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Johansson

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[54] **GRINDING APPARATUS**

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[63] Continuation of Ser. No. 6,112, Jan. 27, 1970, abandoned.

[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **241/259.3,** 241/285 R

[51] **Int. Cl.** **B02c 7/06**

[58] **Field of Search** 241/247, 259.1, 259.3, 241/286

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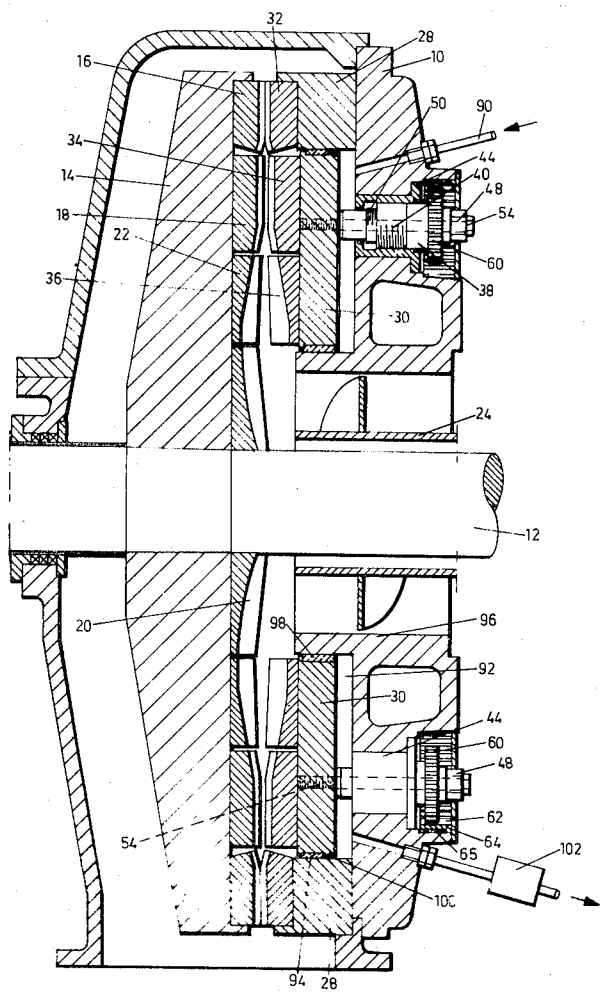
[57] **ABSTRACT**

A grinding apparatus having a pair of grinding discs, at least one of which discs being rotatable and at least one of the discs being adjustable with respect to the other disc by means of two concentric interengaging screws, the outer screw surrounding the inner screw also engaging a part of the casing carrying the adjustable disc.

21 Claims, 3 Drawing Figures



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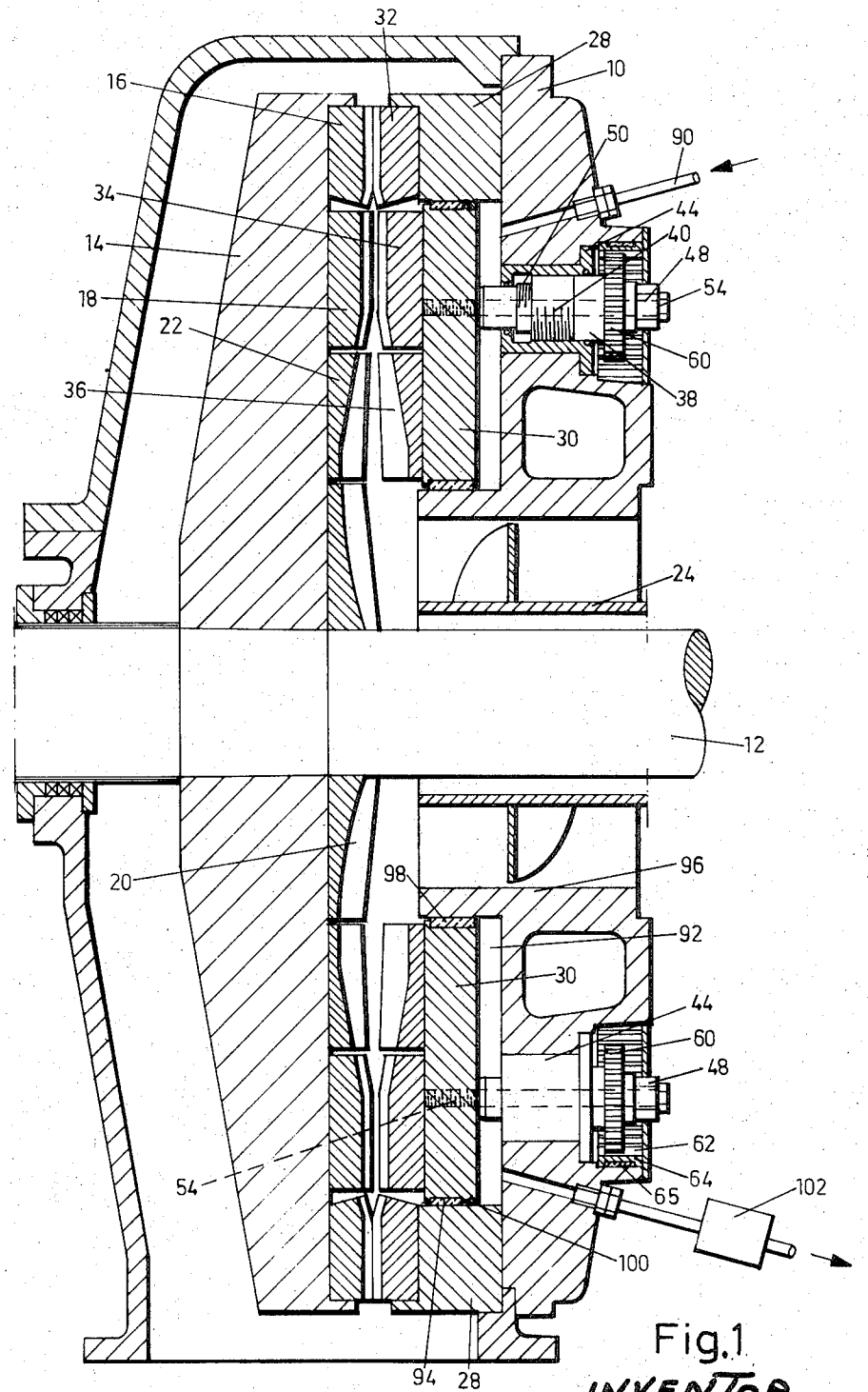

Fig.1

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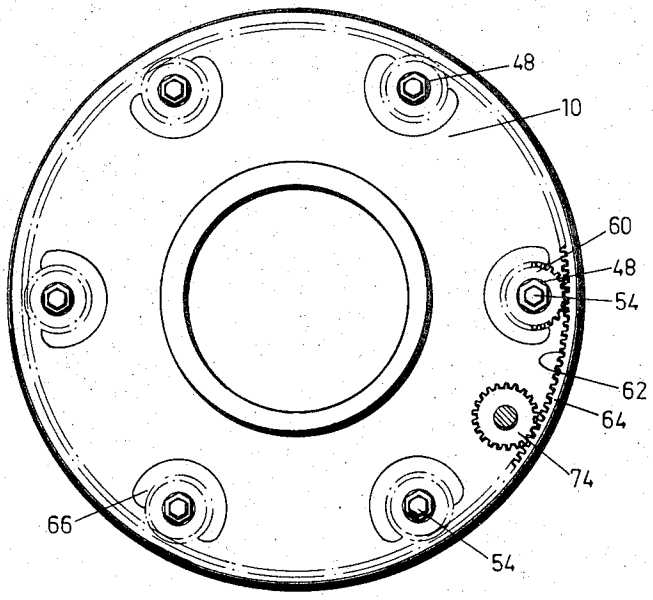

Fig.3

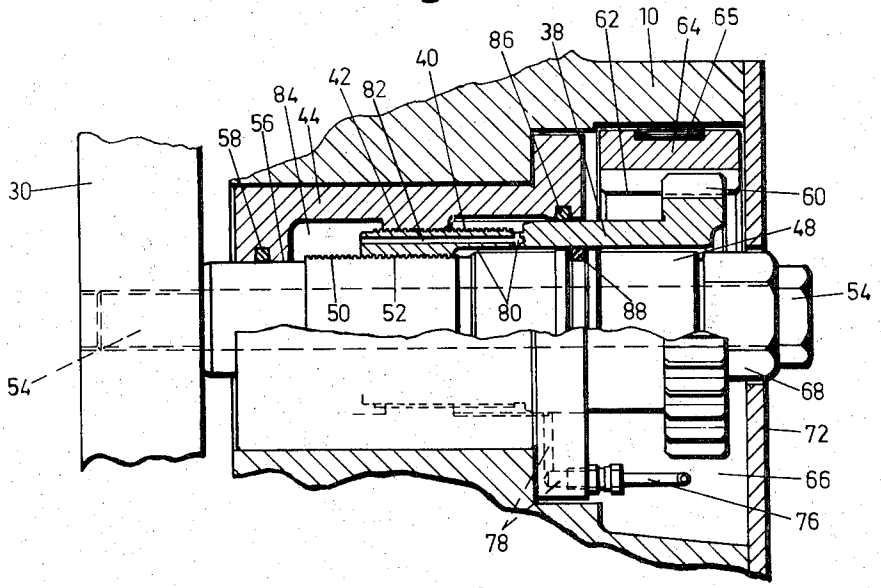

Fig.2

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GRINDING APPARATUS

This is a continuation of Ser. No. 6,112, filed Jan. 27, 1970, and now abandoned.

This invention relates to a grinding apparatus with grinding discs housed in a casing of which discs at least one is rotatable and which discs between themselves form a grinding space for the grinding produce consisting of vegetable or similar material.

More specifically, the invention relates to grinding apparatus of the kind in consideration wherein at least the one grinding disc is formed with two concentrical annular elements. The grinding discs are made so that a gradual disintegration, usually denoted as, respectively, defibration and refining of the produce passing through the grinding space is effected. According to the U.S. Pat. No. 3,684,200 the inner of two concentric annular of disc elements is axially adjustable relatively to the outer one for compensation of the non-uniform wear of the grinding surfaces of the elements. The wear is namely greatest in the inner or primary grinding zone which receives the coarser grinding produce, whereas this latter when entering the outer, secondary grinding zone has already been subjected to a homogenization and a pre-working.

One main object of the invention is to provide an arrangement which permits adjustment of one grinding disc or a portion thereof such as the inner one of two concentric annular elements by actuation from outside while the grinding apparatus is in operation and thus the grinding discs are subjected to the high pressure acting on the grinding produce. This pressure may be created hydraulically, i.e. in the manner disclosed in the U.S. Pat. No. 2,891,733. The arrangement shall according to the invention be capable of permitting fine adjustment of the disc or the annular element in axial direction with very high exactness, such as hundredths of one millimeter to attain the most favourable quality of the grinding produce or the highest possible capacity of the grinding apparatus in response to the properties of the grinding produce.

Another object of the invention is to provide an arrangement which is capable of compensating during the operation proper, i.e. any interruption of the operation, for the unavoidable wear on the grinding disc or the annular element, respectively.

According to one main feature of the invention the grinding disc or a suitably radially inner annular element is adjustable by means of two screws disposed concentrically relatively one another and having threads cooperating with one another, that in addition the outer screw and a part carrying said grinding disc or said annular element have threads cooperating with one another, that the two pairs of threads are threaded in the same direction but with different pitches and that one of the screws is rotationally stationary.

In accordance with the invention the threads due to their great pitch can be made so strong that they are capable of withstanding without any disturbing deformation the high axial pressure exerted on the grinding discs, which may amount to many tons per pair of screws. At the same time, the resulting axial displacement of the grinding disc or the annular element becomes little for one part-turn through an angle of the rotatable screw, whereby an exact fine adjustment of the grinding disc or the annular element is rendered possible. According to a particularly advantageous embodiment of the invention a closed space which is connectable to a pressure source for a pressure fluid is provided behind the adjustable grinding disc or annular element. Hereby, the threads can be relieved to a substantial degree from the high axial working pressure during the adjustment operation proper.

Further objects and advantages of the invention will become apparent from the following description, considered in connection with the accompanying drawings, which form part of this specification and of which:

FIG. 1 is a longitudinal sectional view of a portion of a grinding apparatus constructed according to one embodiment of the invention.

FIG. 2 shows two screws and adjacent parts in the same section as in FIG. 1 but in a greater scale.

FIG. 3 is an end view of the casing of the grinding apparatus shown in FIG. 1.

Referring to the drawings, reference numeral **10** denotes the rigid stand of the apparatus which forms a casing which is passed by a rotatable shaft **12** extending from end to end. The shaft **12** carries a grinding disc **14** to which a number of concentrically disposed annular or disc elements, in the present case three elements denoted **16, 18, 22** are connected by means of bolts not shown. Most suitably each of the annular elements **16, 18, 22** is composed of segments. Provided in the centre of the grinding disc **14** is a disc member **20** which has for its purpose to feed the grinding produce introduced by means of a screw conveyor **24,** and being e.g. in the form of chips or fibre pulp, in a radially outward direction. A stationary grinding disc is composed of two concentric stator rings **28, 30** supporting grinding disc elements **32** and **34, 36,** respectively, each of which also may be composed of segments and between which and the rotatable disc elements **16, 18, 22** a grinding space is formed, which is passed by the grinding produce at an outward direction. The segments of the grinding discs are in known manner formed with ribs and grooves.

The outer stator ring **28** is rigidly secured within the stand **10,** whereas the inner stator ring **30** is axially adjustable by means of pairs of screws formed according to the invention. Each of these pairs comprises an outer hollow screw **38,** which at its external surface is formed with threads **40** cooperating with the threads **42** formed on an inner flange within a sleeve **44** which is rigidly anchored in an axial recess in the casing or stand **10.** An inner screw **48** is formed with an external thread **50** which cooperates with an internal thread **52** formed in the outer screw **38.** The screw **48** extends through the sleeve **44** and bears on the stator ring **30.** A lock pin **54** is disposed freely movable within the inner screw **48** and its end portion is inserted by screwing it into the stator ring **30.** By driving home this lock pin at the outer end thereof the two screws are fixed in predetermined positions relative one another and the stand, respectively. The sleeve **44** is at its interior end bent inwardly towards the screw **48** and forms a guide surface **56** for said screw, which guide surface may house a sealing ring **58.**

The threads **40, 42** between the outer retainer screw **38** and the stationary sleeve **44** are preferably right-threaded and have a relatively great pitch, such as 3 mms per turn. The threads **50, 52** between the two screws **38, 48** are threaded in the same direction, i.e. in the present case also right-threaded, and they have a still greater pitch such as 4 mms per turn. The outer

screw **38** is at its outwardly facing end formed with a gear ring **60**, which cooperates with an inner gear ring **62** formed on an annular member **64** which is disposed around the circumference of the stand **10** inside a space which widens to recesses **66** at the individual pairs of screws. The annular member **64** is externally mounted in a bearing ring, such as a strip **65** of Teflon (R) or some other material having a low friction coefficient. A number of pairs of screws **38, 48,** such as six such pairs, are uniformly spaced about the circumference (see FIG. **3**) and the outer screw of each pair is in gear connection with the common annular member **64** which is turned by means of a gear **74.** Thus the stator ring **30** when being adjusted to its axial position will be actuated simultaneously by a plurality of screws **48,** such as six screws in the illustrated embodiment.

The inner screw **48** has a non-circular, such as hexagonal, outer end portion **68** which fits into a non-circular, such as 12-sided, aperture formed in a plate **72** rigidly attached to the stand **10.** Thus the screw **48** cannot be rotated but only be displaced axially.

Pressure oil from a pressure source not shown is supplied to the threads of each pair of screws through a conduit **76,** which opens into channels **78, 80** formed in the sleeve **44** and the outer screw **38,** respectively. Said screw **38** is also formed with an axial channel **82** for equalization of the pressure in the closed chamber **84** within the sleeve **44,** when the screw **38** moves axially and thus changes the volume of said chamber. The chamber **84** is sealed against the surrounding parts by means of sealing rings **86, 88** in addition to the sealing ring **58.**

A pressure fluid such as a liquid, preferably water, is supplied from a pressure source not shown through a pipe **90** to a space **92** located at the rear side of the stator ring **30.** The stator ring **30** is mounted on the outer stator ring **28** by means of a bearing ring **94** and inwardly on a flange **96** formed on the casing **10** by means of a bearing ring **98.** These bearing rings may consist of strips of material having a low friction coefficient, such as Teflon (R) which render the axial displacement of the stator ring **30** more easy. A sealing ring **100** may be provided in addition between the stator rings **28** and **30.** By supplying pressure fluid to the space **92** an increased pressure is created therein which is controllable by means of a pressure controller **102** provided in a discharge outlet.

The device operates in the following manner. During operation of the grinding apparatus the grinding produce such as the chips or the fibre pulp is introduced by the conveyor **24** into the space between the two grinding discs within which it is carried radially outwardly, while being disintegrated into fibers or fibriles, respectively. In this operation, the rotating grinding disc **14** is subjected to a strong axial pressure in a direction towards the stationary grinding disc, as will become evident from e.g. the patent specifications referred to above. The pressure acting on the inner stationary stator ring **30** may amount to many tens of tons. According to the invention an axial adjustment of the stator ring or disc **30** can now be effected during operation in response to the desired grinding conditions or for compensation of the wear on the disc elements **34, 36** or **18, 22,** respectively, by means of the pairs of screws **38, 48.** These pairs of screws are actuated together by means of the gear ring **64,** whereby the screw **38** is turned and at the same time displaced axially over a distance for each annular part turn or rotation which corresponds to the pitch of the threads **40, 42.** The inner screw **48** is actuated also by said turning movement, but as it cannot rotate, it will be displaced axially only. As the threads are directed in the same direction, and the pitch of the one pair of threads, in the embodiment shown, the pitch of the threads **50, 52** is greater than that of the threads **40, 42,** the turning of the outer screws **38** will result in an axial displacement of the inner screw **48** over a distance corresponding to the difference in the pitches of the threads. In this way a fine and correct adjustment of the stator ring **30** is rendered possible while at the same time the threads which transfer the axial pressure from the stator disc **30** to the casing **10** may have high structural strength so as to eliminate any appreciable deformation. It may be pointed out that the adjustment of the grinding surfaces of the grinding discs relative one another must be effected with an exactness of a hundredth of 1 millimeter, for which reason it is essential that non-controllable deformation shall be avoided of those parts which transfer the axial pressure. The threads between the screws or between one of them at the stationary sleeve **44** are lubricated by means of pressure oil supplied from the conduit **76.**

In order to relieve the pairs of screws **38, 48** as much as possible from the high grinding pressure during the adjustment of the stator ring **30,** it is advantageous to introduce pressure fluid through the conduit **90** into the space **92.** Due to the relatively great surface of the stator disc **30,** this pressure fluid need not exert any particularly high pressure to obtain compensation so that the threads during the adjustment operation are relieved entirely or at least to a major extent from the grinding pressure. Also during normal operation of the grinding apparatus a minor overpressure should be maintained in the space **92** to avoid water intermixed with fibres from leaking out from the grinding disc to the screw **38, 48.**

While one more or less specific embodiment of the invention has been shown and described, it is to be understood that this is for purpose of illustration only, and that the invention is not to be limited thereby, but its scope is to be determined by the appended claims.

What is claimed is:

1. A grinding apparatus with grinding discs housed in a casing of which discs at least one is rotatable and which discs between themselves form a grinding space for the grinding produce consisting of vegetable or similar material, characterized in that one of the grinding discs is adjustable by means of two screws disposed concentrically relatively one another and having threads cooperating with one another, that in addition the outer screw and a part carrying said grinding disc have threads cooperating with one another, that the two pairs of threads are threaded in the same direction but with different pitches and that one of the screws is rotationally stationary.

2. The grinding apparatus as claimed in claim **1,** characterized in that a plurality of concentrically disposed screws are distributed about the circumference of the grinding disc and that the outer screw in each pair is adapted to be turned by a common actuating member.

3. The grinding apparatus of claim **2,** characterized in that the common actuating member is a geared ring.

4. The grinding apparatus as claimed in claim 1, characterized in that said inner screw is devised loosely to bear against the grinding disc, but to be locked in relation to the grinding disc by means of a locking member located within the inner screw and actuatable from outside.

5. The grinding apparatus as claimed in claim 1, characterized in that the threads formed between the outer of the two concentrically disposed screws and the stationary part have a smaller pitch than the threads existing between the screws.

6. The grinding apparatus as claimed in claim 1, characterized in that the two pairs of threads are right-threaded.

7. The grinding apparatus as claimed in claim 2, characterized in that the outer screws in each pair of screws have a gearing ring which cooperates with said geared ring and at the same time is actuated by said geared ring.

8. The grinding apparatus as claimed in claim 1, characterized in that disposed behind the adjustable grinding disc is a closed space which is connectable to a pressure source for a pressure fluid.

9. The grinding apparatus as claimed in claim 8, characterized in that arranged in a pressure fluid conduit connected to the space is a pressure controller for determining the magnitude of the relieve pressure acting on the grinding disc.

10. A grinding apparatus with grinding discs housed in a casing in which discs at least one is rotatable and which discs between themselves form a grinding space for the grinding produce consisting of vegetable or similar material, at least one grinding disc being formed with two concentrical annular elements, characterized in that one of said annular elements is adjustable by means of two screws disposed concentrically relatively one another and having threads cooperating with one another, that in addition the outer screw and a part carrying said annular element have threads cooperating with one another, that the two pairs of threads are threaded in the same direction but with different pitches and that one of the screws is rotationally stationary.

11. The grinding apparatus as claimed in claim 10, characterized in that the adjustable annular element is the radially inner one.

12. The grinding apparatus as claimed in claim 10, characterized in that a plurality of concentrically disposed screws are distributed about the circumference of the annular element and that the outer screw in each pair is adapted to be turned by a common actuating member.

13. The grinding apparatus as claimed in claim 12, characterized in that the common actuating member is a geared ring.

14. The grinding apparatus as claimed in claim 10, characterized in that the inner screw is devised loosely to bear against the annular element, but to be locked in relation to said annular element by means of a locking member located within the inner screw and actuatable from outside.

15. The grinding apparatus as claimed in claim 1, characterized in that the threads formed between the outer of the two concentrically disposed screws and the stationary part have a minor pitch than the threads existing between the screws.

16. The grinding apparatus as claimed in claim 1, characterized in that the two pairs of threads are right-threaded.

17. The grinding apparatus as claimed in claim 12, characterized in that the outer screws in each pair of screws have a gearing ring which cooperates with said geared ring and at the same time is actuated by said geared ring.

18. The grinding apparatus as claimed in claim 1, characterized in that disposed behind the adjustable annular element is a closed space which is connectable to a pressure source for a pressure fluid.

19. The grinding apparatus as claimed in claim 18, characterized in that arranged in a pressure fluid conduit connected to the space is a pressure controller for determining the magnitude of the relieve pressure acting on the annular element.

20. A grinding apparatus having a pair of grinding discs forming between them a grinding space for the material to be ground of which discs at least one is rotatable, and at least one of which discs is provided with two concentrical annular elements, characterized in that one of said annular elements is adjustable by screw means including interengaging threads, a closed space being disposed behind said adjustable annular element, said space being connectable to a pressure source for a pressure fluid, so as to relieve said threads from the grinding pressure between the grinding discs during the adjustment of the annular elements.

21. A grinding apparatus having a pair of grinding discs forming between them a grinding space for the material to be ground of which discs at least one is rotatable, and at least one of which discs is provided with two concentrical annular elements, characterized in that one of said annular elements is adustable by means including two concentrical interengaging screws, the outer surrounding screw also having threads engaging a screw threaded part of the casing carrying said annular element, and a closed space behind said annular element which is adapted to be connected to a source for supplying fluid under pressure whereby to release said threads from the grinding pressure between the grinding discs during adjustment of the annular element.

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