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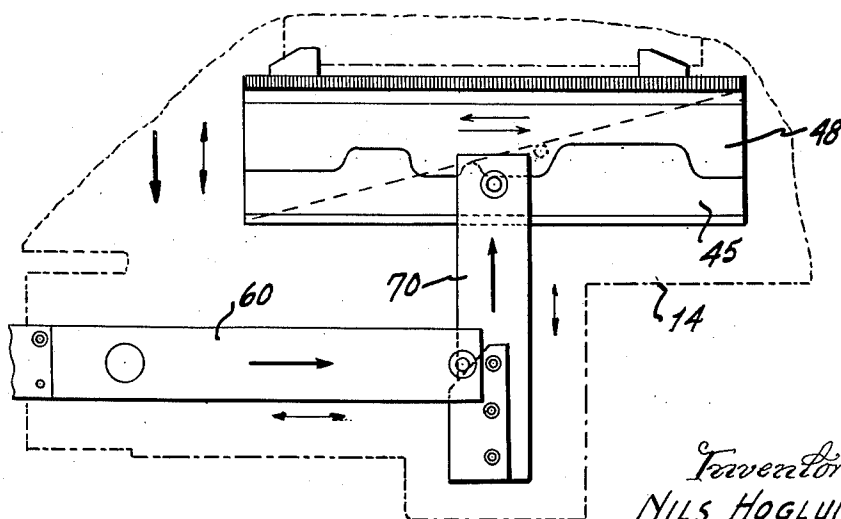
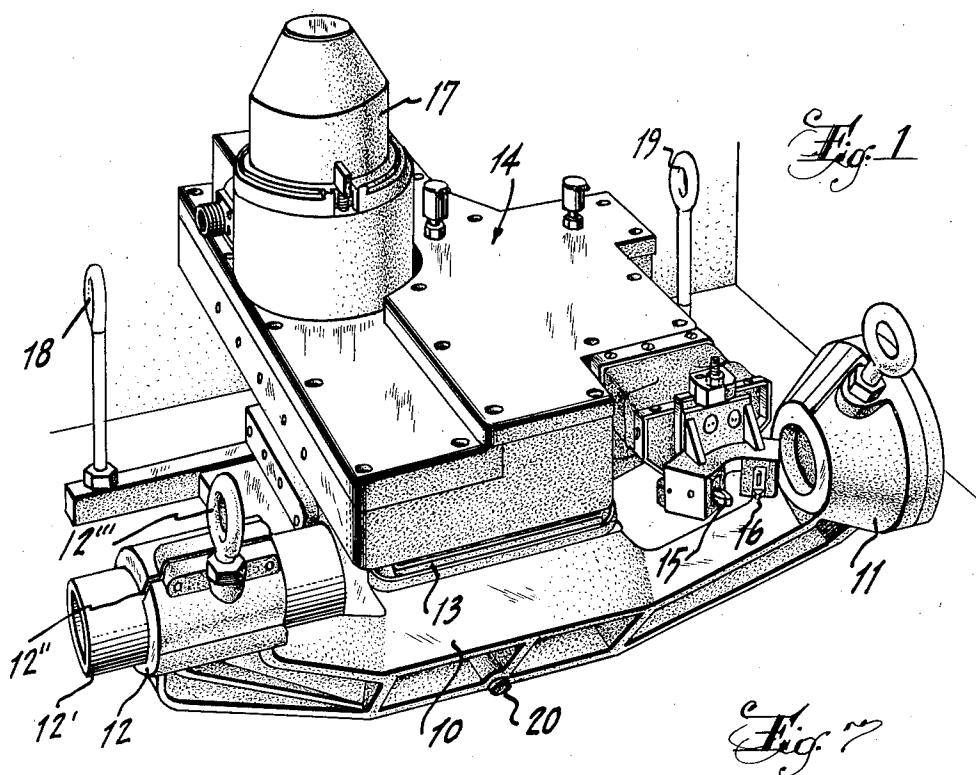
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2,768,619

GRINDING WHEEL DRESSING APPARATUS

Filed May 20, 1954

6 Sheets-Sheet 1



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6 Sheets-Sheet 2

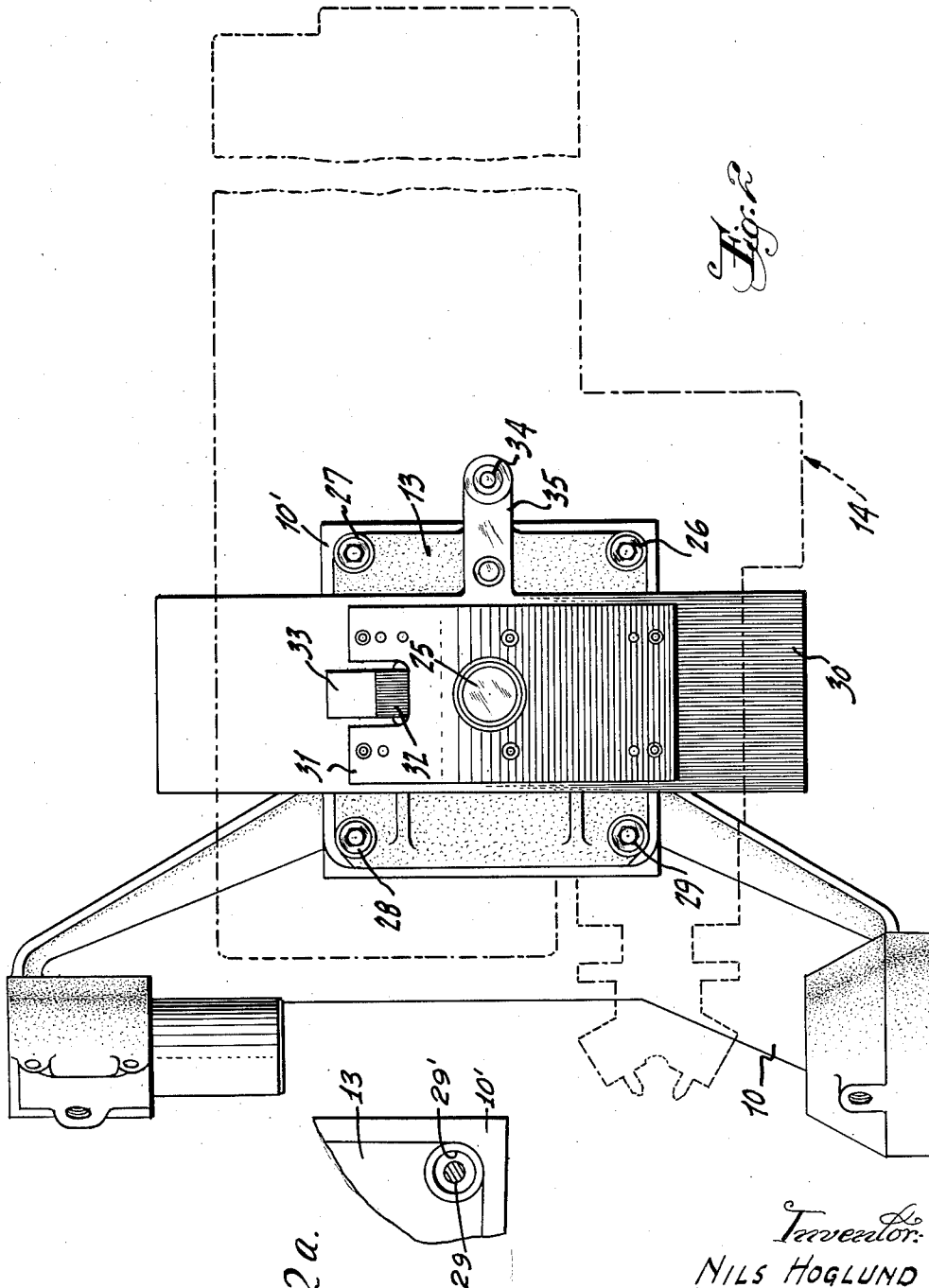


Fig. 2a.

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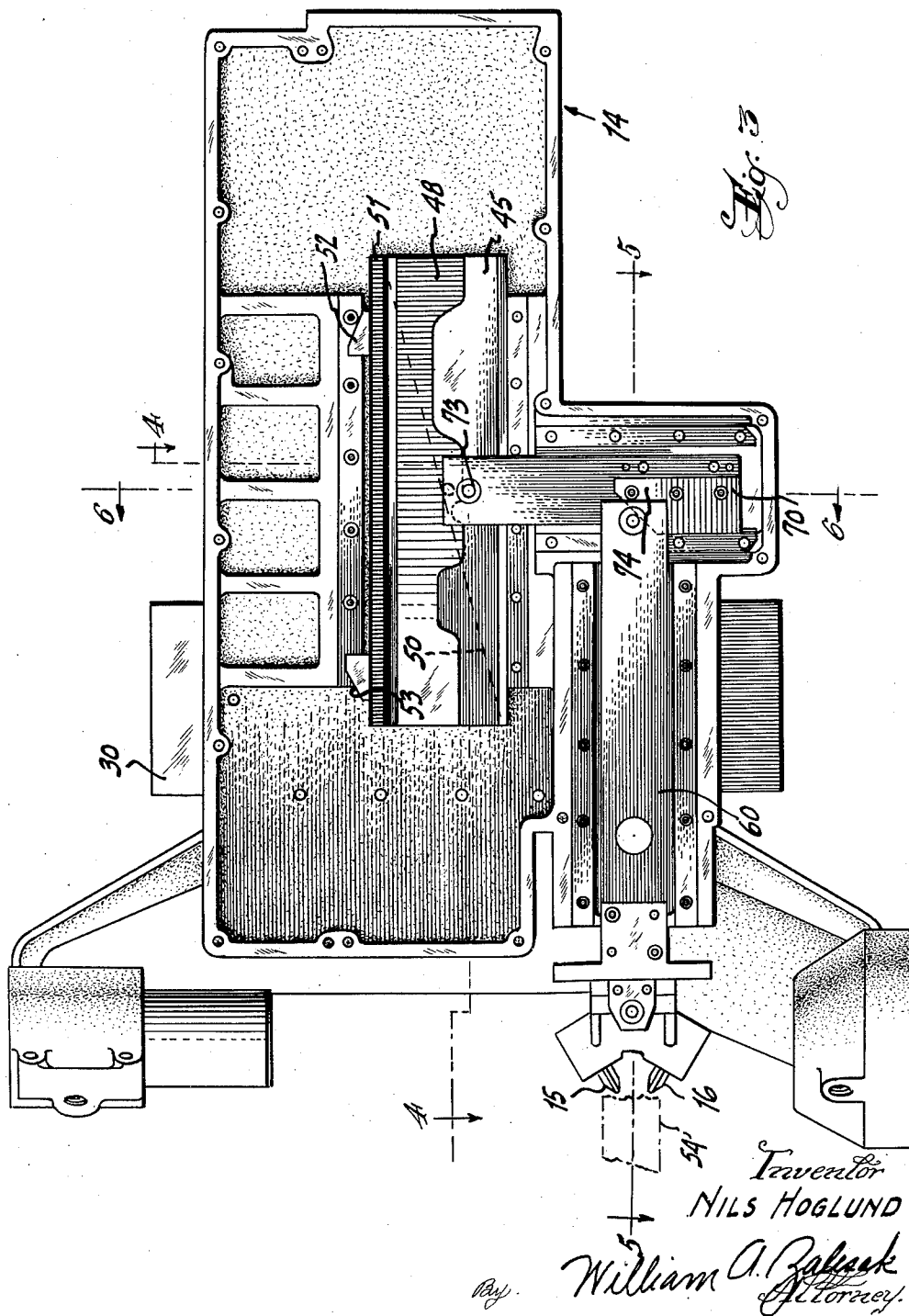
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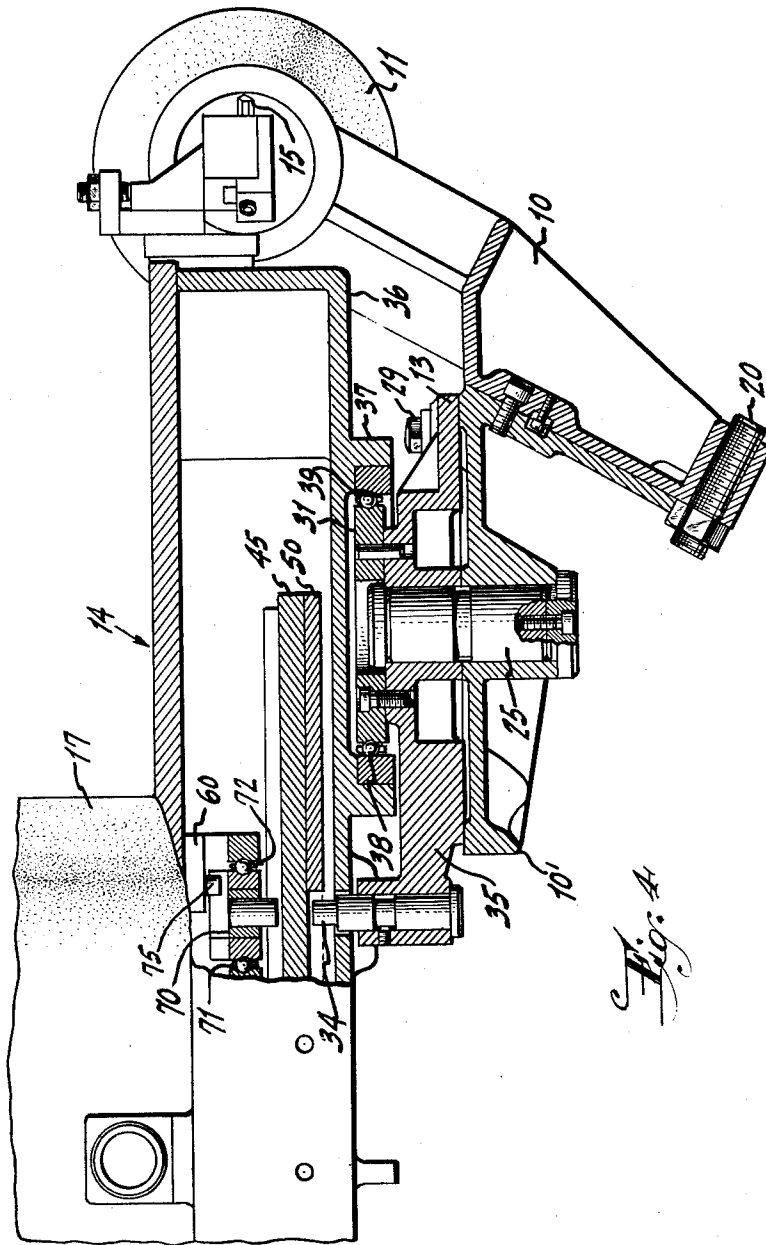


Fig. 4

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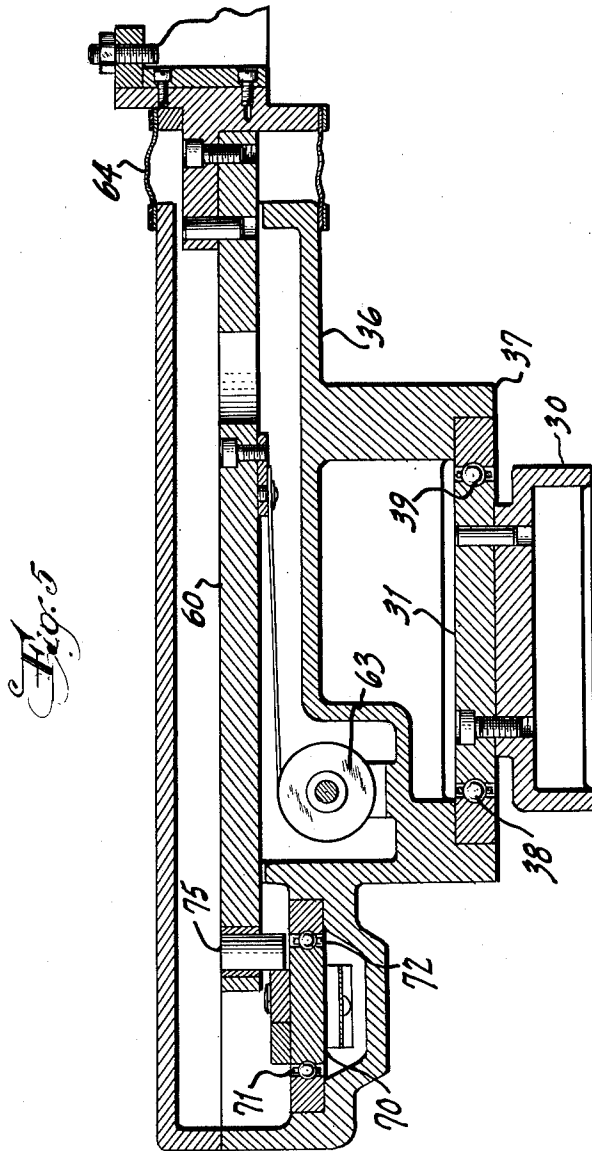
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GRINDING WHEEL DRESSING APPARATUS

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6 Sheets-Sheet 5



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GRINDING WHEEL DRESSING APPARATUS

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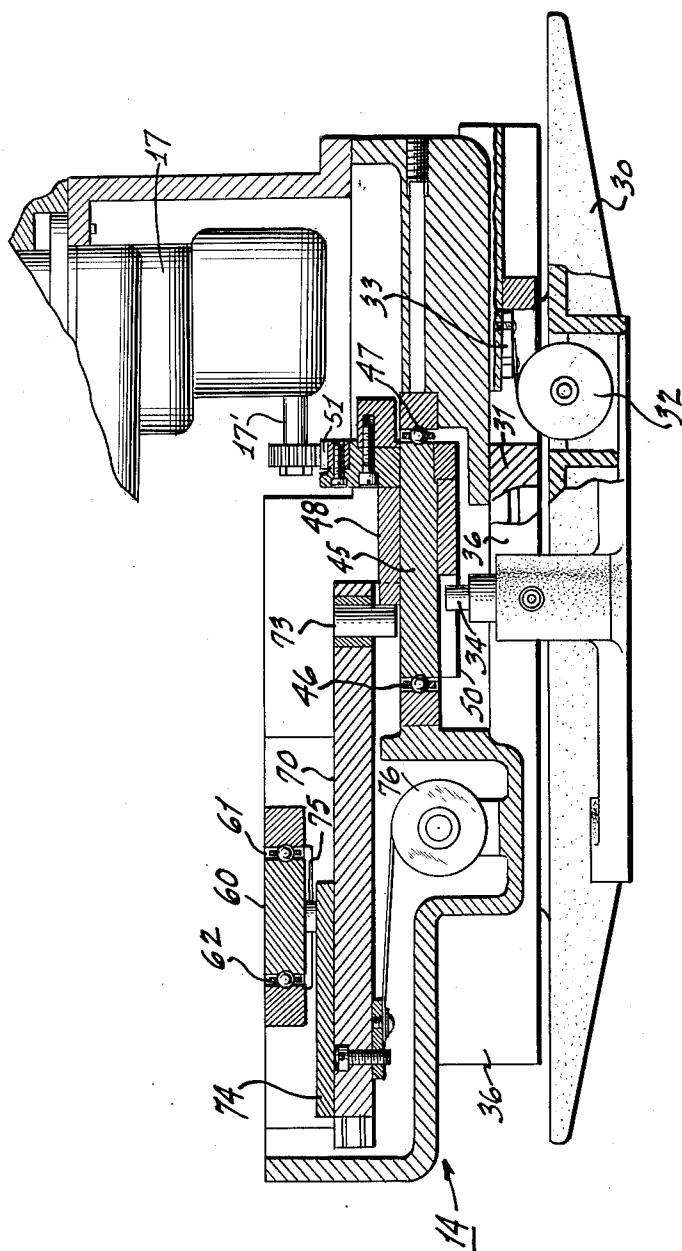


Fig. 6

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2,768,619

GRINDING WHEEL DRESSING APPARATUS

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Application May 20, 1954, Serial No. 431,065

9 Claims. (Cl. 125—11)

My invention relates to apparatus for forming and maintaining contours on grinding wheels, more particularly to improvements in grinding wheel dressing apparatus.

In certain types of plain, cylindrical grinders no space is available for mounting a dresser either on the table of the machine or any other place conveniently. The only place where such a dresser can be supported is between the centers of the grinder where the work piece is normally positioned. However, if so mounted, the apparatus must be so constructed that it can be easily positioned within and placed on or removed from the machine. A dresser of this character must not vary to any great extent in weight as compared with the work piece and it must be so positioned that the dressing tools will occupy a position identical with that of the contour being dressed on the work piece. In addition, the dresser must be extremely compact, must be properly balanced and must be adjustable in its position both between the centers of the grinding apparatus and in the plane in which the dresser is to be mounted. In order to provide the necessary space within the dresser housing to include the template slide and ratio slides, the housing must be so designed and the slides must be so arranged as to their relationship as to obtain the movements desired of the housing and dressing tools while, at the same time, permitting the positioning of the dressing apparatus in the space available.

The principal object of my invention is to provide an improved grinding wheel dressing apparatus particularly suitable for use where space is at a premium and which can be quickly and easily positioned on the grinding wheel apparatus.

Another object of my invention is to provide a dressing apparatus which can be quickly and easily attached to or removed from a grinder and particularly which can be positioned between the centers on which the work piece is supported.

Another object of my invention is to provide such an apparatus that can be easily and precisely adjusted to dressing position even though detachable between dressing operations.

A further object of my invention is to provide a dressing apparatus which is compact, has weight comparable to a piece being ground and which can be substituted for the work piece when in dressing position.

Apparatus made according to my invention includes a bracket having a shelf and providing a base support, the bracket being provided with a pair of female centers to position the dressing apparatus in the same position as the piece to be worked upon by the grinding mechanism. The base supports a slide guide upon which a tool housing is slidably supported to move parallel to the axis of the grinding wheel to be dressed. The housing slidably supports a pair of dressing diamonds which move normally of the axis of the wheel being dressed and of the movement of the housing. The housing proper includes

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a plurality of slides and followers electrically driven for controlling movement of the housing and the dressing tools. A main slide supporting the template and a ratio cam moves normally of the housing, the ratio cam contacting a fixed pin supported on the base to control movement of the housing and the template engaging the follower of an intermediate slide moving normally of the main slide and parallel to the housing movement and in turn carrying a ratio cam. The dressing tools are mounted on a secondary slide for movement normal of the movement of the housing and having a follower engaging the ratio cam on the intermediate slide.

In the drawings Fig. 1 is a front view perspective of a grinding wheel dressing apparatus made according to my invention;

Fig. 2 is a plan view of the bracket and base for supporting the tool housing of the device shown in Fig. 1;

Fig. 2a shows a detail of construction of Fig. 2;

Fig. 3 is a plan view with cover removed of the apparatus shown in Fig. 1;

Fig. 4 is a section taken along the line 4—4 of Fig. 3;

Fig. 5 is a section taken along the line 5—5 of Fig. 3; and

Fig. 6 is a section taken along the line 6—6 of Fig. 3 with a portion broken away to show details of construction.

Referring specifically to Fig. 1, a grinding wheel dressing apparatus made according to my invention includes a bracket 10 having a head stock center 11 and a foot stock center 12, the foot stock center 12 having an adjustable tubular element or sleeve 12' which can be adjusted longitudinally of the axis to fit between differently spaced centers, the bushing being split at 12'' for locking the sleeve 12' in position when properly adjusted by means of the screw 12'''.

The bracket 10 extends rearwardly of the stock centers to provide a shelf 10' for the base 13 and slide guide 31 which is shown in more detail in other views. The housing 14 is slidably mounted on ball-bearing assemblies to be described so as to have movement parallel to the axis of the wheel being ground.

Within the housing and extending therefrom toward the axis of the centers are a pair of dressing tools or cutting diamonds 15 and 16 which are mounted on a slide to be described for movement in and out of the housing normal to the movement of the housing which is parallel to the axis of the wheel being dressed.

The prime mover for driving the various slides mounted within the housing for controlling the movement of the housing and dressing diamonds is the electrical motor 17 mounted on the cover of the housing and which operates in a manner to be described.

A pair of eye hooks 18 and 19 are secured to the bracket shelf so that the whole apparatus can be easily and quickly lifted on and off the grinding equipment. An adjusting screw or button 20 which contacts the grinding apparatus is mounted on the front of the bracket for adjusting the horizontal position of the shelf. Details are shown in other views.

In operation the dressing apparatus is positioned between the centers on which the work piece is normally mounted so that the wheel which dresses the contour on the work piece has the same relative position with and can be contacted by the diamonds as the wheel takes relative to the work piece during operation of the grinder. When the motor 17 is actuated, it causes the housing 14 to move back and forth in a path parallel to the axis of the wheel being dressed, the tool slide and diamonds moving into and out of the housing so as to dress a predetermined contour on the wheel being dressed. Trip members within the housing and mounted on one of the slides

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automatically reverse the motor at the end of the movement of the housing in either direction.

Base, housing slide guide and housing

Reference is had to Figs. 2, 3 and 4. The bracket 10 is provided with a rear shelf 10' to which is fixed a vertically extending stud 25. The base 13 is rotatably mounted on the stud and is provided with four bolts 26, 27, 28 and 29 which extend through oversize holes 29 (see Fig. 2a) in base 13 and can be clamped when the base is angularly positioned as desired relative to the wheel being dressed. The base is provided with an elongated portion 30 on which is mounted a slide guide 31 for supporting the housing 14. The portion 30 has mounted thereon a tensioning spring having a plate 33 which is attached to the bottom of the housing in a manner to be described for urging the housing normally toward the right as viewed in Fig. 1 against a cam follower 34 mounted at the end of the extension 35 secured to the base 13. This will be described in detail below.

As shown in Fig. 4, the bottom portion 36 of the housing 14 is provided with a downwardly extending portion 37 which is received over the slide guide 31 and slidably supported thereon by ball-bearing assemblies 38 and 39.

Template slide

With reference now to Figs. 3, 4 and 6, there is mounted within the housing three slides, a main or template slide carrying the contour template and a ratio cam for controlling movement of the housing along the slide guide, an intermediate slide carrying the template follower and a second ratio cam, and a tool slide carrying the dressing diamonds and cooperating with the intermediate slide. As the main slide is moved parallel to the long axis of the housing and normal to the axis of the wheel being dressed, it carries both the template and the ratio cam so as to control movement of the intermediate slide and the movement of the housing.

The main slide 45 is slidably mounted for movement parallel to the long dimension of the housing within the housing by means of the ball-bearing assemblies 46 and 47 (Figs. 3 and 6). Secured to the top of the slide 45 is the template 48 which determines the movement of the dressing diamonds and hence the contour of the grinding wheel being dressed. Mounted on the under side of the slide 45 is the ratio cam 50 which contacts the fixed cam follower 34 against which the housing 14 and cam 50 are urged by the biasing spring 32.

A rack 51 is mounted on top of the slide 45. It is meshed with a gear train 17' connected to the prime mover or motor 17. When the motor is energized, the slide 45 is reciprocated back and forth toward and from the wheel being dressed. The motor is reversed by mechanism not shown when the dogs 52 and 53 contact micro-switches (not shown) to open and close the switches.

It will be appreciated that as the slide and ratio cam 50 are moved back and forth since biasing spring 32 urges the cam against the follower 34, the housing is forced to move back and forth parallel to the axis of a wheel 54 being dressed.

Tool and intermediate slides

With reference now to Figs. 3, 4, 5 and 6, a tool slide 60 is slidably mounted and supported by ball-bearing assemblies 61 and 62. A biasing spring 63 urges the slide inwardly of the housing 14 against a ratio cam and slide in a manner to be described. The slide 60 carries at its outer end the dressing tools 15 and 16. A boot 64 provides a dust protector for the slide.

An intermediate slide 70 is slidably mounted within the housing 14 by means of ball-bearing assemblies 71 and 72. It has mounted at one end a cam follower 73 which contacts the contour edge of the template 48. At the other end of the slide 70 is the ratio cam 74 which is contacted by the follower 75 on the tool slide.

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A biasing spring 76 urges the slide 70 and follower 73 against the template 48.

All of the slides described above operate in parallel planes, one above the other. As shown in Fig. 7, the various slide movements are shown by the double headed arrows while the heavy arrows show the force of the biasing spring.

The above arrangement permits the main slide and tool slide to be closely spaced, thus reducing the width of the housing along the direction of the axis of the wheel to be dressed.

Operation

When it is desired to dress a grinding wheel, the work piece is removed from between the centers of the grinding wheel apparatus. My dresser is then lifted into place by means of the eye hooks 18 and 19. The female centers 11 and 12 are engaged by the grinder centers and the shelf adjusted to the proper plane by the adjusting screw 20.

When the unit is properly positioned, the motor 17 is energized and, as a result, the slide 45 is reciprocated in a direction toward and from the centers. The housing is moved parallel to the axis of the wheel being dressed due to contact between the follower 34 and ratio cam 50. The degree of movement is determined by the angle of the inclined surface on the ratio cam 50.

At the same time as the template 48 moves across follower 73 of the intermediate slide, the diamonds are moved in and out of the housing 14 and normal to the movement of the housing. The result of the movement of the housing and the tools is that the tools follow a contour determined by the contour of the template.

The advantages of this dresser over any other dresser so far built is that it can be used on machines where no space can be found for mounting a dresser permanently on the machine. The dresser can be easily removed and placed beside the grinder during the grinding operation and put back on the grinder when needed and precisely located back at its initial position without any difficulty. The dresser is fully automatic as far as dressing operations are concerned and no skilled operators are required for even the most complex dressing operations. This present design is primarily intended for dressing grinding wheels, for gas turbine shaft profiles, and for grinding complex profiles where it is absolutely necessary to obtain a good finish. By means of grinding the profiles rather than any other type of machining, the turbine shafts can be made lighter and still equally strong or stronger by obtaining a good surface finish of the material so that no highly stressed surface will appear due to tool marks and the like.

I claim:

1. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced centers secured thereto and a supporting shelf, a slide guide mounted upon said shelf, a housing slidably mounted on said slide guide for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide and a ratio cam mounted on the opposite surface of said main slide, a cam follower fixed to said shelf and engaging said ratio cam for controlling movement of said housing, a tool slide on said housing and movable into and out of said housing and parallel to the movement of said main slide, and an intermediate slide movable transversely of the movement of said main slide and said tool slide and having a follower at one end thereof engaging said template and a ratio cam at the other end thereof engaging said tool slide for controlling movement of said tool slide, said slides having movement in parallel planes, a rack connected to said main slide and a prime mover mounted on said housing and engaging said rack for moving said main slide.

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2. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced aligned centers secured thereto and a supporting shelf, a housing slidably mounted on said shelf for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide and a ratio cam mounted on the opposite surface of said slide, a pin fixed to said shelf and engaging said ratio cam, a tool slide movable into and out of said housing and parallel to said main slide, and means connected between said tool slide and said template for controlling movement of said tool slide, said slides having movement parallel to each other in parallel planes, and means for moving said main slide.

3. A grinding wheel dressing apparatus comprising a base having a pair of centers secured thereto for supporting said apparatus in the position normally occupied by a work piece on a grinding apparatus, a housing slidably mounted on said base for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide, means fixed to said base and engaging said slide for controlling movement of said housing, a tool slide movable into and out of said housing and parallel to said main slide and closely spaced therefrom, and an intermediate slide movable transversely of said main slide and said tool slide and having means engaging said template at one end thereof and means at the other end thereof engaging said tool slide, said slides moving in parallel planes, and a prime mover connected to said main slide for moving said main slide and means for biasing said slides against each other and said fixed means.

4. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced aligned centers secured thereto for supporting said apparatus on a grinding wheel assembly, a supporting shelf on said assembly, a base rotatably mounted upon said shelf, a housing slidably mounted on said base for movement parallel to the axis of the grinding wheel being dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide and a ratio cam mounted on the opposite surface of said slide, a pin fixed to said base and extending through said housing and engaging said ratio cam, means for biasing said housing and ratio cam against said pin, a tool slide movable into and out of said housing and parallel to said main slide, and an intermediate slide movable transversely of said main slide and said tool slide and having a cam follower engaging said template at one end thereof and a ratio cam at the other end thereof engaging said tool slide, means for biasing said intermediate slide against said template and said tool slide against said intermediate slide, and a prime mover connected to said main slide and mounted on said housing for causing movement of said housing and tool slide.

5. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced aligned centers secured thereto for supporting said apparatus in the position of a work piece on a grinding wheel assembly, a rotatable base on said bracket, a housing slidably mounted on said base for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said housing and an elongated triangularly shaped ratio cam mounted on the opposite surface of said slide, a pin fixed to said base and engaging the inclined edge of said ratio cam, a tool slide movable into and out of said housing and parallel to said main slide and closely spaced therefrom, and an intermediate slide movable transversely of said main slide and said tool slide and having a cam follower engaging said tem-

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plate at one end thereof and a ratio cam at the other end thereof controlling movement of said tool slide, the ratio cam of said intermediate slide extending beyond the end of said tool slide, said tool slide having a cam follower positioned between said last ratio cam and the cam follower on said intermediate slide, a rack connected to said main slide and a prime mover engaging said rack for moving said main slide and mounted on said housing.

6. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced aligned stock centers secured thereto and a supporting shelf extending therefrom, a base on said shelf, an elongated housing slidably mounted on said base for movement parallel to the axis of a wheel being dressed, said housing extending beyond said base and away from said stock centers, and means on said bracket engaging the grinding wheel apparatus for adjusting the position of said base, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide and a ratio cam mounted on the opposite surface of said main slide, means fixed to said base and engaging said ratio cam for controlling movement of said housing, a tool slide movable into and out of said housing and parallel to said main slide, and an intermediate slide movable transversely of said main slide and said tool slide and having connections between said slides for controlling movement of said tool slide, and a prime mover engaging said main slide for moving said main slide and mounted on said housing.

7. A grinding wheel dressing apparatus comprising a bracket having means for supporting said apparatus between the centers of a grinding machine for holding a work piece on a grinding machine, a rotatable base on said bracket, and adjusting means on said bracket for adjusting the position of said base, a housing slidably mounted on said base for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said housing and a ratio cam mounted on the opposite surface of said slide, means fixed to said base and engaging said ratio cam to control movement of said housing, a tool slide movable into and out of said housing and parallel to said main slide, and an intermediate slide movable transversely of said main slide and said tool slide and connected between said slides for controlling movement of said tool slide, and means connected to said slides for causing movement of said slides and said housing.

8. A grinding wheel dressing apparatus comprising a bracket having means for supporting said apparatus between the centers of a grinding wheel apparatus in a position occupied by a work piece during grinding operations, a rotatable base mounted on said bracket for rotation about a vertical axis, means on said bracket for rotating said bracket about a horizontal axis, a housing slidably mounted on said base for movement parallel to the axis of a wheel to be dressed, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on said slide, a tool slide movable into and out of said housing and parallel to said main slide, and an intermediate slide movable transversely of said main slide and said tool slide and connected between said main and tool slides for controlling movement of said tool slide, said slides moving in parallel planes, and a prime mover engaging said main slide for moving said main slide and mounted on said housing.

9. A grinding wheel dressing apparatus comprising a bracket having a pair of spaced stock centers secured thereto and a supporting shelf, a slide guide mounted upon said shelf, a housing slidably mounted on said slide guide for movement parallel to the axis of said stock centers, a main slide movable in one direction within said housing and normal to the movement of said housing, a template mounted on one surface of said main slide and

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a ratio cam mounted on the opposite surface of said main slide, a cam follower fixed to said shelf and engaging said ratio cam for controlling movement of said housing, a tool slide on said housing and movable into and out of said housing and parallel to the movement of said main slide, and an intermediate slide movable transversely of the movement of said main slide and said tool slide and having a follower at one end thereof engaging said template and a ratio cam at the other end thereof engaging said tool slide for controlling move-

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ment of said tool slide, said slides moving in parallel planes, a rack connected to said main slide and a prime mover mounted on said housing and engaging said rack for moving said main slide.

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