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COPYING LATHE

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3 Sheets-Sheet 1

*Fig. 1.*



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*Att. in v. Atty*

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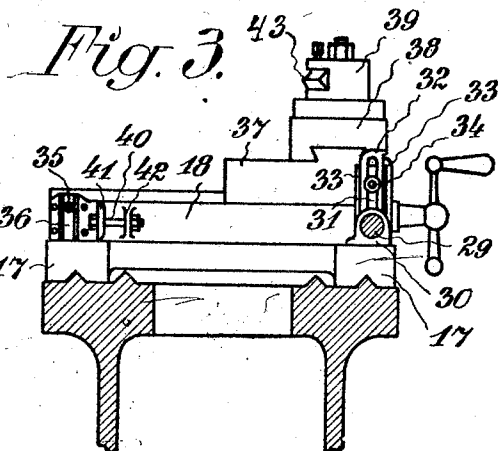
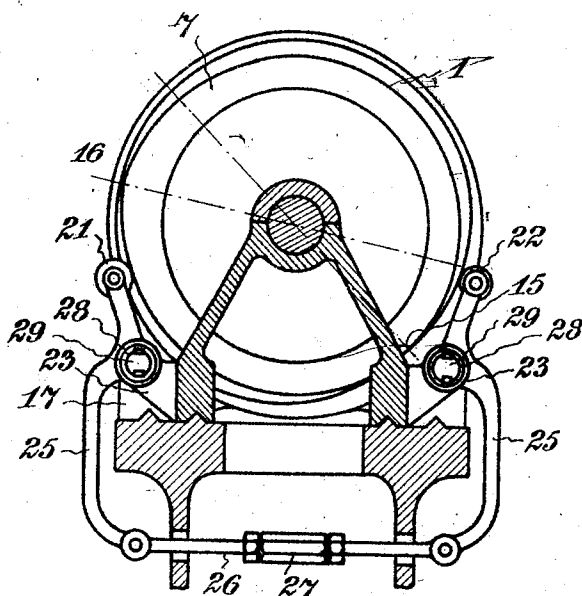
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*Fig. 2.*



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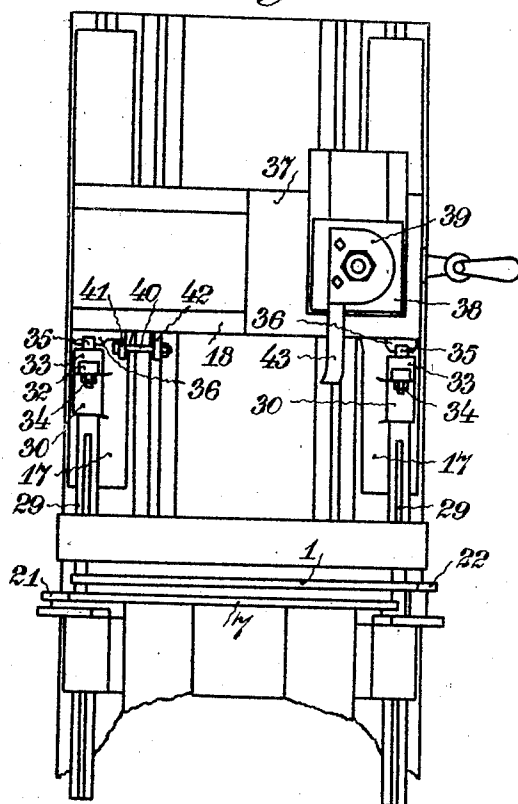
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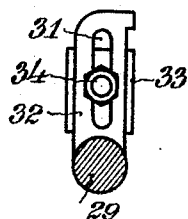
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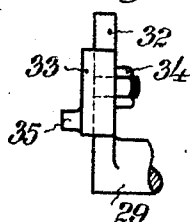
*Fig. 4.*



*Fig. 5*



*Fig. 6.*



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*J. A. R. Bennet,*

*By* *W. H. F. Smith* *att'y*

## UNITED STATES PATENT OFFICE.

JULES AXEL RUTGER BENNET, OF LUND, SWEDEN.

## COPYING LATHE.

Application filed April 28, 1923. Serial No. 635,360.

*To all whom it may concern:*

Be it known that I, JULES AXEL RUTGER BENNET, a citizen of Sweden, resident of Lund, in the county of Malmohus, Sweden, have invented certain new and useful Improvements in Copying Lathes, of which the following is a specification.

This invention relates to improvements in copying lathes for producing turned articles that must be given a very exact circumference by using a copy or former in such a way that said circumference exactly corresponds to the copy or former used, for instance in turning of piston rings or the like. Hitherto in such turning a guide pin connected with the cross slide of the saddle has usually been pressed positively against the former or copy fixed in a chuck or fastened in a similar manner in such a way that the cross slide with the turning tool will be moved inwards or outwards during the rotation of the copy. Such devices, however, are affected with the disadvantage that the cross slide and the turning tool do not positively and exactly follow the movements of the circumference of the copy or former on account of the inertia of the moving parts and the play resulting therefrom and from other causes, this being a considerable drawback when it is the question of producing work of precision and thus also it is impossible to use other than extremely low velocities when turning. This is also the case when a roller is used for guiding the tool which roller is running in a groove in the former. In order to make it possible for the roller freely to rotate it must rest only against one side of the groove in order not to be prevented from rotating, and therefore a certain play must be provided between the roller and the groove, so that an exact copying cannot be attained, irrespective of the fact that this defect will be increased gradually by wear of the groove and the roller.

The use of two guiding surfaces or formers is already known as well as of two rollers one of which is pressed against one of the formers and the other roller against the other former, but these two rollers are mounted on a common axis and act in the same way and with the same drawbacks as stated above. Moreover the latter device has for its purpose to produce surfaces of rotation and not in the same way as the

present invention to turn non-circular surfaces such as piston rings.

It is also already known to change the ratio of gear of levers for the production of pieces of work of different sizes by using one and the same former or copy.

These disadvantages are done away with by the present invention by using an auxiliary or a so called counter-former guiding the movements of the cross slide and the tool during the turning together with the main-former from and towards the piece of work in such a way that the greatest accuracy in shaping the piece of work in conformity to the used former may be obtained in an extremely simple manner. In this way the very great advantage is gained that in shaping the piece of work the cutting speed may be increased to the highest permissible for the turning tool and the material of the piece of work without affecting the exactitude of the shaping in any way.

In the accompanying drawing Fig. 1 is an end view of a machine constructed in accordance with the present invention. Fig. 2 is a vertical section through a lathe bed having the new apparatus mounted thereon in a form different from the one shown in Fig. 1. Fig. 3 is a similar section in two different planes to the right and left in the figure. Fig. 4 is a plan view of the lathe. Figs. 5 and 6 are views in two different planes of a constructional detail.

For the purposes of the present invention, it will be assumed that a perfectly correct main former has been provided and with such main former as the guide, a similar counter former has been formed. The main former 1 and the counter former 7 are indicated on the drawings.

After giving the counter-former 7 its proper circumference dependent of the main-former in any other suitable way it may be placed in a chuck or a driving plate of a lathe together with the main-former without changing its position in relation to the latter, and in such a way that its centre O (Fig. 3) coincides with the axis of the spindle of the lathe. The cross slide 18 of the lathe saddle 17 carries two arms 19 and 20 and on the ends of these arms rollers 21 and 22 are provided one of which 21 is running along the circumference of the counter-former 7 and the other 22 along the circumference of the main-former 1 in

diametrical opposition to the first mentioned roller when rotating the formers. The arms 19 and 20 are adjustable in the longitudinal direction of the cross slide 18 and may be fastened in such a way that each of the rollers 21 and 22 is held against its former, as shown on the drawing. During the rotation of the spindle of the lathe the cross slide 18 thus will move to and fro because it is displaced in one direction by the main-former and in the other direction by the counter-former. During this movement the rollers 21 and 22 will always simultaneously rest against the edges of their formers without any play whatever as is the case when weights, springs or other devices necessary for the movements of the cross slide are used and only one former. The arms 19 and 20 may of course be locked in right position by any suitable devices. By the movements of the cross slide caused by the formers the tool working at the piece of work, for instance a piston ring, will of course be moved in a similar way so that the piece of work is given a circumference exactly corresponding to the main former.

Another form of the invention is shown in Figs. 4 to 8. It is not necessary that the points of contact between the rollers 21 and 22 and the formers 7 and 1 are exactly opposite each other on a diameter through the centre of the spindle of the lathe, as shown in Fig. 3, as they also may be arranged in some other way forming a more suitable form of the invention for practical use. It is evident that also when the two formers are turned a certain angle in relation to each other and thereafter bolted together, a corresponding movement may be imparted to the cross slide with a shorter although always constant distance between the two rollers 21 and 22 running on the formers, if these rollers are adjusted to such a distance in relation to each other that one of them 21 is in contact with the highest point 16 on the counter-former 7 when the other roller 22 is in contact with the lowest point 15 on the main-former 1. Also in this case the sum of the distances between the centre of rotation O and the points of contact of the two rollers is always one and the same. In this case the rollers are carried by the upper ends of two double armed levers 25 mounted in bearings 23 fastened to the fast head stock of the lathe. The lower arms of the levers 25 are pivotally connected with each other by means of a rod 26. The length of this rod 26 corresponds to the distance between the fulcrums of the levers so that a parallelogram is formed whereby the sum of the distances between the centre of the spindle of the lathe and the axis of the rollers 21 and 22 always is the same. It is advantageous to provide the rod 22 with a turn-buckle 27 for the purpose of adjusting

the length of the rod. The levers 25 are mounted in the bearings 23 by means of hollow journals 28 fastened on the levers and in which horizontal shafts 29 are keyed. The other end of each shaft rests in bearings 30 (Figs. 5 and 6) on the saddle 17. On the shafts 29 vertical arms 32 provided with a longitudinal slot 31 are fastened in front of the bearings 30. An adjustable carrier 33 is made to slide in said arms and to be fastened to the same. The carrier 33 may be locked in its different positions by means of a nut 34 and on the side most remote from the arm 32 provided with a pin 35 engaging in a guide-way 36 on the cross slide 18. Thus when the main-former 1 and the counter-former 7 rotate the levers 25 and thereby also the shafts 29 and the arms 32 are turned forwards and backwards, whereby the carrier 33 by means of the pin 35 engaging in the guide-way 36 moves the cross slide 18 forwards and backwards in such a way that the turning tool 43 will be moved perfectly uniformly with the rollers 21 and 22 and the piece of work is given a circumference that is entirely determined by the main-former 1. By the movement of the carrier 33 in the slot of the arm 32 and its locking in different positions various ratios of gear may be obtained, so that pieces of work of different sizes or diameters may be manufactured by using one and the same main-former and counter-former. The feeding slide 37 is carried by the cross slide 18 and carries the top slide 38 with the tool holder 39. The guide-way 36 fastened on the cross slide 18 may be provided with a special adjusting device in order to eliminate eventual play between the guide and the pin 35. This may be done by means of a bolt 40 passing through a flange 41 on the guide and an eye 42 on the cross slide.

It is obvious that the various details of the apparatus described above can be carried out in different ways without digressing from the spirit of the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A copying lathe comprising a main former, a guiding member cooperating therewith, a counter-former, a second guiding member cooperating with the counter-former and connected with the first mentioned guiding member to move uniformly with the latter in the rotation of the main former and counter-former, the counter-former having a form of such a relation to that of the main former that the sum of the distances between the points of contacts of the two guiding members upon the main former and counter-former and the axis of rotation is always constant, a head stock for the lathe, a cross slide for the lathe,

double arm levers pivotally mounted on the fast head stock of the lathe for supporting the guiding members, an adjustable member connecting said levers, and means fixed  
5 to the levers for transmitting movement to the cross slide of the lathe.

2. A copying lathe, comprising a main former and a counter-former, double arm levers, an adjustable member connecting  
10 said levers, a guiding member carried by each lever and cooperating with a particular former, said guiding members being uniformly movable, the sum of the distances between the axis of the lathe spindle and the  
15 axis of the guiding members being always constant during the turning of the levers, a head stock for the lathe, a cross slide for the lathe, double arm levers mounted on shafts journaled in bearings on the fast  
20 head stock of the lathe for supporting the guiding members, arms carried by said shafts for transmitting movement to the

cross slide of the lathe, carriers in guide-ways in said cross slide, and means for adjustably securing said arms to said carriers. 25

3. A copying lathe, comprising a main former and a counter-former, the latter being turned in relation to the former through an angle less than  $180^\circ$ , and guiding members cooperating with the respective form-  
30 ers at points which are not diametrically opposed, the counter-former having a form in such relation to the form of the main former that the sum of the distances between the points of contacts of the guiding  
35 members and formers and the axis of rotation is always constant.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

JULES AXEL RUTGER BENNET.

Witnesses:

ERIC ERICSSON,

G. PETERSSON.