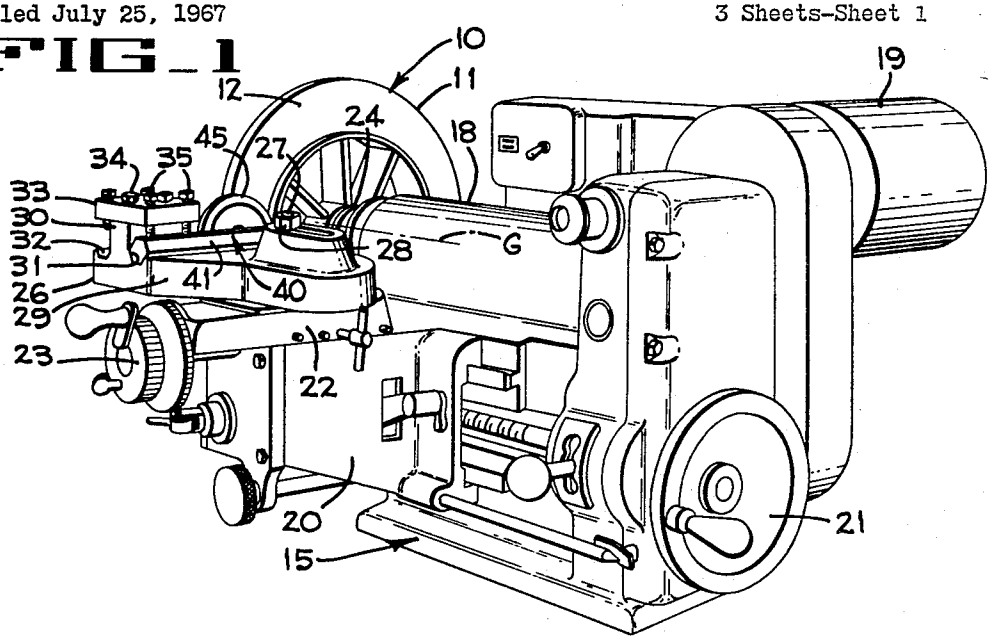
March 17, 1970 W. B. ELLEGE 3,500,589

DISC BRAKE GRINDER

Filed July 25, 1967 3 Sheets-Sheet 1

FIG_1



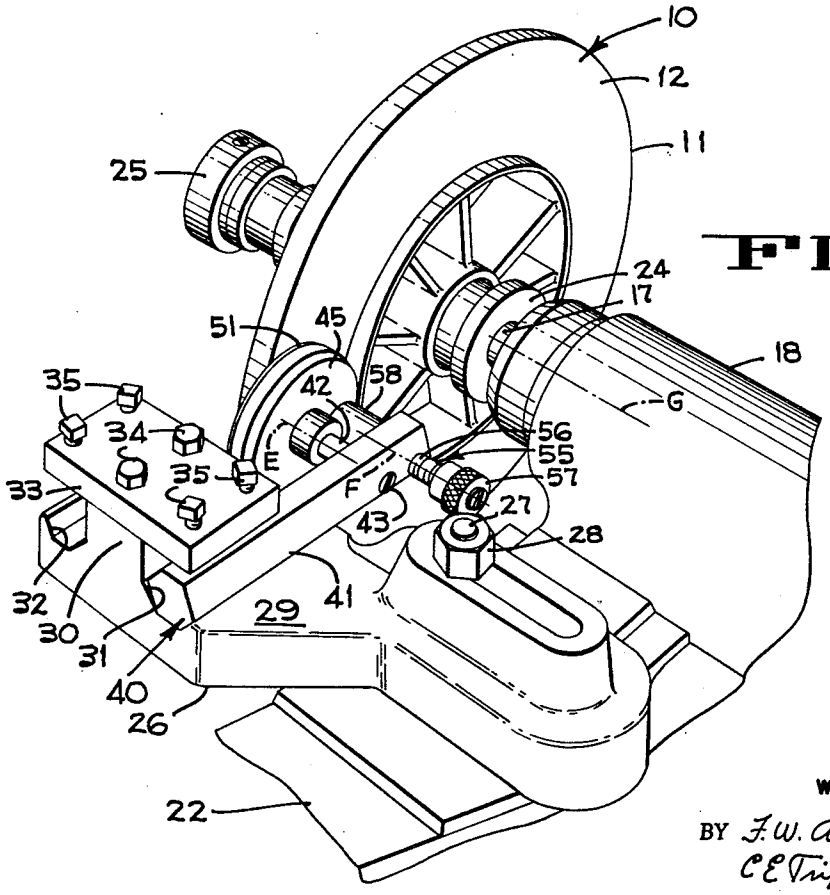


FIG_2

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DISC BRAKE GRINDER

Filed July 25, 1967 3 Sheets-Sheet 2

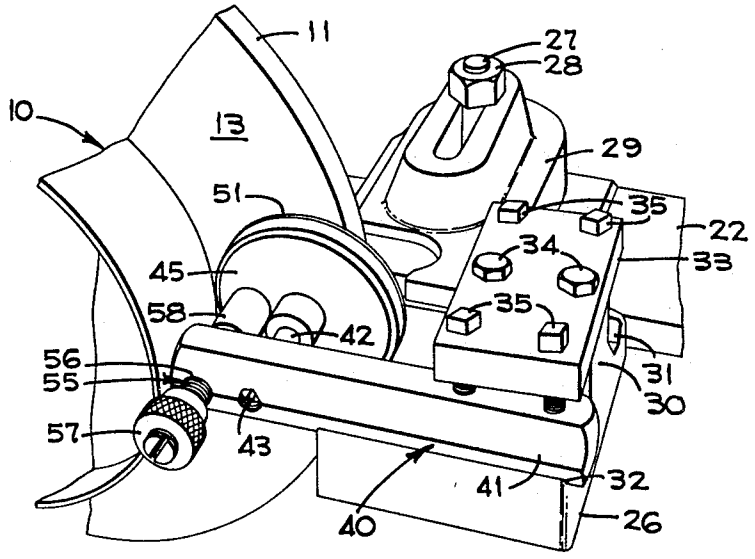
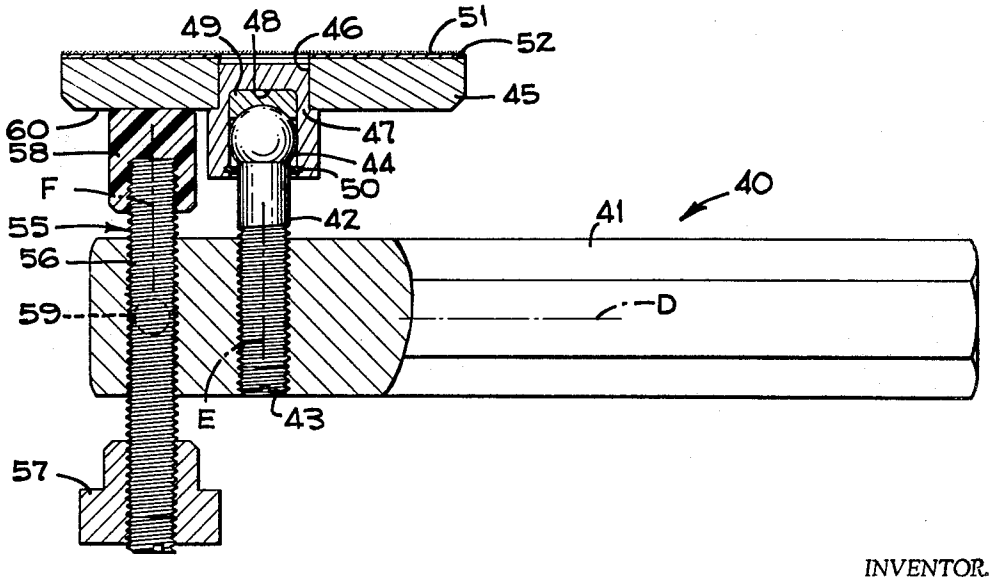


FIG_3

FIG_4



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DISC BRAKE GRINDER

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FIG_6

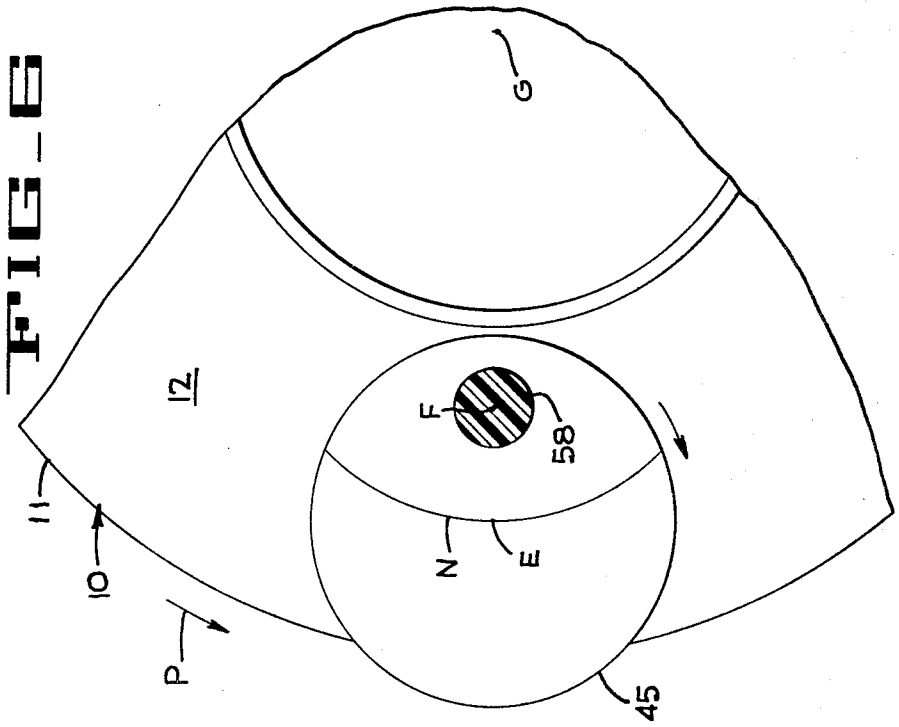
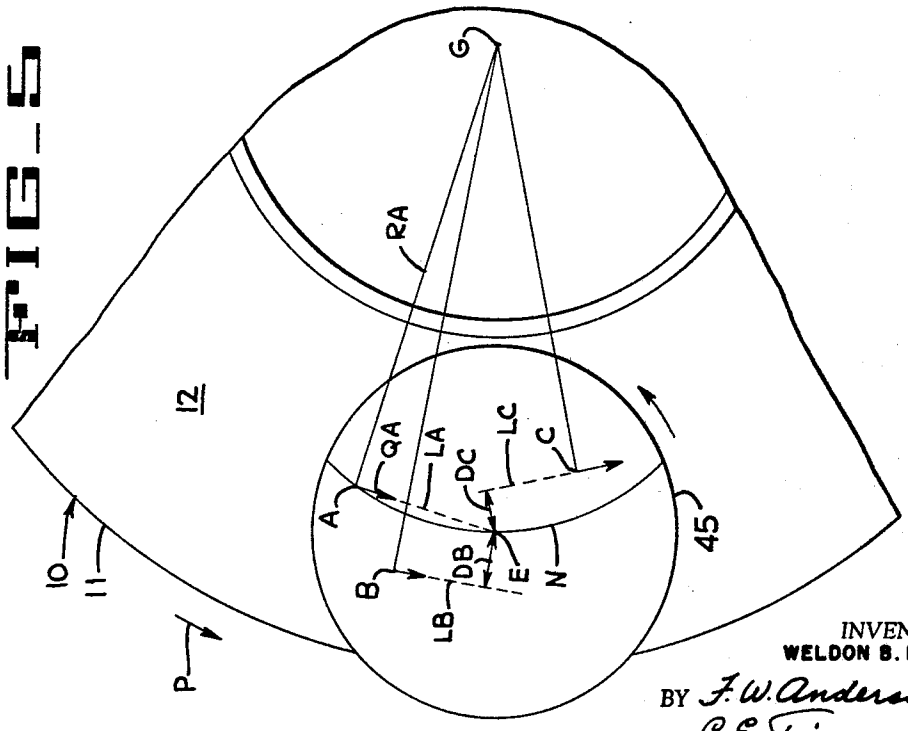


FIG_5



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United States Patent Office 3,500,589 Patented Mar. 17, 1970

3,500,589

DISC BRAKE GRINDER

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Filed July 25, 1967, Ser. No. 655,816
Int. Cl. B24b 7/02
U.S. Cl. 51—132 4 Claims

ABSTRACT OF THE DISCLOSURE

A grinding device for finishing flat surfaces on disc brake rotors has a support bar from which a stub shaft extends. A grinding disc on the stub shaft has a flat front abrasive grinding face which is rotated when brought into engagement with a rotating rotor disc. The grinding disc is positioned to rotate about an axis spaced from the axis of rotation of the brake rotor. The grinding device has a pressure member with a plastic pad which is shifted to engage the back of the grinding disc between the axis of rotation of the disc and the axis of rotation of the rotor. The disc, which rotates in the same direction as the rotor before the pressure member engages the disc, rotates in the opposite direction to the rotor after the application of pressure to the disc to quickly finish the rotor surface.

BACKGROUND OF THE INVENTION

The present invention relates to a grinding device for grinding a flat surface such as the sides of a disc brake rotor.

A typical disc brake rotor, which attaches to the wheel of an automobile, has a flange with an annular face on each side. During braking of the vehicle, a brake shoe mounted in the vehicle on each side of the flange engages the annular face to stop the automobile. It is desirable, for proper braking action, that the annular faces on the brake rotors be flat and smooth. However, long or hard use of the brakes tends to roughen or groove these surfaces. To restore the brakes, the rotor surfaces should be turned on a lathe to remove the irregularities from the surfaces. After turning, the surfaces should then be ground to finish the surfaces to the desired degree of smoothness.

SUMMARY OF THE INVENTION

In the present invention, a simple, effective grinding device is provided to grind the opposite annular faces on a disc brake rotor. The device can be mounted on the lathe used to turn the rotor surfaces, and can be easily operated by unskilled personnel. In brief, in the preferred form of the invention, a support bar, which is held in the tool holder of the lathe, has a stub shaft extending laterally therefrom which carries a grinding disc. The grinding disc, which is freely rotatable on the stub shaft, has a flat front abrasive grinding face. By moving the lathe carriage on which the tool holder is mounted, the grinding face on the disc is brought into engagement with the annular face on one side of the disc brake rotor which is mounted for rotation in the lathe. The axis of rotation of the grinding disc, when the grinding face of the disc engages the annular face of the rotor, is parallel to but spaced from the axis of rotation of the rotor. Initially, the grinding disc is rotated in the same angular directional sense as the rotor rotates. A pressure member, mounted in the support bar parallel to the stub shaft, can be shifted into engagement with the back of the grinding disc between the axis of rotation of the grinding disc and the axis of rotation of the brake rotor. When this is done, pressure is exerted on one side of the grinding disc which is universally pivotal to a limited extent on the stub shaft. Thus, one side of the grinding disc is urged with greater pressure into the brake rotor, and the grinding disc rotates in a direction opposite to the direction of rotation of the brake rotor. The rotation of the grinding disc by the rotor in a direction opposite to the direction of rotation of the rotor quickly produces the desired smooth finish on the annular rotor surface. The opposite face of the disc brake rotor is then finished in the same manner.

It is therefore one object of the present invention to provide a grinder for grinding a flat rotating surface in which a flat grinding member is driven by the member being ground. It is another object of the present invention to provide a simple, effective grinder for grinding disc brake rotors. It is yet another object of the present invention to provide a grinder for grinding a flat rotating surface in which a flat grinding member is driven by the member being ground but oppositely thereto for quick effective finishing of the surface to be ground.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a view in perspective of the grinding device of the present invention mounted in a lathe to grind a disc brake rotor;

FIGURE 2 is a view in perspective showing the grinding device mounted in the tool holder of the lathe to grind one of the annular surfaces on one side of the disc brake rotor;

FIGURE 3 is a view in perspective somewhat similar to FIGURE 2 but showing the grinding device mounted to grind the annular surface on the opposite side of the disc brake rotor;

FIGURE 4 is a view partly in cross-section of the grinding device;

FIGURE 5 is a schematic diagram showing some of the forces exerted on the grinding disc by the rotating brake rotor before the pressure member is shifted into engagement with the grinding disc; and

FIGURE 6 is a schematic diagram showing the direction of rotation of the grinding disc after the pressure member is shifted into engagement therewith.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The disc brake rotor **10**, which, in use, is attached to the wheel of an automobile, has a flange **11** with a flat annular surface **12, 13**, respectively, on each side. During braking of the automobile, the surfaces **12, 13** are engaged by brake linings mounted on the automobile on each side of the flange **11**. The surfaces **12, 13**, which should be smooth for optimum braking, become rough, and sometimes grooved, through use. To restore the brakes, the surfaces **12, 13** are first turned and then ground to a smooth finish.

A lathe **15**, which can be used in machining the disc brake rotor **10**, is shown in FIGURE 1. The lathe is described in more detail in U.S. Patent 2,663,975. A spindle **17** (see FIGURE 2) is journaled on axis G in the housing **18** of the lathe and can be selectively connected to a motor **19** for rotation. A carriage **20** is mounted on the side of the housing and is reversibly movable thereon in a direction parallel to the spindle by reversible rotation of handwheel **21**. A cross slide **22** is mounted on the carriage and is reversibly movable thereon in a direction perpendicular to the direction of travel of carriage **20** by reversible rotation of handwheel **23**.

A disc brake rotor **10** which has been removed from a wheel of an automobile is mounted on an adapter **24** on the spindle and secured thereon by nut **25**. For machining the two annular surfaces **12, 13** of a disc brake rotor (which constitute work surfaces), a dual track tool holder **26** is mounted on bolt **27**, which extends upwardly from the cross slide, in lieu of the tool holder (identified as

tool support **90**) shown in U.S. Patent 2,663,975. The tool holder is clamped to the cross slide by nut **28** received on the bolt **27**.

As shown in FIGURES 1, 2 and 3, the tool holder **26** has a base portion **29** with an upstanding post **30**. A groove **31**, **32** on each side of the post defines a track to receive a tool support bar. A locking plate **33** is secured to the upper end of post **30** by screws **34**. The plate **33** extends over a tool support bar received in groove **31** or **32** and screws **35** will firmly hold the tool support bar in the groove.

In restoring disc brake rotors, the annular surfaces **12**, **13** are initially turned simultaneously by two turning tools (not shown) secured, respectively, in grooves **31** and **32** to machine annular surfaces **12** and **13**. Alternately, the surfaces **12**, **13** can be turned individually. After the turning operation, the surfaces **12** and **13** are finished by the grinding tool, or device, indicated generally at **40**.

As shown best in FIGURE 4, the grinding tool **40** has a support bar **41** of hexagonal cross section with a longitudinal axis D. A stub shaft **42** is threadedly received in the support bar near the end thereof and extends laterally therefrom on an axis E perpendicular to axis D. A set screw **43** is threadedly received in the support bar **41** to bear against the end of shaft **42** for tightly locking the shaft in the bar. The stub shaft **42** terminates at its outer end in a spherical ball **44**.

A disc **45** has a central opening **46** into which a hub **47** is tightly received. Hub **47** has a socket **48** with a ball seat **49** therein. The ball end of shaft **42** is received in the socket and is held therein by ring **50**. An annular abrasive sheet **51** is cemented on the front face **52** of disc **45**. The disc **45**, which is freely rotatable on shaft **42**, is capable of limited universal movement with respect to shaft **42** by virtue of the ball and socket connection between disc **45** and shaft **42**.

A pressure member, indicated at **55**, is mounted in support bar **41** on an axis F parallel to the longitudinal axis E of stub shaft **42**. The pressure member has a threaded stem **56** extending through the support bar adjacent the end of the bar. A knurled knob **57** is secured to the end of the stem away from the disc **45**, and a plastic button, or pad **58**, made of Teflon or other suitable low friction bearing material, is secured to the other end of the stem adjacent the disc **45**. A set screw **59** is threadedly received in the bar to bear against stem **56** to adjust the friction force resisting the turning of the stem. The pad **58**, which is in registration with disc **45**, can be shifted towards or away from the back face **60** of the disc by turning the knob **57**.

After the two flange surfaces **12** and **13** have been turned with lathe turning tools, the turning tools are removed from tool holder **26** and the grinding tool **40** is mounted therein. To grind surface **12**, the support bar **41** of grinding tool **40** is inserted in groove **31** with the end of the bar flush with the edge of base portion **29** and with the abrasive grinding face toward surface **12**, as shown in FIGURE 2. The carriage **20** is advanced slowly by rotation of handwheel **21** until the flat abrasive grinding face **51** of the grinding disc **45** lightly touches the surface **12** which is not rotating at this time. It will be noted that the disc, which is universally movable on shaft **42**, will move to a position perpendicular to axis E of shaft **42** on contact with the rotor flange **11**. The pressure pad **58** is positioned out of contact with the back of the grinding disc and the carriage **20** is backed away slightly by handwheel **21**. The cross slide **22** is then moved in by rotation of handwheel **23** until the right edge (as viewed in FIGURE 2) of disc **45** is in registration with the inner edge of annular surface **12**. The lathe spindle is then connected to the motor to rotate the disc brake rotor, and the carriage **20** is advanced slowly until the flat grinding face of disc **45** contacts surface **11**.

When the grinding disc engages the rotor flange, which is rotating counterclockwise as indicated by arrow P in FIGURE 5, the disc will rotate, in axis E, counterclockwise if in a position relative to the rotor as shown in FIGURE 5. It will be noted that the rotating rotor exerts an incremental force on the grinding disc at each point of contact therewith. At each point, the force acting on the grinding disc acts along a line perpendicular to the radial rotor line which extends from the axis G of rotation of the rotor to the point. Thus, the force QA transmitted from the rotating rotor to the grinding disc at point A acts along a line LA which is perpendicular to the radial line RA. Any force line, such as line LA, which passes through the axis E of rotation of the grinding disc, will have no tendency to rotate the disc either clockwise or counterclockwise. The locus of points at which forces act along lines passing through the axis of rotation of the grinding disc is represented in FIGURE 5 by line N, which, for convenience, can be designated a null line. Forces transmitted by the rotating rotor and acting on the grinding disc to the left of the null line N (as viewed in FIGURE 5) tend to rotate the disc counterclockwise; forces transmitted by the rotating rotor and acting on the grinding disc to the right of the null line N (as viewed in FIGURE 5) tend to rotate the disc clockwise. The influence of the force transmitted to the disc at any given point, such as B or C, will depend on the distance DB or DC of the line of force LB or LC from the axis of rotation of the grinding disc. When the grinding disc is positioned relative to the rotor as shown in FIGURE 5, the disc will rotate in the same direction (counterclockwise) as the rotating rotor as long as the pressure pad is out of engagement with the grinding disc.

The pressure pad **58** is then shifted into engagement (on axis F) with the back face **60** of the grinding disc between the axis of rotation of the rotor and the axis E of rotation of the grinding disc, as shown in FIGURE 6. The plastic Teflon pad will not prevent the disc **45** (which is made of steel) from rotating (because the disc **45** will slide with respect to the pad) but the pad will urge the right side of the disc (as viewed in FIGURE 2) into the rotating rotor with increased force. The forces transmitted from the rotating rotor to the right side of the null line N (as viewed in FIGURE 6) increase as the pad is urged into the disc, causing the grinding disc to rotate clockwise, as shown in FIGURE 6. The rotation of the grinding disc in a direction opposite to the rotation of the rotor quickly smoothes flange face **12**, diminishing the forces which urged the grinding disc to rotate clockwise, thus slowing down the clockwise rotation of the disc. When the disc almost stops rotating, the carriage **20** is backed off.

The grinding tool is removed from groove **31**, the carriage **20** is advanced, and the tool is then inserted in groove **32**, with the grinding disc toward the flange face **13** as shown in FIGURE 3. The grinding steps followed to grind surface **12** are repeated for surface **13**.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention as set forth in the appended claims.

Having completed a detailed description of the invention so that those skilled in the art could practice the same, I claim:

1. Apparatus for grinding a flat work surface rotatable about an axis of work rotation comprising

(a) a support,

(b) a grinding disc mounted on a shaft on said support for rotation about an axis of disc rotation spaced from said axis of work rotation, said grinding disc having a flat front abrasive surface,

(c) means, mounting said disc for universal movement on said shaft,

(d) means to move said support toward and away from said work surface,

(e) a pressure member mounted on said support be-

hind the grinding disc and between said axis of disc rotation and said axis of work rotation,

(f) and means for moving said pressure member into engagement with the back of said disc to urge the front abrasive surface of the grinding disc into said work surface.

2. The apparatus of claim **1** in which the pressure member has a pad of low friction bearing material at one end to engage the back of said disc.

3. Apparatus for grinding a flat work surface rotatable about an axis of work rotation comprising:

(a) a support bar,

(b) a stub shaft secured to and extending laterally from the support bar,

(c) a grinding disc mounted on the stub shaft for limited universal movement relative thereto, said grinding disc having a flat front abrasive surface rotatable about an axis of disc rotation,

(d) a pressure member having a stem in threaded engagement with the support bar, said pressure member terminating in a low friction bearing material pad shiftable on rotation of the stem along a line into engagement with the back of the grinding disc to

urge the grinding disc into said work surface, said line along which the pad is shiftable lying between said axis of work rotation and said axis of disc rotation.

4. The apparatus of claim **3** in which said line along which the pad is shiftable and the axes of rotation of the disc and work surface are parallel.

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U.S. Cl. X.R.

51—259