March 18, 1958 K. LAU 2,826,877

DIAMOND GRINDING AND POLISHING DEVICE

Filed Dec. 6, 1956

Fig. 1

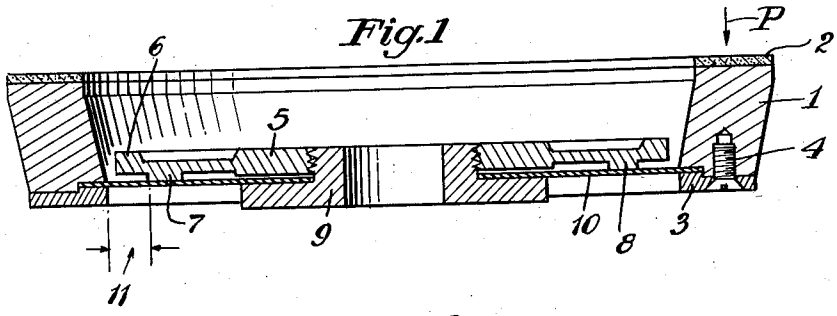


Fig. 2

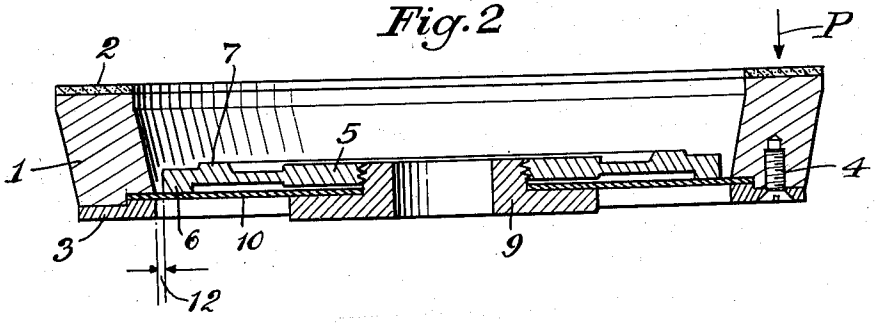


Fig. 3

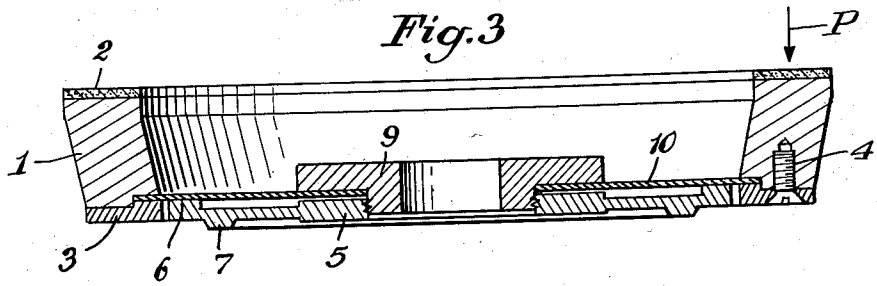


Fig. 4

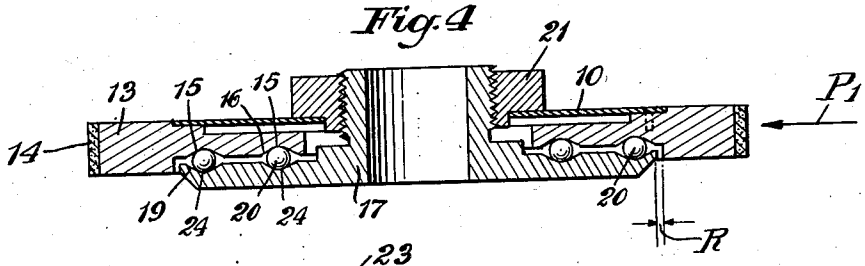
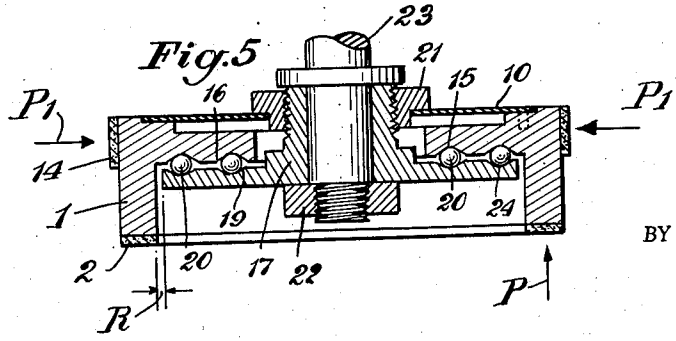


Fig. 5



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DIAMOND GRINDING AND POLISHING DEVICE

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6 Claims. (Cl. 51—168)

This invention relates generally to diamond grinding and polishing devices used for grinding and polishing purposes, and has particular applicability to grinding and treatment of hard surfaces.

It was known in the grinding art to use grinding and polishing devices comprising flexible means, which made the grinding surfaces of such devices elastic with respect to the grinding or polishing pressure. For this purpose grinding devices have been provided with spiral-spring means, spring-wire brackets, or rubber inserts between the grinding members and the hub means, which connect the grinding devices with their driving means, so as to provide the elastic action of said flexible means with respect to the grinding pressure exerted upon the grinding surfaces of such devices. These intermediate spring members were exposed to substantial fatigue, which contributed to a rapid wearing of said spring means and the grinding surfaces. The adjustment of the tension of such spring members was also rather difficult and inconvenient.

It is a general object of the present invention to provide an improved grinding and polishing device, including a flexible intermediate member, which will eliminate the fatiguing of the elastic means and of the grinding surfaces, and will also provide a simple and accurate means for adjustment of the flexible action of said flexible means, and thus the elasticity of the grinding device with respect to the desired grinding pressure.

More specifically it is an object of the present invention to provide an intermediate flexible member between the grinding member and the hub means, which will form part of the grinding member.

A further object of this invention is to provide a tensioning member of annular shape leaning upon the flexible member of large dimensions, being connected to the hub means, which will enable a simple and advantageous adjustment of the flexible action of the flexible member, and thus the elasticity of the grinding member relative to the predetermined grinding pressure exerted upon the grinding layers provided on the outer surfaces of the grinding member.

A still further object of the present invention is to design a novel and advantageous grinding and polishing device having the diamond grinding, or polishing layers disposed both upon the circumference of the annular grinding device and also upon the face of such device.

The foregoing statements are merely illustrative of the various purposes and objectives of this invention. Other objects and advantages will readily become apparent from a study of the following specification, when considered in conjunction with the accompanying drawing, in which several modifications of the grinding and polishing device embodying the principles of this invention are shown, in which:

Fig. 1 shows somewhat diagrammatically a sectional view of an improved grinding device embodying the invention, and comprising a bowl shaped annular grinding device having the grinding surface on an outer face of the same;

Fig. 2 shows the grinding device of Fig. 1 modified by the provision of a different tensioning disc-shaped member;

Fig. 3 shows a modification of the grinding device of Fig. 1, wherein the hub means and the tensioning member are reversed in their relative position;

Fig. 4 shows a cross-section view of a grinding device having the grinding surface on the outer circumference of the same;

Fig. 5 shows a combined grinding device having two grinding surfaces, one on its outer circumference and the other on an outer face of the grinding member.

Referring to the drawings, and more particularly to Fig. 1 thereof, the grinding device comprises a grinding disc 1 of preferably bowl-shaped form, which has provided on its face a grinding layer 2. A flexible member 10 is supported on said grinding member 1 by means of an annular member 3, fastened to the grinding member 1 by means of screws 4. The inner side of said flexible member 10 is connected to a hub means 9, provided on the grinding shaft for connecting the grinding device to its driving means, not shown. The arrangement of parts is such that an annular portion 11 of the flexible member 10 is free of support, and can therefore be utilized for giving the device the desired degree of elasticity relative to the grinding pressure. The flexible member 10, which preferably is in the form of a membrane, or disc is supported, and tensioned, by means of a tensioning ring 5. The tensioning ring 5 is disposed on the hub means 9, and is provided with annular ribs or bosses 6 and 7, preferably disposed on opposite sides of the member 5 at different distances from the hub means 9.

As can be seen in the modification according to Fig. 1 the membrane, or disc 10, is tensioned by the lower rib 7. In providing tensioning members 5 of different size, provided with annular ribs of different diameter, the degree of elasticity of the disc 10 can be adjusted in simple manner to any desired degree. This is obtained in that different sized members 5 will produce different free annular surfaces 11 on the membrane 10, thus changing to any desired degree the elasticity of the membrane 10. Under the influence of the grinding pressure P on its grinding surface 2, the grinding member 1 will tend to bend downwardly along its periphery. This action will tend to lift the rib 8 and to depress the rib 7. These bending forces will be compensated by the free annular area 11 of the flexible member 10, which will thus provide the necessary flexibility for the grinding operation. The degree of flexibility of the device can be easily adjusted by the appropriate dimensioning of the tensioning member 5, or by selecting the desired diameter of the annular ribs 7, 8 in appropriate manner.

In the arrangement of the modified device, as shown in Fig. 2, the position of the tensioning member 5 is reversed relative to the membrane 10, in that in this case the rib 6 is in contact with the membrane 10 leaving only a relatively small free annular space 12 between the inner surface of the grinding member 1 and the covered inner portion of the membrane 10 beneath the annular rib 6. This modification according to Fig. 2 will substantially increase the rigidity of the grinding device, as compared with the modification shown in Fig. 1, due to the substantially smaller annular membrane surface 12 as compared with the annular surface 11 of Fig. 1, the latter providing a substantially softer grinding action. The elasticity of the grinding device will increase corresponding with an increase spacing of the supporting ribs 6 or 7 from the inner wall of the grinding member 1, and thus increasing the annular free area of the membrane 10.

In the modification of the grinding device shown in Fig. 3, the relative position of the tensioning ring 5 and

of the hub means 9 is reversed. In this case, the elastic action of the membrane 10 will be substantially reduced, so that the grinding device will become substantially rigid. In this case the membrane 10 is rigidly supported by the rib 6 from beneath and under the action of the grinding pressure P will not be able to produce any resilient spring action.

In Fig. 4 there is shown a modification of the grinding device wherein the grinding layer 14 is disposed on the outer circumference of the grinding member 13, and the grinding pressure P_1 is exerted upon the grinding device not in axial direction, but rather in a direction perpendicularly to the axis of the device. For this purpose the hub means 17, and the grinding ring 13 are respectively provided on their inner surfaces with recesses 24, 15 disposed opposite each other. The recesses are provided with sloping surfaces 16 and 19, and balls 20 are disposed within said recesses 15, 24. The resulting bearing support will enable an angular displacement of the grinding member 13 relative to the inner hub 17. The membrane 10 is in this case disposed above the grinding ring 13, to which it is fixedly secured, and the inner edge of the disc 10 is supported by a nut 21, screwed upon the hub 17. The adjustment of the degree of elasticity of the grinding device in this modification is also very simple, and is effected by the adjustment of the pressure of the nut 21 upon the membrane 10. Under the grinding pressure P_1, the grinding ring 13 will be moved towards the hub 17 reducing the spacing gap R between the grinding ring 13 and the hub 17. This pressure will produce a resilient action of the membrane 10 to a greater or less extent according to the degree of pressure exerted by the nut 21. The balls 20 will be displaced by this grinding pressure, and will be able to return to their central position only after the grinding pressure P_1 is compensated by the spring action of the membrane 10.

The arrangement as shown in Fig. 5 provides the possibility, in accordance with the present invention, of combining the forms of two grinding devices shown in Figs. 1 to 4 into a novel grinding unit, provided with grinding surfaces both upon its face and also upon its circumference. The bowl-shaped grinding member 1, with its grinding surface 2, is also provided with a second grinding surface 14. The hub 17 is fixedly secured to the driving means or shaft 23 by means of a nut 22. The previously described recesses 15, 24 are, in this case, disposed upon the inner surface of the grinding member 1 and in the hub 17, opposite each other. The balls 20 are again disposed within these recesses, thereby enabling an angular displacement of the grinding member 1 relative to the hub 17. The flexible membrane 10 is disposed above the grinding member 1, to which it is secured at its periphery, and at its inner edge the membrane 10 is secured to the hub 17 by means of the adjustable nut 21. By loosening or tensioning the nut 21, the degree of elasticity of membrane 10 is readily varied. Under the grinding pressure T_1 upon the grinding layer 14, the spring action of the grinding device will be effected in the manner shown in Fig. 4 by the movement possible in the gap space R between the outer circumference of the hub 17 and the inner wall of the grinding member 1. The grinding pressure P upon the grinding layer 2 will effect the spring action of the membrane 10 in a manner similar to that shown in Fig. 1.

From the foregoing description it will be apparent that the invention contemplates a simple and effective means for providing an elastic, adjustable grinding device, which can be easily adjusted to the desired grinding pressure, and also enables the design of a combined grinding unit available for grinding operations having two spaced grinding layers.

Although there is shown and described particular grinding devices, it is to be understood that the same were merely for the purpose of illustration, and that changes and modifications may readily be made therein, by those skilled in the art, without departing from the spirit and scope of the invention.

I claim as my invention:

1. A grinding and polishing device including a ring-shaped grinding member having a grinding layer disposed upon one of its outer surfaces, a driving means for said grinding device, a hub means connecting the grinding member with said driving means, a flexible member for attachment of the ring-shaped grinding member to said hub means, and a tensioning member for tensioning said flexible member of said grinding device, said tensioning member having annular ribs of different diameters on both sides of said member, one of said ribs being in contact with said flexible member for supporting and tensioning said flexible member, whereby the degree of elasticity of said flexible member is adjusted by the appropriate turning of said tensioning member and the respective annular ribs.

2. A grinding and polishing device including a ring-shaped grinding member having at least one grinding layer disposed on one of its outer surfaces, a driving means for said grinding device, a hub means connecting said grinding member with said driving means, a flexible member for attachment of the ring-shaped grinding member to said hub means, the hub means and the grinding member of the device having complementary annular recesses disposed opposite one another with sloping sides, and balls disposed between said recesses for movably supporting the grinding member relative to said hub means.

3. A grinding and polishing device including a ring-shaped grinding member having at least one grinding layer disposed on one of its outer surfaces, a driving means for said grinding device, a hub means connecting said grinding member with said driving means, a flexible member for attachment of the ring-shaped grinding member to said hub means, the hub means and the ring-shaped grinding member of the device having complementary annular recesses disposed opposite one another with sloping sides, whereby said recesses in the ring-shaped grinding member are provided on the inner side of same, and balls disposed between said recesses for movably supporting the grinding member relative to said hub means.

4. A grinding and polishing device including a ring-shaped grinding member having at least one grinding layer disposed on one of its outer surfaces, a driving means for said grinding device, a hub means connecting said grinding member with said driving means, a flexible member for attachment of the ring-shaped grinding member to said hub means, the hub means and the grinding member of the device having complementary annular recesses disposed opposite one another with sloping sides, and balls disposed between said recesses for movably supporting the grinding member relative to said hub means, and nut means provided on said hub means in operative contact with the flexible member for adjusting the tension of said flexible member.

5. The combination in a grinding device having a grinding member with a plurality of grinding layers disposed on different outer surfaces of said grinding member, driving means for said grinding device, a hub means connecting the grinding member with said driving means, a flexible member disposed between said grinding member and said hub means for attachment of said ring-shaped grinding member to said hub means, and supporting means in said grinding member and said hub member enabling an angular movement of said grinding member relative to said hub means comprising annular recesses in the grinding member and the hub means disposed opposite each other, balls between said recesses, whereby the grinding pressure on one of said grinding surfaces will develope a resilient spring action of said flexible member, and the grinding pressure on the other of said grinding surfaces will develope a resilient spring action of said flexible member in combination with said supporting

means disposed between said grinding member and said hub means.

6. The combination in a grinding device having a grinding member with a plurality of grinding layers disposed on different outer surfaces of said grinding member, driving means for said grinding device, a hub means connecting the grinding member with said driving means, a flexible member disposed between said grinding member and said hub means for attachment of said grinding member to said hub means, and supporting means in said grinding member and said hub means enabling an angular movement of said grinding member relative to said hub means comprising annular recesses in the grinding member and the hub means disposed opposite each other, balls between said recesses, adjusting means provided on said hub means for the adjustment of the tension of said flexible member, whereby the grinding pressure on one of said grinding surfaces will develope a resilient spring action of said flexible member, and the grinding pressure on the other of said grinding surfaces will develope a resilient spring action of said flexible member in combination with said supporting means disposed between said grinding member and said hub means.

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