Dec. 11, 1951 L. E. TOPHAM 2,577,932

COPYING LATHE

Filed Aug. 1, 1947 3 Sheets-Sheet 1

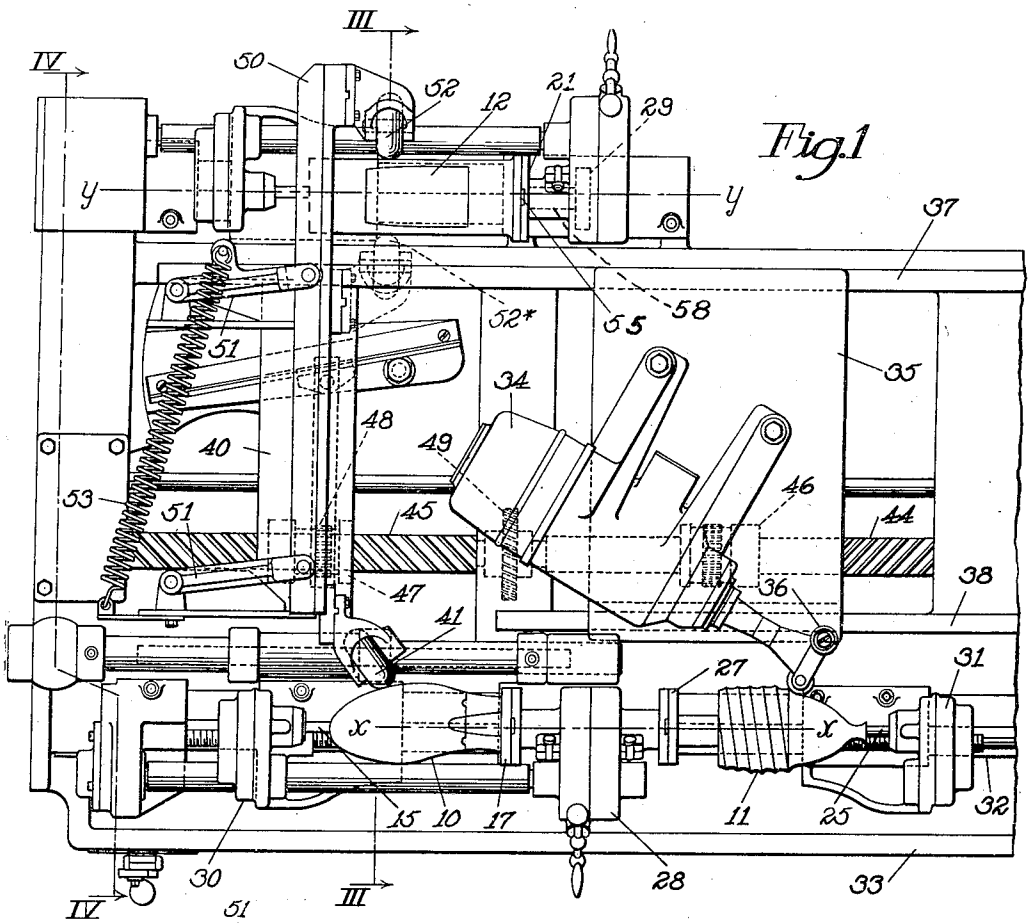


Fig.1

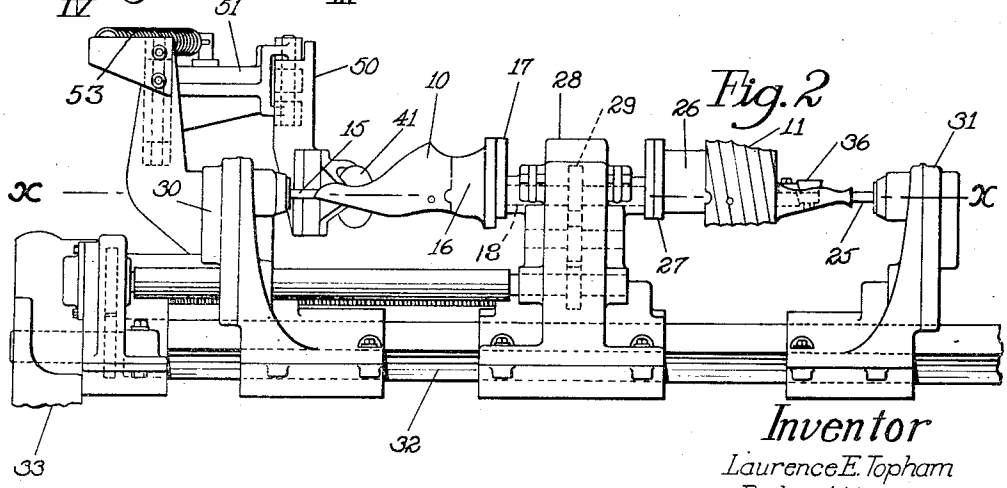


Fig.2

Inventor

Laurence E. Topham

By his Attorney

Leonard Ryan.

Dec. 11, 1951 L. E. TOPHAM 2,577,932

COPYING LATHE

Filed Aug. 1, 1947 3 Sheets-Sheet 2

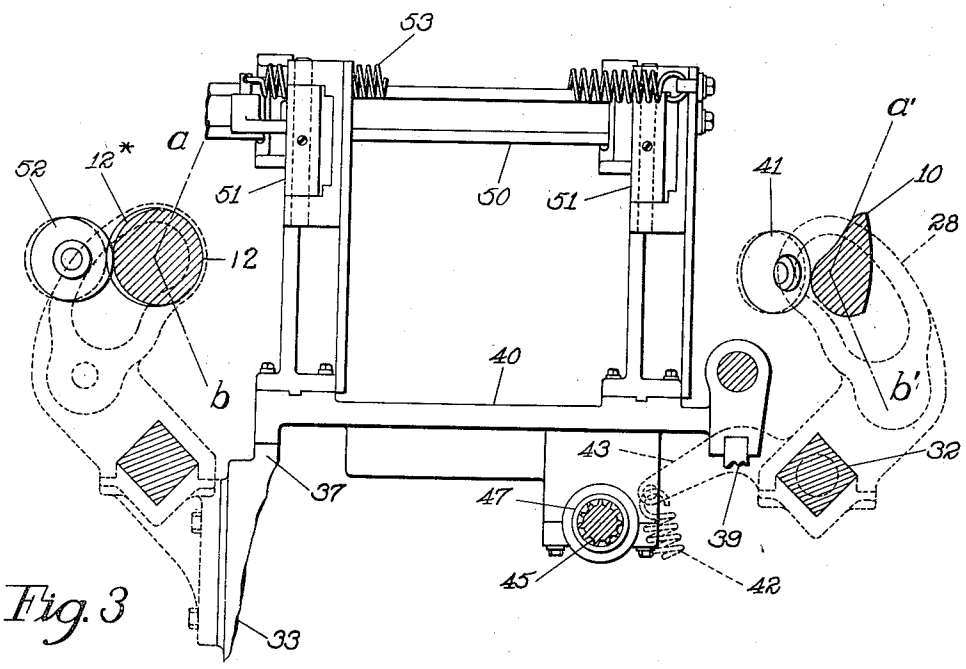


Fig. 3

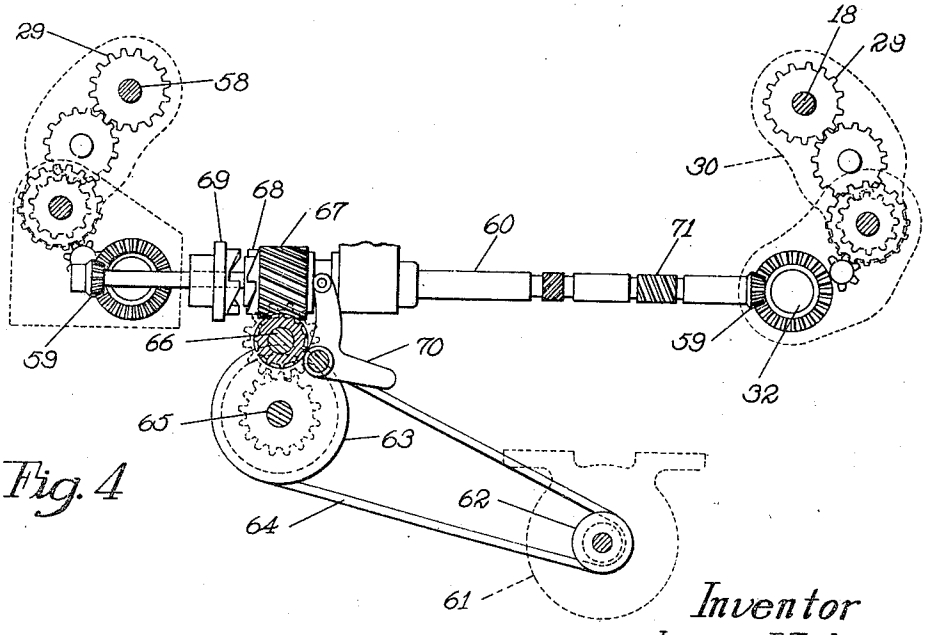


Fig. 4

Inventor
Laurence E. Topham
By his Attorney
Thomas J. Ryan

Dec. 11, 1951 L. E. TOPHAM 2,577,932

COPYING LATHE

Filed Aug. 1, 1947 3 Sheets-Sheet 3

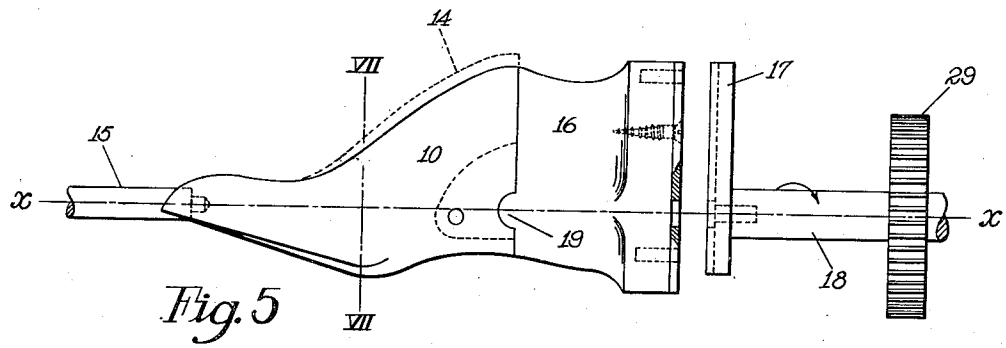


Fig. 5

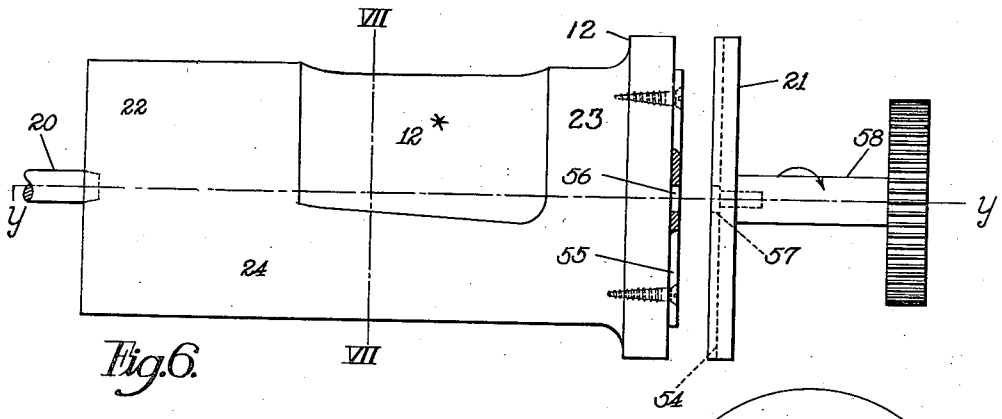


Fig. 6.

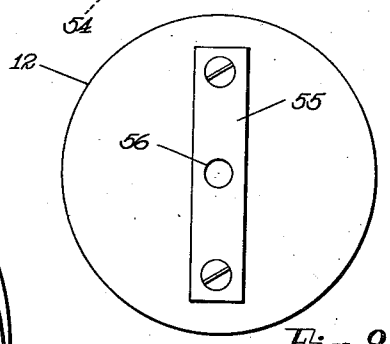


Fig. 8

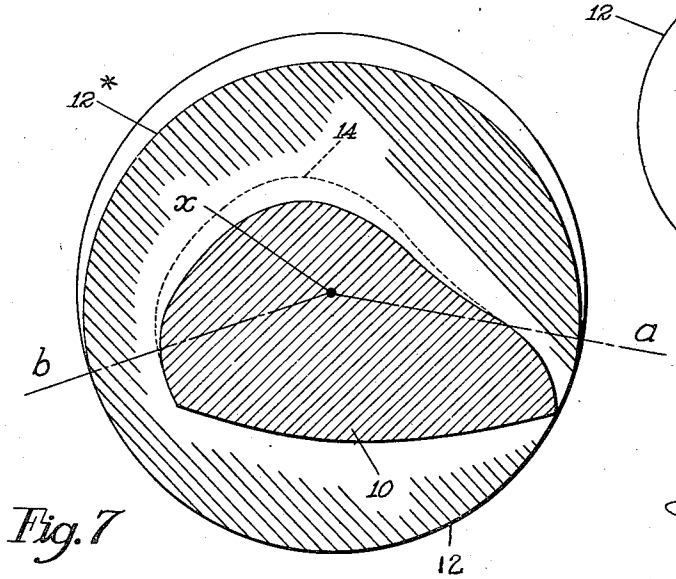


Fig. 7

Inventor

Laurence E. Topham

By his Attorney

Thomas J. Ryan

Patented Dec. 11, 1951

2,577,932

UNITED STATES PATENT OFFICE

2,577,932

COPYING LATHE

Laurence E. Topham, Wenham, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application August 1, 1947, Serial No. 765,575

5 Claims. (Cl. 142—15)

1

This invention relates to copying lathes, and its purpose is to provide automatic means for modifying the magnitude or the contour of the girth of the copy in one or more selected areas thereof without necessarily modifying other areas in any respect.

To facilitate an understanding of the invention, the following distinction between girth-grading and girth-modifying should be borne in mind: girth-grading affects all radial and girthwise dimensions of the copy according to some systematic order of magnification or reduction by a "grading factor," whereas girth-modifying, instead of being systematic, may be arbitrary, unsystematic and localized wherever desired, without use of any grading factor.

The invention has special utility for making models from which lasts may be copied in the usual well-known way. To cite a typical example for the purposes of the description to follow, let it be assumed that a shoe manufacturer has selected a last-model of a desired style from the stock of a last manufacturer, but prefers a slight increase of girth in the waist only of the lasts to be supplied to him. To satisfy such a preference a new model must be made from each master model of a set, and it will be termed a "copy" in this description to avoid confusion with the master model.

In the example chosen for illustration, the increase of girth in the copy is all above the bottom, that is, in the height of the instep, and none of the increase is in the width of the bottom or "insole pattern." A problem of this kind calls for localized modification, not girth-grading, since girth-grading would alter the insole pattern, the profile, the toe-spring and the general style of the copy. Now, increasing the girth of a model as specified above is equivalent to adding a layer of stock to the instep but nowhere else, except the boundary of the modified area where the added stock may merge with the unmodified area.

To deal with problems of this kind, the present invention provides a copying lathe in which a swing-frame, a model, a model-wheel, a feed carriage, a work-block, a cutter and a cutter-carriage are related and operated as in lathes hitherto used, with this exception, namely, no girth-grading mechanism is needed or used. In addition to the elements above specified, the invention includes a rotary modifying cam and a cam-follower for shifting the model-wheel back and forth with girth-modifying effects. The model-wheel is carried by the cam-follower, and

2

is thereby shifted along the length of the model as the follower is shifted along the length of the cam. The modifying cam is at least as long as the model to be copied, and is driven at the same speed as the model and the work-block. Consequently, the point of contact between the cam and its follower will follow a spiral course around the cam as the point of contact between the model and the model-wheel follows a spiral course around the model.

The perimeter of the cam has neutral areas or segments and modifying areas or segments, the neutral areas being cylindrical and of "neutral radius," so called because the effect of that radius is to locate the model-wheel where it will produce neither increase nor decrease in the corresponding radial dimension of the copy. On the other hand, all areas of other radii will place the model-wheel where it will have modifying effects.

The principles of the invention have now been set forth sufficiently to disclose a mechanical distinction between girth-grading and girth-modifying, namely, in girth-grading the back-and-forth motions of the model-wheel are derived from, and synchronized with, those of the swing-frame, but in girth-modifying the back-and-forth motions of the model-wheel are derived from a source other than the swing-frame, they are arbitrarily timed, and, more likely than not, they are out of phase with the motions of the latter.

It is to be understood that any modifying cam may be replaced by another having different modifying effects. In some circumstances it might be desired to modify a copy not by altering the girth in the waist, but by adding a bulge corresponding to a bunion, or, in other circumstances, to modify a copy by making the toe portion thereof wider or not so wide as that of the model, or by altering the profile of the toe only. All these and other alternative modifications are within the range of the invention, and require only modifying cams in which the desired modifying characteristics have been embodied.

Referring to the drawings:

Fig. 1 represents a top plan view of a portion of a copying lathe in which a modified copy of a model is in process of being generated in accordance with the invention;

Fig. 2 is a front elevation of the assemblage represented in Fig. 1;

Fig. 3 is a vertical section in a plane indicated by line III—III in Fig. 1 but including only those

elements that are directly instrumental in modifying the copy;

Fig. 4 is a left side elevation of transmission gearing some of which is enclosed in the casings intersected by line IV—IV in Fig. 1;

Fig. 5 is a front elevation of a model and means for supporting it in the swing-frame of a lathe;

Fig. 6 is a front elevation of a modifying cam and means for supporting it in the lathe;

Fig. 7 is a composite view including a section of a model (line VII—VII in Fig. 5), the corresponding girthwise contour of a modifying cam, and the corresponding modifying effect (dotted line) of the cam superposed on the model; and

Fig. 8 is an end elevation of a modifying cam.

The drawings include a representation of a lastmaker's model 10 of a forepart. The omission of the heel part has no significance related to this invention. Its only significance is that the copying lathe chosen for putting the invention into practice is of a type that produces foreparts and heel parts individually for two-part hinge lasts. Furthermore, a lathe of this type produces a "left" copy from a "right" model, and vice versa, but that characteristic of the lathe has no significance related to the present invention.

Figs. 1 and 2 include a work-block 11 in process of being turned to produce a modified copy of the model 10. The difference between the model and the copy, other than the ordinary difference between a "right" and a "left," is a quantity added to the copy by a rotary modifying cam 12. This quantity, when combined with the quantities derived from the model 10, has the same effect as it would have if embodied in the model itself instead of being embodied, as illustrated, in an individual modifying cam. The fundamental quantities embodied in any selected model 10 remain unchanged so far as the model is concerned, but any desired plus or minus quantities embodied in a modifying cam may be combined with them to produce a modified copy of the model.

Dotted lines 14 in Figs. 5 and 7 indicate the equivalent of the modifying effect of the cam 12. It is to be observed that the modifying quantity derived from the cam 12 is so localized as to increase the girth and depth of the copy without producing any difference in the "insole pattern" thereof. Nevertheless, the modifying quantity could be otherwise located by a modifying cam of different design with or without changing the "insole pattern" of the copy. In brief, then, the modifying quantity represented by the dotted lines 14 may be regarded as the equivalent of a patch fastened to the model.

In Fig. 5 the broken line x—x represents the rotational axis of the model and means for carrying it. The same axis is represented by a dot x in Fig. 7. The carrying means include a freely rotatable tail-stock 15, a driving block 16, a face-plate 17 and a live spindle 18. The model and the block 16 are provided with interlocking surfaces 19 corresponding to the abutting joint surfaces of a well-known type of hinge last. The confronting faces of the block 16 and the face plate 17 are also provided with interlocking means including a tongue and a groove by which axial alinement and rotational phase of the model and the spindle are maintained.

The cam member 12, when set up for use, is supported by a freely rotatable tail-stock 20 and a face-plate 21 both constrained to a fixed axis y of rotation. The peripheral surface of the cam is the operating surface, and for the specific purpose of modifying the instep of a forepart without modifying the insole pattern or other area thereof it is provided with two circumferential bands 22 and 23 of 360°, both cylindrical and of an arbitrary neutral radius, a cylindrical segment 24 of the same radius connecting the bands 22 and 23, and the modifying segment 12* of other radii bounded by the bands 22, 23 and 24. The portions 22, 23 and 24 of neutral radius correspond to those portions of the copy that are not to be modified.

The copying lathe partially illustrated in the drawings embodies some of the principles and some of the features of lathe described in United States Letters Patent 2,072,228, granted March 2, 1937, on application of Topham and Knott.

The work block 11 (Figs. 1 and 2) and a driving block 26 are provided with interlocking joint surfaces and the block 26 and a face-plate 27 have interlocking connections similar to those of the cam 12 and its face-plate. The two face-plates 17 and 27 are rigidly connected to each other by the spindle 18. The toe end of the work-block 11 is supported by a freely rotatable tail-stock 25.

The spindle 18 is journaled in an arm 28 affixed to a rockshaft 32, and the tail-stocks 15 and 25 are journaled in arms 30 and 31. The rockshaft and the three arms 28, 30 and 31 constitute a swing frame, the rockshaft being square except its ends which are cylindrical and journaled in bearings in a main frame 33. The arm 28 is hollow and encloses a train of gears 29 one of which is affixed to the spindle 18.

An electric motor 34 (Fig. 1) is fastened to a cutter-carriage 35 and provided with a rotary cutterhead 36 for operating on the work-block 11. The carriage 34 is arranged to slide on rails 37, 38 provided by the frame 33.

The rail 37 and a rail 39 provide a track for a follower carriage 40 on which a model-wheel 41 is mounted to cooperate with the model 10. A tension spring 42 (Fig. 3) connected to an arm 43 of the swing-frame normally presses the model against the wheel 41.

As in the lathe of Patent 2,072,228, the carriages 35 and 40 are fed toward each other by a shaft having a feed-screw 44 for the cutter-carriage, and a feed-screw 45 of opposite lead for the follower carriage. The carriages are provided with nuts 46 and 47, engaging the feed-screws, respectively, the nut 47 having a spur gear 48 by which it may be rotated with length-grading effect while the screw-shaft rotates to move the carriages. Since this type of length-grading mechanism is described in the aforesaid Patent 2,072,228, its details need not be described here. The screw-shaft is provided with a spur gear 49 between its screw portions. Other gearing (not shown) transmits rotation to the gear 49 from a worm 71 (Fig. 4).

The model-wheel 41 is carried by a follower 50, and the latter is carried by the carriage 40 to which it is connected by parallel links 51. These links constrain the model-wheel to horizontal movement approximately at right-angles to the turning axis x of the model. The follower 50 includes an anti-friction roll 52 arranged to run on the periphery of the modifying cam 12. A tension spring 53 anchored to the carriage 40 will be connected to one of the links 51 of the follower when the roll 52 is arranged to engage the rear side of the modifying cam, as repre-

sented in full lines in Fig. 1. In these circumstances the follower will be biased against the cam 12 with more power derived from the spring 53 than the opposing bias of the model against the model-wheel derived from the spring 42 (Fig. 3). Consequently, the position of the model-wheel will be governed by the modifying cam and the spring 53 despite the inferior bias of the spring 42.

On the other hand, if the modifying duty of the cam 12 were to decrease, instead of increase, the girth of a copy, it could be done by shifting the roll 52 to a location indicated in dotted lines 52* where its point of contact with the cam would be 180° from that of the location first specified. When the roll 52 is arranged to engage the front side of the cam the spring 53 (Fig. 1) need not be used, since the spring 42 (Fig. 3) will then suffice to bias the roll against the cam as well as to bias the model against the model-wheel.

The face-plate 21 (Fig. 6) has a groove 54 extending diametrically to receive a metal strip 55 of equal width affixed to the abutting end of the cam 12. These details provide interlocking means for driving the cam. They also provide for setting the cam in either of two positions 180° apart, according to the setting of the roll 52 for additive or subtractive modifying effect. A hole 56 is made in the strip 55 to receive the head 57 of a pin set in the groove 54 of the face plate and centered on the rotational axis y. The head 57 and the tail-stock 20 maintain the axis of the cam on the rotational axis y, while the strip 55 and groove 54 maintain rotational phase relation of the cam and the model.

The face-plate 21 at the rear of the lathe (Fig. 1) is affixed to a spindle 58 corresponding to the spindle 18 at the front. The two spindles are interconnected by transmission gearing (Fig. 4) including a gear train 29 for the spindle 58 like the corresponding train 29 for the spindle 18. The transmission gearing also includes bevel gears 59, 59 both affixed to a shaft 60. This gearing synchronizes the rotation of the spindles 18 and 58. Rotation derived from an electric motor 61 is transmitted by pulley 62, 63 and a belt 64 to a countershaft 65, thence by gears to another shaft 66, and thence by gears 67 to the driving member 68 of a jaw clutch. The driven member 69 of this clutch is affixed to the shaft 60, but the driving member 68 is arranged to slide on the shaft to engage and disengage the member 69, and is under control of a mechanism represented by a lever 70.

In operation, the model 10, the block 11 and the modifying cam 12 will rotate equally and remain in cyclic phase with each other, and whenever the roll 52 is spaced from axis y by a distance equal to the neutral radius of the cam the modifying effect of the model wheel 41 will be zero. If the modifying surface 12* of the cam is in a cavity of less than neutral radius, as illustrated in Figs. 6 and 7, and if additive modifying effect is desired, the roll 52 will be set to bear against the rear side of the cam (solid lines in Fig. 1) and the spring 53 will be used to govern the model wheel accordingly. Therefore, whenever the follower roll 52 enters the cavity in the cam the model wheel 41 will move forward with additive modifying effect. If subtractive modifying effect were desired it could be obtained by shifting the roll 52 to the location indicated at 52*, turning the cam member 180° with respect to its face-plate 21, and detaching the spring 53. In that event the model wheel 41 would move backward whenever the follower roll enters the cavity in the cam. The forward and backward movements of the model wheel will be out of phase with the oscillations of the swing frame.

Considering the specific example of a modifying effect indicated in Figs. 3 and 7, the longer segment defined by the radial lines a and b is the modifying segment of the cam, and the shorter segment is the non-modifying or neutral segment thereof. As applied to the ball region of a model, the lines a' and b' at the right of Fig. 3 correspond to the lines a and b applied to the modifying cam. In this view the model 10 is displaced to the right of its normal position a distance equal to the depth of the cavity in the cam member. The normal positions of the roll 52 and the model wheel are indicated with dotted lines.

In Fig. 7, in which a cross-section of the model is superposed on a diagrammatic section of the modifying cam, the lines a and b define the angular extent of the modifying effect of the cam as applied to the upper portion of the model, but not to the lower portion thereof.

Having thus 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 swing-frame including rotatable means for carrying a work-block and a model, means for driving said carrying means, a model-wheel for cooperating with the model in the swing-frame, a cutter for operating on the work-block in the swing-frame, a partially cylindrical cam movable by said driving means in phase with revolutionary cycles of said carrying means but out of phase with oscillations of the swing-frame, and mechanism for shifting said model-wheel back and forth to modify the motions imparted to the swing frame by the rotating model, said mechanism including a member cooperatively related to the periphery of said cam and directly connected to the model wheel.

2. A copying lathe comprising a swing-frame including rotatable means for carrying a work-block and a model, a carriage, a cam-follower movably related to said carriage but carried thereby to partake of its traverse, a model-wheel carried by said follower, a rotary cam cooperatively related to said follower for shifting said model-wheel back and forth to modify the motions imparted to the swing-frame by the model, means for driving said rotatable means and said cam at equal speeds, and a cutter-carriage provided with a cutter for operating on the work-block.

3. A copying lathe comprising a swing-frame including rotatable means for carrying a work-block and a model, a cam rotatable about a fixed axis, a carriage, a cam-follower peripherally engageable with said cam and movably related to said carriage but carried thereby to partake of its traverse, a model-wheel cooperatively related to the model in the swing frame and responsive to the motions of said follower to modify the motions imparted to the swing-frame by the model, means for driving said rotatable means and said cam at equal speeds, and a cutter-carriage provided with a cutter for operating on the work-block.

4. A copying lathe comprising cutting means for operating on a work-block, a swing-frame including rotatable means for carrying the work-block and a model, a carriage, a cam-follower movably related to said carriage but carried thereby to partake of its traverse, a model-wheel

carried by said cam-follower, a rotary cam by which said follower is contacted and linearly moved for shifting the model-wheel back and forth, and means for driving said cam and said rotatable means at equal speeds, said cam having concentric peripheral segments of neutral radius and unequal angular extent and a peripheral segment of other radius for modifying the copy of the model.

5. A copying lathe comprising cutting means for operating on a work-block, a swing-frame including rotatable means for carrying the work-block and a model, a carriage, a cam-follower movably related to said carriage but carried thereby to partake of its traverse, a model-wheel carried by said cam-follower, a rotary cam cooperatively related to said follower and rotatable about a fixed axis for shifting said model-wheel back and forth, and means for driving said cam and said rotatable means at equal speeds to

modify the motions imparted to the swing frame by a rotating model, said cam having successively effective peripheral segments of a neutral radius by which the model-wheel will be maintained in a non-modifying location.

LAURENCE E. TOPHAM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,753,391	Topham	Apr. 8, 1930
1,798,926	Black et al.	Mar. 31, 1931
1,864,187	Curtis	June 21, 1932
2,154,726	Clausing	Apr. 18, 1939
2,277,153	Scott et al.	Mar. 24, 1942
2,365,311	Topham	Dec. 19, 1944
2,411,135	Landers et al.	Nov. 12, 1946