

May 29, 1934.

G. J. SUTTON

1,960,760

TRUING DEVICE FOR ABRASIVE WHEELS

Filed April 9, 1928

3 Sheets-Sheet 1

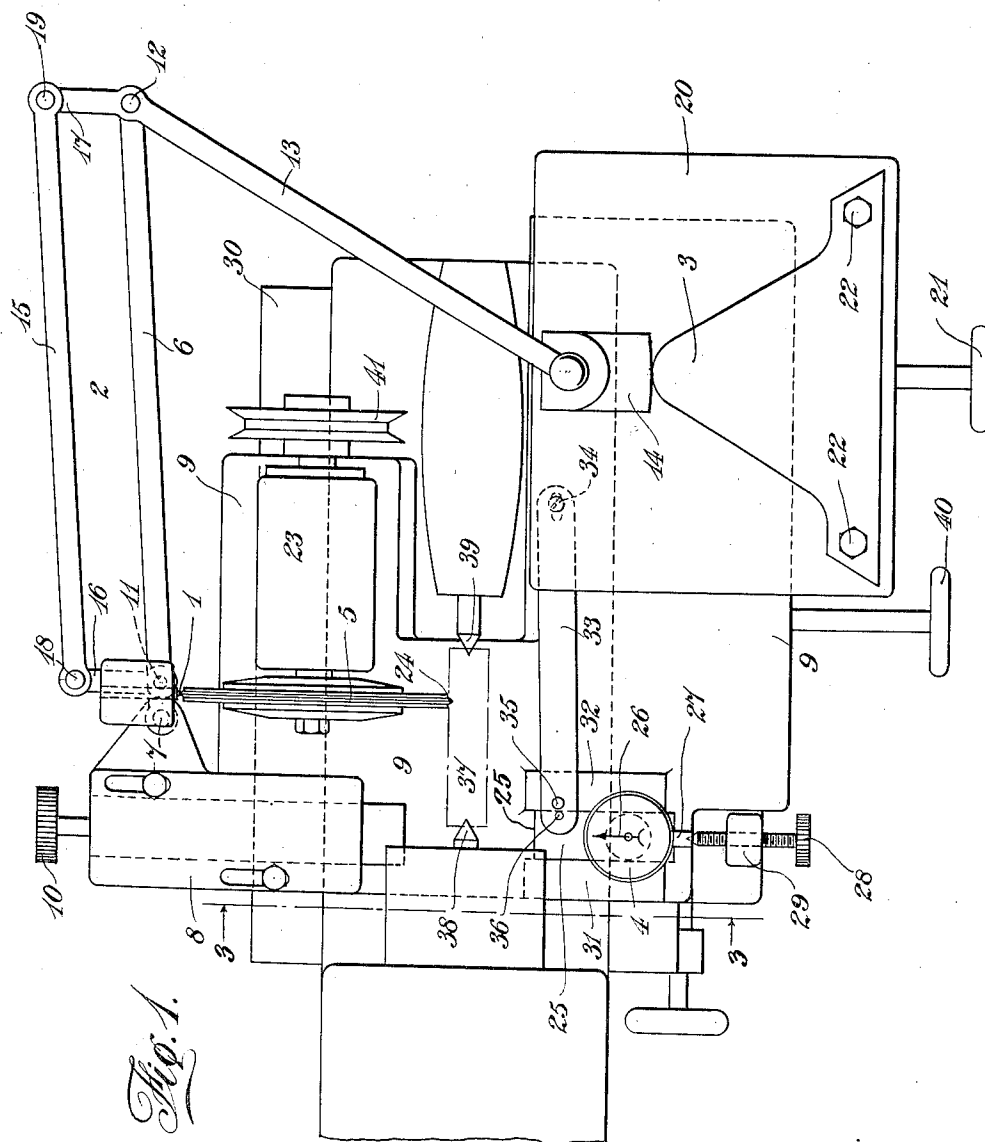


Fig. 1.

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Fig. 2.

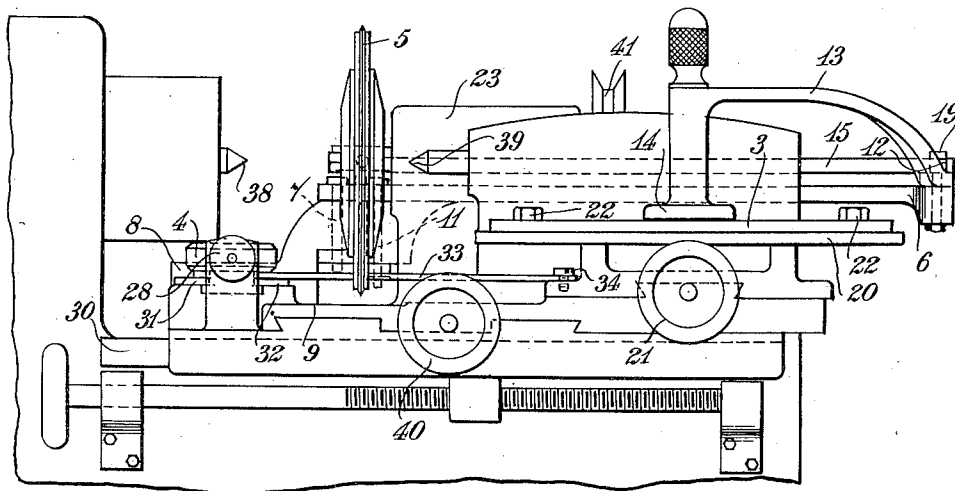
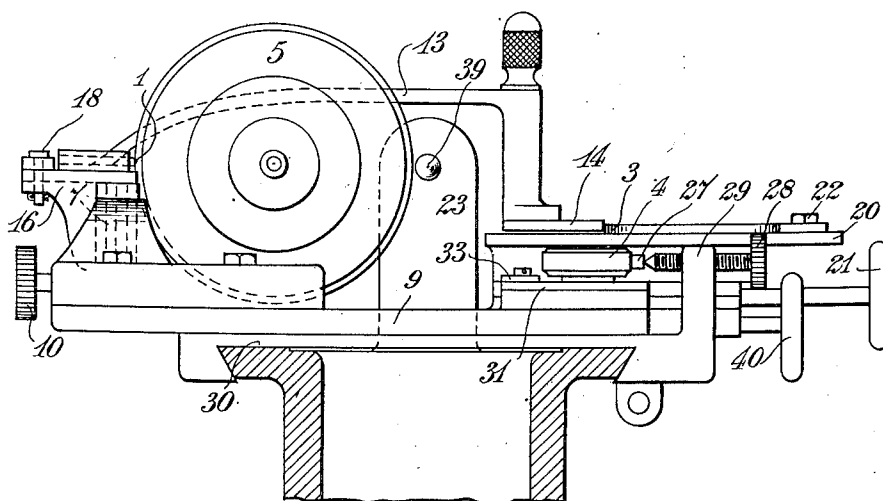


Fig. 3.



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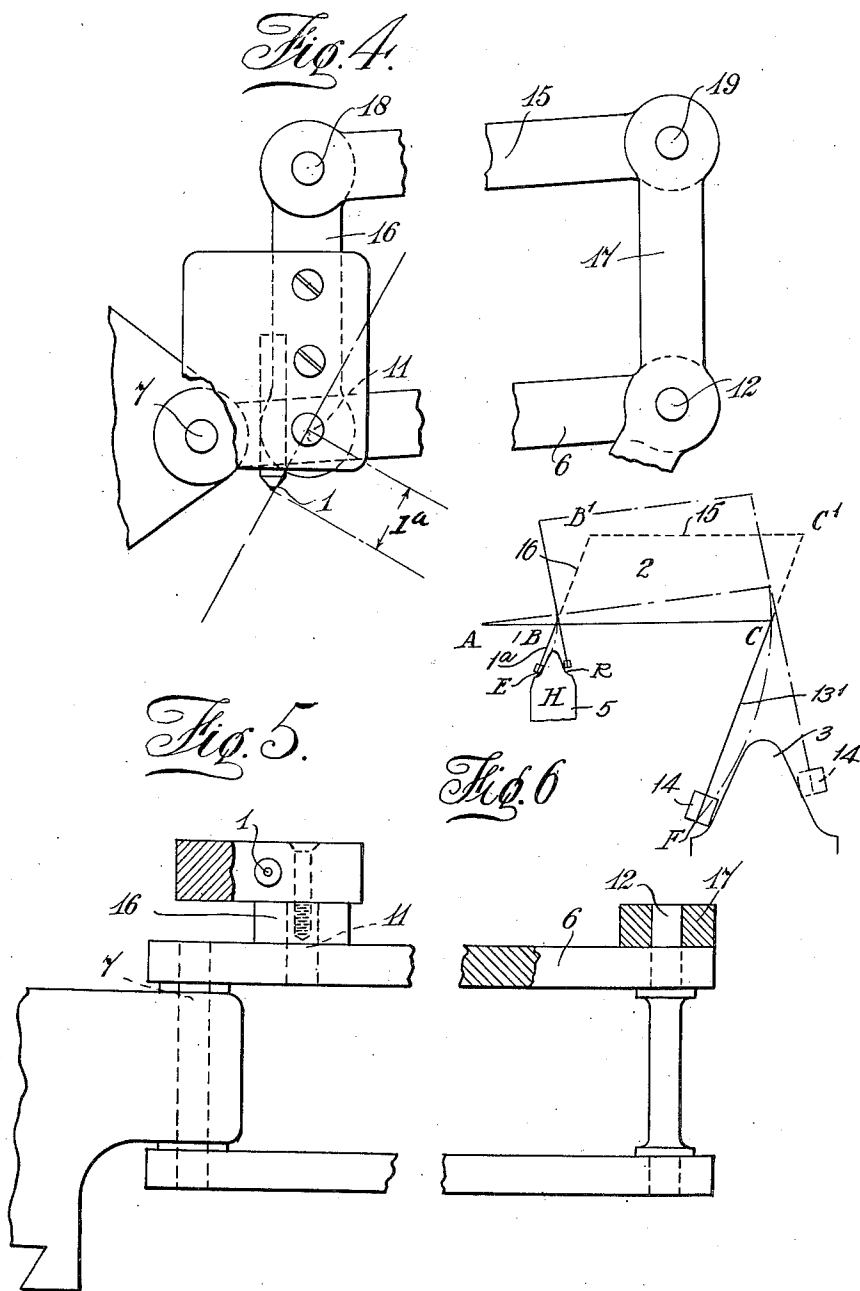
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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TRUING DEVICE FOR ABRASIVE WHEELS

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13 Claims. (Cl. 125—11)

This invention relates to a machine for use in forming, shaping, truing and reconditioning objects for example grinding wheels or grinding discs and other objects, the said machine being of the kind in which an abrading tool such as a diamond is carried by a pantographic appliance which is actuated in such manner as to cause the diamond to act on a surface when in rotation so as to true the said surface.

The general object of the present invention is to provide an improved machine of the aforesaid kind which is simple in operation, efficient and permits of the work being trued in one operation and by unskilled labor without removal of the work or reversal of the device as well as allowing of the finished size of the work being read at a glance, however much the object such as the grinding wheel or grinding disc has been reduced in the truing operation.

A further object of the invention is to provide means whereby the abrading tool such as a diamond carried by the pantographic device can be rectilinearly displaced towards or from the grinding wheel or disc or the object to be trued.

A further object of the invention is to provide means whereby a master pattern which coacts with a stylus carried by the pantographic appliance can be rectilinearly displaced in a direction to vary the depth of cut independently of the movement of the pantographic device.

Another object of the invention is to provide means whereby the finished size of the article on which the grinding wheel or grinding disc is to act, can be read at a glance so that the operator definitely knows that the grinding operation of the screw-threaded or otherwise formed article is complete.

These and other objects will become apparent from the detailed description hereinafter contained.

In order that the invention may be clearly understood and readily carried into effect, reference is made to the accompanying drawings which show diagrammatically and by way of example a forming, shaping truing and/or reconditioning device in accordance with the present invention.

Fig. 1 is a plan of a machine constructed in accordance with the present invention.

Fig. 2 is a side elevation of Fig. 1.

Fig. 3 is an end elevation of Fig. 1 with the head stock removed and the base of the machine shown in section and looking in the direction of the arrows 3—3 Fig. 1.

Fig. 4 is a detailed plan view on an enlarged scale of the pantographic appliance and the diamond holder carried thereby.

Fig. 5 is an end view of the construction shown in Fig. 4.

Figure 6 is a diagrammatic view of the pantograph mechanism.

Referring to the drawings, 1 denotes a cutting or abrading tool of any suitable type which in the illustrated embodiment comprises, for example, a diamond of non-circular profile, for instance it may be shaped so as to conform to the natural cleavage lines of the stone. The profile of the former or stylus 14, hereinafter more fully described, is made so as to be identical with the profile of the abrading tool but the latter is, of course, on a smaller scale than said stylus. 2 indicates generally a pantographic appliance and 3 is a master pattern or former, 4 being a precision gauge and 5 an abrading wheel or grinding wheel or disc. In the constructional example illustrated a simple form of wheel has been chosen and therefore a simple form of master pattern or former for the sake of simplicity, but more complicated forms can be dealt with or treated with the apparatus of the present invention.

The pantographic appliance 2 which is fixed at or is adjustable to the desired ratio conveniently comprises an arm 6 which is conveniently connected as at 7, to a slide 8 mounted on a cross slide 9 relatively to which the slide 8 may be adjusted by a screw 10. To the arm 6 of the pantographic appliance is pivoted as at 11 near its pivoted end a short arm which is represented by the distance between the pivot 11 and the operative face of the diamond 1 or other tool as indicated by the dotted line 1a in Fig. 4, and to the arm 6 at or near its outer end as at 12 is pivoted a long arm 13 which carries a tracer or feeler 14. The pantographic appliance 2 comprises a parallel arrangement of links namely 6, 15, 16 and 17, these links being pivotally interconnected at the points 11, 18, 19 and 12. The link 16 carrying the blocks 16' in which the diamond 1 is supported and the arm 13 carrying the tracer or feeler 14 together with the rods or links forming the pantographic appliance are angularly displaceable on the pivotal support 7. The master pattern 3 is mounted on a slide 20 which can be displaced at right angles to the slide 9. Displacement of the slide 20 in a direction parallel to the plane of the grinding wheel or disc 5 can be effected by means of the hand wheel 21 on the screw 21' the

master pattern 3 being secured to the slide 20 by bolts 22 or other suitable means.

Figure 6 is purely a diagrammatic view of the pantograph mechanism, while Figure 4 shows more particularly the diamond holder and the means for setting the latter in correct position. In the diagrammatic view shown in Figure 6, the arm A—C is pivoted to the slide 8 at A. At a point B such that A—C equals four times A—B, a short arm E—B and at C a long arm F—C are pivoted to the arm A—C, the length of F—C being four times the length of E—B.

E—B is extended at B' and F—C is extended to C', B—B' and C—C' being of equal length and the points B'—C' are pivotally linked together. The actual parts corresponding to F—C and C—C' are 13 and 17 (Figures 1 and 4) and these are in one piece. The function of the link coupling the rearward extension of the two arms is to maintain the latter parallel to each other throughout their movement. These linked extensions are shown in dotted lines so that the parts governing the ratio of the pantograph may be more clearly visualized. (In practice the arm A—C is duplicated for the sake of rigidity).

A diamond is rigidly mounted on E—B and a stylus shaped to conform to the profile of the diamond is mounted rigidly on F—C.

Any suitable point such as F on the outward face of the stylus, for instance on the center line indicated by the line 13' Figure 6 being set at a known distance from C, the corresponding central point E on the outward face of the diamond must be set at a distance from B so that the ratio of E—B to F—C is the same as the ratio of A—B to A—C and the line E—B must be parallel to the line F—C.

To complete the diagram, a former is indicated at 3 and the profile of the grinding wheel under treatment is shown at 5 (H). The angular displacement of the stylus during movement over the former and the exactly corresponding displacement of the diamond on a reduced scale are shown by the view of the mechanism in another position indicated in dot and dash lines.

It will be seen that so long as the radius at the corners of the selected diamond is not greater than the radius R at the foot of the thread form a diamond of very substantial proportions may be used to true wheels for the grinding of very fine thread forms.

It will be clear from the diagrammatic representation that the short arm E—B and the long arm F—C represent distances from the pivots B and C to points on the operative face of the diamond and stylus which correspond in position and that to obtain the results required the lines joining these points respectively must be parallel to each other and of correct ratio in length. (It should be noted that in the construction shown in the drawings, the lines joining these critical points are parallel to one another and of the required ratio in length, although the parts carrying the diamond and stylus do not follow the straight lines indicated in the diagram for reasons of constructional convenience).

When a new diamond is to be mounted, the appropriate stylus, (made to a corresponding profile as stated), is mounted on the long arm of the pantograph and the effective length and angular position of the arm F—C as above defined are found. The diamond must then be so mounted that the effective length of the theoretical arm E—B is of correct ratio with, and parallel to, F—C.

For this purpose, in practice the diamond is mounted in a frame or block rigidly held to the link 16 and this block is provided with means of adjusting the position of the diamond so that its operative face may be brought into such a position that its distance and position relatively to the pivot 11 fulfill the conditions stated above.

The grinding wheel or disc 5 is mounted and rotatable in a suitable support 23 which is carried by the slide 9. In the example illustrated the grinding wheel or disc 5 has a simple operative face or profile which consists of a single ridge or rib 24 and the master pattern or former 3 is of the same shape as the profile of the grinding wheel or disc but of much larger dimensions.

The ratio between the profile of the wheel or disc 5 and that of the master pattern 3 depends on the ratio of reduction or enlargement of movement which it is desired to produce by the pantographic appliance and such ratio can be varied to meet requirements. In the constructional form illustrated by way of example the ratio of the distance of the fulcrums 7 and 11 to the pivotal points 7 and 12 is as 1 to 25. Likewise the ratio of the distance between the point 11 and the point of the diamond 1 to the distance between the point 12 and the point of contact of the tracer or feeler 14 with the master pattern 3 is as 1 to 25. The aforesaid ratio has been found a convenient one to allow of a speedy operation and also to secure a high degree of accuracy.

Mounted on suitable guides on the slidable frame 9 is a subsidiary slide 25 which carries the precision gauge 4. The precision gauge 4 which affords a visible reading of the adjustment of the cutter or abrading tool 1 may be of any suitable construction but in the present form it comprises a circular scale graduated in thousandths of an inch over which a pointer 26 or index hand is adapted to move the said index hand being operated by a spring controlled stem 27. The outer end of the stem 27 bears against an adjustable screw stop 28 mounted in a fixed or stationary bearing 29 secured to a longitudinally displaceable slide 30 on which the slide 9 carrying the slide 8, the slide 20, and the gauge slide 25 are mounted. The slides 20, 25 and the gauge slide guides 31, 32 are displaceable crosswise with the slide 9.

The gauge slide 25 is actuated by the slide 20 through a lever 33 pivotally connected as at 34 to the slide 20 and fulcrumed at 35 in the gauge slide guide 32 the other end of the lever being pivotally connected as at 36 to the gauge slide. The arms of the lever 33 are arranged to produce or reproduce movements in accordance with the ratios of the movements of the pantographic appliance. In the present constructional form shown by way of example the ratio of the distance between the points 36 and 35 to the distance between the points 35 and 34 is as 1 to 25. The work piece is shown at 37 and is mounted between the usual centres of support 38, 39. The cross slide 9 which carries the grinding wheel and its support 23 and the adjustable slides 8 and 20 for the pantographic appliance 2 and the master pattern 3 respectively as well as the gauge slide guides 31, 32 with the gauge slide 25 can be adjusted relatively to the work piece 37 by means of a hand wheel 40 and screw 40'.

The shape of the operative face of the tracer or feeler 14 is the same as that of the abrading tool or diamond 1 but obviously in the example shown it is of considerably larger dimensions

and proportions according to the ratio required.

The apparatus operates as follows: A finished work piece for example a screw threaded tap or master tap may be mounted between the centres 5 38 and 39. The cross slide 9 is then adjusted so as to bring the ridge 24 into the bottom of the recess between two adjacent threads on the work piece 37. The pointer or index hand 26 is then adjusted to zero. Hitherto the pantographic appliance has been swung to one side by moving the arm 13 to the right which takes the diamond 1 or cutter clear of the grinding wheel or disc 5.

The screw threaded work piece 37 for example the master tap is then removed and the desired work piece is substituted therefor. The grinding disc or wheel 5 is then displaced by displacement of the slide 30 to the beginning of the work piece or vice versa and the grinding wheel or disc 5 is adjusted to the correct position and then set in rotation by means of the pulley 41 connected by a belt (not shown) or other suitable means to a rotatable piece of mechanism, or line of shafting. The work piece may be caused to travel during its rotation to give the required helical or thread form or the grinding wheel or disc may be carried by the slide or saddle 30 past the work piece. This operation is repeated until such time as it is considered that the grinding wheel or disc requires reconditioning or truing. When such occasion arises the slide 20 and with it the master pattern 3 are displaced outwardly by rotation of the screw 21 a definite or suitable amount. This has the effect of bringing the diamond 1, cutter or abrading tool up to the grinding wheel 5 and the diamond is then caused to move across or over the edge of the grinding wheel whilst the latter is in rotation by moving the feeler 14 over and in contact with the master pattern 3. Such an operation renews the edge of the grinding disc or wheel 5 so that the latter is again ready for further use. In the adjustment of the slide 20 the diamond will have been displaced inwardly a definite but unknown amount. The grinding wheel 5 is again brought into contact with the work piece 37 and the aforesaid cycles of operation are renewed until the grinding or abrading wheel 5 has cut into the work piece to such an extent that the pointer 26 or index hand indicates zero. In this position the form or shape cut on the work piece 37 will correspond exactly with the form or shape on the master tap or work piece to which the grinding wheel has been previously set. It should be understood however that when the slide 20 is displaced definitely an unknown amount the gauge slide 25 has been forced inwardly precisely the same amount as the diamond 1 or cutting tool. The distance the gauge slide has been forced inwardly will be indicated by the index hand or pointer 26, and until this index hand or pointer 26 returns to zero then the cutting action on the work piece 37 will require to be continued and the shaping, forming, truing and the reconditioning of the edge of the grinding disc or wheel 5 will not affect the reading of the gauge 4. Forming, shaping, truing and/or reconditioning of the grinding wheel or disc need only be effected when desired or only when considered necessary. In any case the cutting action on the work piece 37 by the grinding wheel or disc 5 should if necessary or required be continued until the ridge 24 has penetrated the work piece 37 to such an extent that the index hand 26 on the gauge indicates zero.

The invention has hereinbefore been described as applied to a grinding wheel or disc of simple

contour but it should be clearly understood that wheels or other articles having more complicated operative surfaces or contours may be treated by the apparatus of the present invention, and further although the invention has been described above as applied to the shaping of a grinding wheel having a contour which is formed, shaped, trued or reconditioned after use the apparatus of the present invention may be applied to the production or formation of any desired contour or the reconditioning of a formed contour or face upon a wheel, disc, rod cylinder, hollow cylindrical body or other articles during the rotation of such articles.

What I claim is:—

1. In a machine of the class described, the combination of a grinding wheel adjustable in opposite directions in its own plane, a pantographic appliance pivotally supported adjacent to the grinding wheel, an abrading tool carried by the pantograph, a stylus having an approximately similar profile to that of the abrading tool and carried by one arm of the pantographic appliance, a master pattern associated with the said stylus, a slide carrying the master pattern, a subsidiary slide, a gauge and means fulcrumed in a relatively stationary part of the machine and coupling the subsidiary slide to the master pattern slide to effect displacement of the subsidiary slide in a direction opposite to that of the master pattern carrying slide so as to effect the adjustment of the gauge reading to suit the reduced diameter of the grinding disk.

2. In a machine of the class described, the combination of a grinding wheel, a pantograph pivotally supported and rectilinearly displaceable in opposite directions relatively to the grinding wheel, an abrading tool carried by the pantograph, a stylus arm forming an arm of the pantograph and having a stylus adapted to engage a master pattern, a gauge mounted on an adjustable slide, an adjustable slide carrying the master pattern and a lever coupling the master pattern slide with the gauge slide.

3. In a machine of the class described, the combination of a grinding disk, a pantograph, an abrading tool mounted thereon, a stylus, a master pattern mounted on an adjustable slide and with which the stylus coacts, a precision gauge mounted on an adjustable slide, and a lever connecting the gauge slide and the master pattern slide and pivotally fulcrumed to a relatively stationary part of the machine so that the said bar transmits the movement of the master pattern slide to the gauge slide, the movement of the latter being less in extent by the same ratio as that adopted for the pantograph mechanism.

4. In a machine of the class described a device for re-conditioning the operative face of a grinding element comprising in combination a main supporting frame, a tool holder, an abrading tool of non-circular operative profile rigidly mounted in said holder a pantograph linkage mechanism pivotally mounted on said frame and rigidly carrying said tool holder on one of said links, a stylus rigidly mounted on another link of said pantograph and having an operative face corresponding in profile to the operative face of the abrading tool but on a larger scale and a master pattern mounted on said frame and located adjacent said stylus, the linkage of the pantograph being such that movement of said stylus in contact with the pattern causes successive operative points of the profile of said abrading tool contacting with the element to correspond in position in respect of said

element to similar successive operative points of the profile of said stylus in respect to said pattern.

5. In a machine of the class described a device for reconditioning the operative face of a grinding element comprising in combination a main supporting frame, a tool holder, an abrading tool rigidly mounted in said holder and having a non-circular operating face, a stylus having an operative face corresponding in profile to the operative face of said abrading tool but on a larger scale, a master pattern mounted on said frame and adapted to co-act with said stylus and a pantograph linkage mechanism pivotally mounted on said supporting frame having said tool holder rigidly mounted on one link and said stylus mounted on a longer link, the arrangement of said pantograph, said tool, and said stylus being such that corresponding parts of the operative profiles of said tool and said stylus will always be maintained in parallel relationship on movement of said stylus over said pattern.

6. In a machine of the class described a device for reconditioning the operative face of a grinding element comprising in combination a main supporting frame, a tool holder, a diamond abrading tool having an operative face of irregular contour rigidly mounted in said holder, a stylus having an operative face corresponding in profile to the operative face of said abrading tool but on a larger scale, a master pattern mounted on said frame and adapted to co-act with said stylus, and a pantograph linkage mechanism pivotally mounted on said supporting frame having said tool holder rigidly mounted on one link and said stylus rigidly mounted on a parallel link, the ratio between the sizes of the operative faces of said tool and said stylus being the same as the ratio between the lengths of said parallel links.

7. In a machine of the class described a device for re-conditioning the operative face of a grinding element comprising in combination a main supporting frame a pantograph linkage mechanism pivotally mounted on said frame and having parallel links of different lengths adjacent opposite ends thereof, an abrading tool of non-circular operative profile rigidly mounted on said smaller parallel link a stylus rigidly mounted on the longer parallel link of said pantograph and having an operative face corresponding in profile to the operative face of the abrading tool but on a larger scale corresponding to the ratio of the lengths of said parallel links and a master pattern mounted on said frame and located adjacent said stylus.

8. In a machine of the class described a device for reconditioning the operative face of a grinding element comprising in combination a main supporting frame a pantograph linkage mechanism having parallel links of different lengths adjacent opposite ends thereof and pivotally mounted on said frame, a diamond abrading tool of a shape following the natural cleavage lines of the diamond structure rigidly mounted on the smaller of said parallel links a stylus rigidly mounted on the longer parallel link of said pantograph and having an operative face corresponding in profile to the operative face of the abrading tool but on a larger scale corresponding to the ratio of the lengths of said parallel links and a master pattern mounted on said frame and located adjacent said stylus, said abrading tool and said stylus being mounted on said pantograph so that the corresponding parts of the operative profiles of said tool and said stylus are parallel to one another.

9. In a machine of the class described, the combination of a grinding wheel, a pantograph pivotally supported and rectilinearly displaceable in opposite directions relatively to the grinding wheel, a diamond having a non-circular profile in its operative plane rigidly mounted on the pantograph, a tracer bar forming an arm of the pantograph, a stylus having a profile in its operative plane similar to that of the diamond but on a larger scale and carried by said tracer bar, and a master pattern engageable by the said stylus, the said diamond and stylus being mounted with corresponding parts of their operative profiles in parallel relationship to one another and always movable in the same plane.

10. In a machine of the class described, the combination of a grinding wheel, means to adjust the grinding wheel in opposite directions in its own plane, means to adjust the grinding wheel in a plane at right angles thereto, a diamond having an operative face of non-circular profile, a stylus having an operative face corresponding in profile to the operative face of the diamond but on a larger scale, a master pattern adapted to co-act with the stylus, and a pantograph rigidly carrying said diamond and said stylus and pivotally mounted on a frame disposed adjacent to the grinding wheel and adjustable in a plane parallel to the plane of the grinding wheel and also in a plane at right angles to the grinding wheel, the point of support of the pantograph and the position of the diamond and stylus carried thereby being so relatively arranged that the operative profiles or faces of the diamond and the stylus are always maintained in parallel relationship during movement of the said stylus over the master pattern.

11. In a machine of the class described, the combination of a grinding wheel, means to adjust the latter in its own plane, means to adjust the grinding wheel in a plane at right angles thereto, a master pattern, a frame adjustable in opposite directions and in directions at right angles thereto, a pantographic mechanism pivotally suspended on said frame and carrying a non-rotatable and rigidly mounted diamond holder, a diamond having an operative face of non-circular profile and mounted and disposed in said holder in a position such that a line passing through any point on the operative edge of the diamond and the axis of the pivot adjacent to the pantographic suspension pivot forms the short arm of the pantographic mechanism, a stylus having an operative face similar in profile to that of the diamond but on a larger scale and carried by the pantograph and in such manner that a line passing through a point on the operative edge of the stylus corresponding to the corresponding point on the operative edge of the diamond and the axis of the pantograph pivot remote from the pantographic suspension pivot and aligned therewith forms the long arm of the pantograph, and means to maintain the operative profiles of the diamond and the stylus in parallel relationship during movement of the said stylus over the master pattern.

12. In a machine of the class described, a pantographic appliance comprising a main arm pivotally supported adjacent to a grinding wheel, a diamond of non-circular profile mounted in a holder which is pivotally connected to the pantograph main arm at a point near its pivotal support, a stylus of profile corresponding to that of the diamond but on a larger scale, an arm carrying the said stylus and pivotally connected to the

pantograph main arm at a point remote from its pivotal support, the distance between the pantograph main pivotal support and the pivot of the diamond holder relatively to that between the said main support and the pivot of the stylus arm, as well as the distance between the pivot of the diamond holder and a point on the operative face of the diamond relatively to that between the pivot of the stylus arm and a corresponding point on the operative face of the stylus being of the same ratio as the relative dimensions of the diamond and the stylus and the straight line joining the pivot of the diamond holder and a point on the operative face of the diamond and that joining the pivot of the stylus arm to a corresponding pivot on the operative face of the stylus being parallel to one another.

13. In a machine of the class described, a pantograph linkage mechanism comprising a short arm, a long arm, a pivotal support for the short

arm, a pivotal support for the long arm, a diamond of non-circular profile rigidly mounted at the extremity of the short arm, a stylus having a profile corresponding to that of the diamond but on a larger scale and rigidly mounted at the extremity of the long arm, the distance between the pivotal support of the short arm and a point on the operative face of the diamond, relatively to the distance between the pivotal support of the long arm and a corresponding point on the operative face of the stylus being of the same ratio as the relative dimensions of the diamond and the stylus so that a straight line joining the pivot of the short arm to a point on the operative face of the diamond is parallel to a straight line joining the pivot of the long arm to a corresponding point on the operative face of the stylus and is maintained parallel thereto throughout the movement of the pantograph.

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25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140