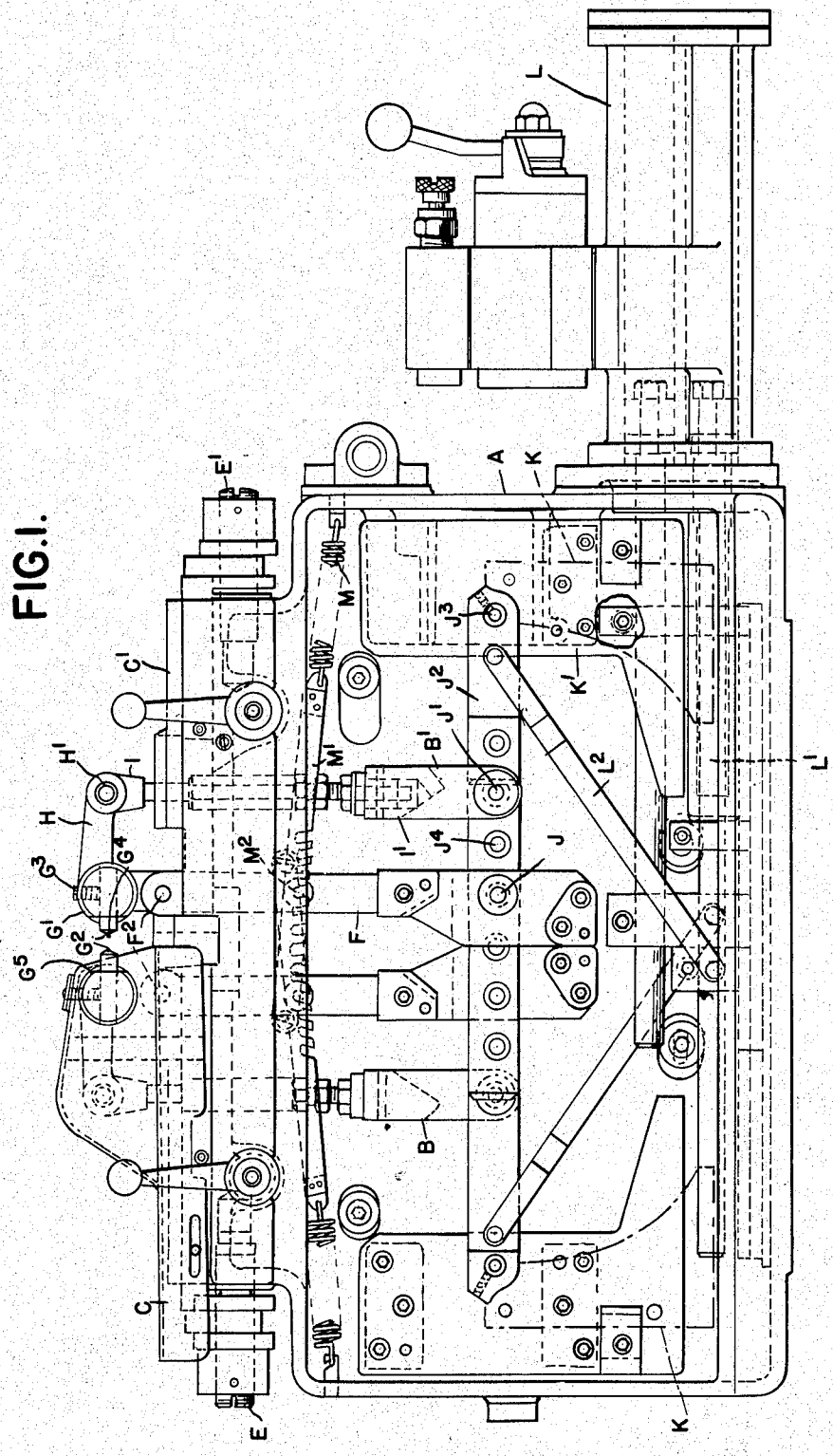
Feb. 24, 1942. I. J. GRUENBERG 2,274,543

TRIMMING MECHANISM FOR GRINDER WHEELS

Filed June 10, 1940 3 Sheets-Sheet 1

FIG. 1.



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FIG.2.

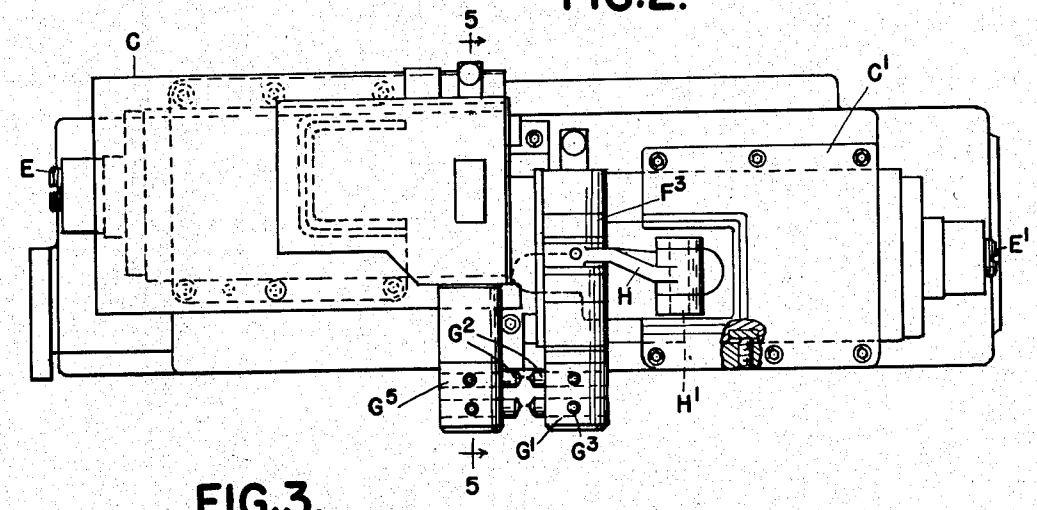
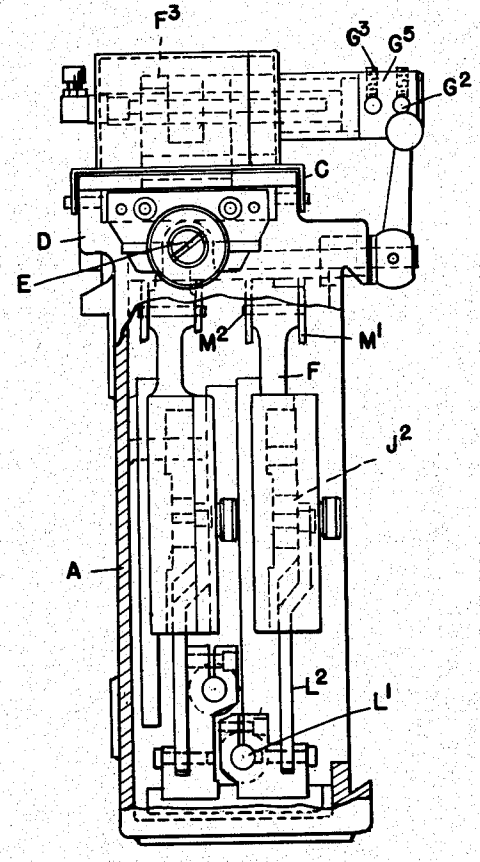


FIG.3.



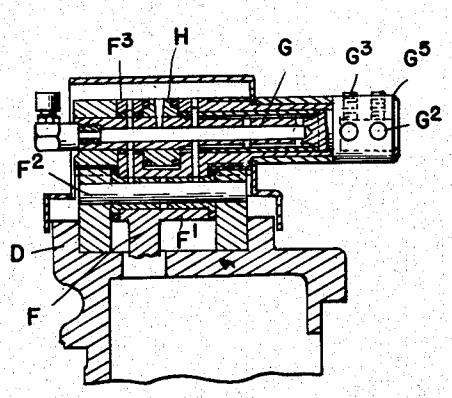


FIG.5.

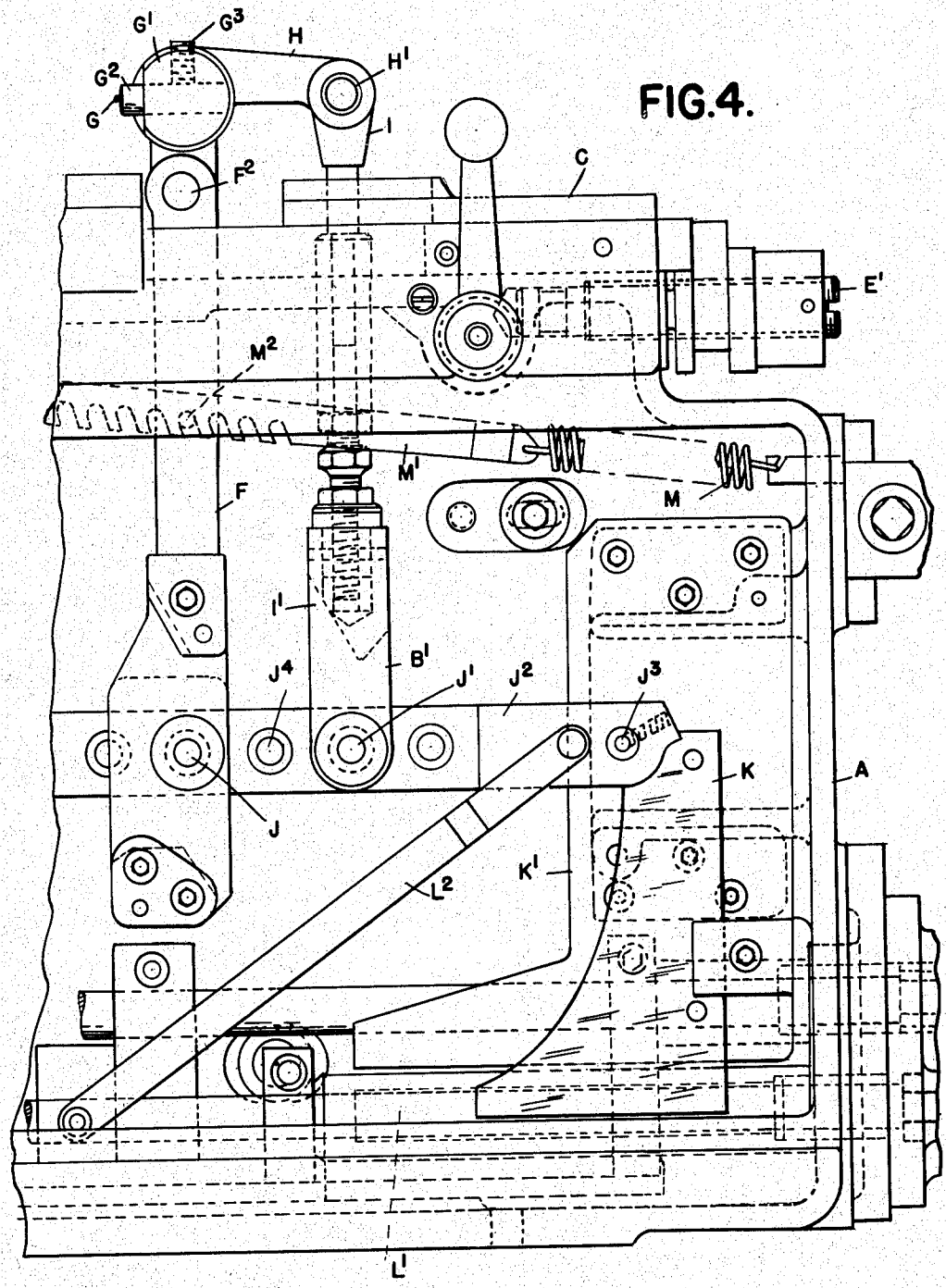
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FIG.4.



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UNITED STATES PATENT OFFICE

2,274,543

TRIMMING MECHANISM FOR GRINDER WHEELS

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Application June 10, 1940, Serial No. 339,821

11 Claims. (Cl. 125—11)

The invention relates to trimming mechanisms for grinder wheels, such as are designed for use in form grinding. More particularly, the invention relates to trimming mechanisms of that type employing pre-fashioned templets for controlling the movement of the trimming point, together with a pantograph mechanism through which the travel of said trimming point exactly reproduces the curve of the templet at a reduced scale.

Trimmers used with certain grinding machines, such for instance as those employed for the grinding of gears, are controlled by templets of involute contour. With these the trimming point during its travel does not always extend normal to the curve it is fashioning, and this change in angularity sometimes produces a distortion in the form. This is for the reason that the rocking of the diamond or other trimming point may bring another portion thereof into contact with the work. As the mechanism intermediate the templet and the trimming point is of a pantograph character having a short arm to which the trimmer is attached, and a long arm carrying the pin that traces the templet, the change in angularity of the trimming point is largely governed by the length of this short arm which functions more or less as a radius.

It is the primary object of the instant invention to maintain the member carrying the trimming point as nearly as possible normal to the curve it is tracing at all points during its travel. This cannot be exactly accomplished inasmuch as the curve is not an arc of a circle but by selecting an arc of proper radius it divergence from the desired curve is relatively small. It is, therefore, an object of the instant invention to provide means for proportionately adjusting the lengths of the long and short arms of the pantograph, so that the latter corresponds approximately to the radius of the selected arcuate curve. To this end the invention consists in the method and construction as hereinafter set forth.

In the drawings:

Figure 1 is a front elevation of the trimming mechanism;

Figure 2 is a plan view thereof;

Figure 3 is an end elevation, with parts broken away;

Figure 4 is an enlarged view, similar to Figure 1, of a single pantograph mechanism;

Figure 5 is a cross section on line 5—5 of Figure 2.

As shown in Figure 1, A is a suitable frame for supporting the trimming mechanism and which is adapted to be mounted in operative relation to the grinding machine (not shown). On this frame are adjustably mounted a pair of pantograph mechanisms B and B' each controlled by a templet and provided with a diamond trimmer. The mountings for these mechanisms are formed by independently adjustable carriages C and C' which are supported in guideways D extending across the top of the frame. E and E' are adjusting screws at opposite ends of the frame for respectively adjusting the carriages C and C' as will be hereinafter described.

The particular type of pantograph mechanism which is specifically illustrated comprises a vertically extending arm F provided at its upper end with a head portion F' which is pivotally secured to the carriage by a pin F^2. Above this pin the head is provided with a bifurcated bearing F^3 in which is journaled the cylindrical shank G of the trimmer head G'. This head is transversely bored to receive one or more diamond holders G^2 which may be secured in different positions of adjustment by set screws G^3. Between the furcations of the bearing F^3 there is secured to the shank G a laterally extending arm H having its outer end connected by a pivot pin H' with the bifurcated upper end I of a vertically extending link I'. The arm F and link I' are parallel to each other and at their lower ends are pivotally connected by pins J and J' to a horizontally extending bar J^2. The outer end of the bar J^2 carries a pin J^3 for engaging the templet K. The latter is mounted on the frame A in a supporting casing K' and is so positioned as to control the movement of the trimmer as hereinafter described.

With the construction as thus far described, it will be understood that the arm F, link I', arm H and bar J^2, together with their pivotal connections and the supporting pivot F^2 constitutes a parallelogram frame, which together with the projecting portion of the bar J^2 and the diamond carrier G^2 constitutes the pantograph. To properly function as such, the diamond point G^4 and the pin J^3 must always be in a straight line passing through the axis of the supporting pivot F^2, which therefore makes the radial length of the diamond from the axis of the head G' proportional to the length between the pivot J and pin J^3 of the bar J^2. It is, however, possible to adjust the diamond carrier G^2 in the head G so as to increase or diminish its radial length in which event a proportional adjustment must be made in the length of the bar J^2. Also, by operating the screw E' the carriage C' is adjust-

ed on the ways D so that the diamond point G^4 may be adjusted into operative relation to the grinder wheel to be trimmed.

The description just given of the pantograph B' applies to the pantograph B, the two mechanisms being located on opposite sides of the longitudinal center of the frame to fashion the opposite sides of the grinder wheel when arranged therebetween. These pantographs may be operated either manually or by power, but as shown they are actuated by hydraulic rams L mounted on one end of the frame. The pistons L' of these rams are connected by Links L^2 to the bars J^2 and function to press the pins J^3 against the templets K and to move the same along the curved contour thereof. This movement through the medium of the pantograph will cause the diamond point G^4 to trace a similar curve. Springs M anchored to the frame and connected through notched rods M' with pins M^2 on the rods F serve to resiliently hold the pin J^3 in contact with the contour of the templet. The method of adjusting and operating the mechanism for the trimming of a particular curved contour is as follows.

The templet for a particular involute curve, as for instance corresponding to a gear tooth of predetermined pitch and pressure angle, is mounted in the casing K'. The operator then selects an arcuate curve which has the least divergence from this involute curve and determines the radius thereof. The diamond holder G^2 is then adjusted radially in the head G' so that the point G^4 is spaced from the axis of said head a radial length proportionate to the radius of said arc, this being determined by the ratio in length of the portions of the arm F above and below the axis of the pin F^2 to the axes of the head G' and pin J respectively. As specifically shown, this ratio is six to one, which requires that the radial length of the trimming point from the axis of the head G should be one-sixth the length between the pivot J and the pin J^3. To facilitate such adjustment the bar J^2 is provided with a series of equispaced apertures J^4 for receiving the pins J and J'. This permits of lengthening or shortening the projecting portion of the bar J^2 by shifting said pins J and J' into the apertures J^4, after which the diamond holder G^2 may be proportionately adjusted. While this does not permit of adjusting the radial length of the trimmer to be exactly proportional to the radius of the selected arc, it is a close enough approximation for all practical purposes and simplifies the operation of adjusting the machine. After the completion of the adjustments just described, the carriages C and C' may be adjusted by the operation of the screws E and E' so as to position the diamond points G^4 in proper relation to the grinder wheel to be trimmed. Such adjustment of the carriages would alter the tension of the springs M, but by engaging a different notch of the bar M' with the pin M^2 a proper tension will be restored.

If the trimming mechanisms B and B' were arranged in the same plane they would interfere with each other, and to avoid this they are placed in spaced parallel planes. The trimming points G^4 of the two trimming mechanisms must, however, be arranged in the same plane, which is accomplished by forming one of the trimming heads G^5 of greater length than the other trimming head G', and locating the diamond holders in a common plane perpendicular to the axes of these heads. Two sets of diamond holders are preferably provided, these being in spaced planes; the one set being used for roughing out the work and the other for the final finish. These trimming mechanisms are, in effect, compound pivotally connected lever systems, each including a trimming arm and a templet engaging follower arm. By proportionately adjusting the length of these arms, the average center of movement of each approximates that of the curve which is traced.

While I have described adjustment of the carriages C and C' by the screws E and E' for the purpose of positioning the trimming points in relation to the work, such adjustment is not always necessary. This is for the reason that the pantograph mechanism is capable of sufficient angular movement about its fixed pivot F^2 to properly locate the trimming point in relation to the work and the follower arm in relation to the templet. The adjustment of the carriages C, C', is, however, advantageous to compensate for wear in the diamond point which would otherwise slightly alter the position of the curve with respect to the work.

What I claim as my invention is:

1. In a method of trimming curved contours with templet controlled pantograph trimming mechanism having projecting arms of proportionate length for respectively engaging the templet and for carrying the trimming point, the steps of selecting an arcuate curve having the least divergence from the curve of the templet, adjusting the length of the trimming arm to be approximately proportionate to the radius of the selected arc and proportionately adjusting the length of the templet engaging arm.

2. In a method of trimming curved contours with templet controlled pantograph trimming mechanism including a supporting fulcrum pivot and adjustable arms for respectively engaging the templet and carrying the trimming point; the steps of selecting an arcuate curve having the least divergence from the curve of the templet, adjusting the trimming point carrying arm to a length substantially proportional to the radius of said arcuate curve, adjusting the length of the templet engaging arm to maintain a constant ratio to the length of the trimming arm and adjusting the fulcrum pivot to position the trimming point in relation to the work.

3. A trimming mechanism comprising a pantograph proportioned for a predetermined reduction and having a short arm for carrying the trimming point and a long arm for engaging a templet, and means for adjusting the lengths of said short and long arms to change the degree of angular movement thereof while maintaining a constant ratio of reduction.

4. A trimming mechanism comprising a pantograph proportioned for a predetermined reduction and having a short arm for carrying the trimming point and a long arm for engaging a templet, means for adjusting said long arm to any one of a series of predetermined lengths, and means for adjusting said short arm to a proportional length to maintain a constant reduction ratio.

5. A trimming mechanism comprising a pantograph proportioned for a predetermined reduction and having a short arm for carrying the trimming point, a member forming one of the sides of the pantograph projecting beyond the same to form a long arm for engaging a templet, said member being provided with a series of pivot

apertures and pivots for alternative engagement with said apertures to connect the same to the adjacent sides of the pantograph thereby varying the length of the projecting arm, and means for adjusting said short arm to a proportionate length to maintain a constant reduction ratio.

6. A trimming mechanism comprising a pantograph proportioned for a predetermined reduction and including pivotally connected sides of a parallelogram frame, a head projecting laterally from one of said sides in axial alignment with the pivot between said side and an adjacent side, a member carrying the trimming point radially adjustably secured to said head to form a short projecting arm, a member forming the side connected to the opposite end of the first mentioned side and projecting to form a long arm for engaging the templet, said member being provided with a series of pivot apertures and detachable pivots for alternative engagement with said apertures to connect said member to the adjacent sides of the parallelogram frame and to vary the projecting length of the templet engaging portion, said arm being adjustable to a proportionate length to maintain a constant reduction ratio.

7. A trimming mechanism comprising a pantograph proportioned for a predetermined reduction and having a short arm for carrying a trimming point and a long arm for engaging a templet, means for adjusting the lengths of said short and long arms to change the degree of angular movement thereof while maintaining a constant reduction ratio, a supporting frame, a carriage on said frame upon which said pantograph is mounted, and means for adjusting said carriage on said frame to compensate for any adjustment of said short arm.

8. A trimming mechanism comprising a pantograph including pivotally connected sides of a parallelogram frame, a fulcrum pivot engaging one of said sides intermediate the pivotal connections to adjacent sides positioned for a predetermined reduction ratio, a head projecting laterally from a transverse side in axial alignment with the pivotal connection to the first mentioned side, a member carrying the trimming point radially adjustably secured to said head to project oppositely from the side to which said head is attached, a member forming the second transverse side and projecting to form a templet engaging arm, said member being provided with a series of pivot engaging apertures, pivot pins detachably engaging alternative pairs of said apertures to connect said member to the adjacent sides and to vary the length of the projecting arm, said trimming point carrying arm being adjustable to a proportionate length, a supporting frame, a carriage on said frame upon which said fulcrum pivot is mounted, and means for adjusting said carriage on said frame to compensate for any adjustment of said trimming point carrying member.

9. A templet controlled compound lever trimming mechanism including a trimming arm, a templet engaging follower arm, and means for proportionately adjusting the length of said arms to change the degree of angular movement thereof while maintaining a constant ratio therebetween and to locate the average centers of movement of said arms approximately at the average centers of the curves respectively traced thereby.

10. In a method of trimming curved contours with templet controlled pivoted lever trimming mechanisms, the steps of adjusting the length of the trimming arm from a pivot center to correspond approximately to the radius of a circular arc having the least divergence from the curve to be trimmed, and in adjusting said mechanism to locate said pivot center approximately at the average center of said curve.

11. In a method of trimming curved contours with templet controlled compound pivoted lever trimming mechanisms, the steps of adjusting the length of the trimming arm from a pivot center to correspond approximately to the radius of a circular arc having the least divergence from the curve to be trimmed, proportionately adjusting the length of the templet engaging arm, and in adjusting the mechanism to locate said pivot center approximately at the average center of the curve to be trimmed.

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