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Kahmann

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[54] **GRINDING APPARATUS FOR FIBROUS MATERIAL**

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[52] **U.S. Cl.** **241/37,** 241/245, 241/259.2

[51] **Int. Cl.** **B02c 7/14**

[58] **Field of Search** 241/37, 244, 245, 259.1, 241/259.2, 259.3

[56] **References Cited**

UNITED STATES PATENTS

2,930,534	3/1960	Baxter	241/259.1 X
2,947,485	8/1960	Woodruff	241/259.2 X
2,971,704	2/1961	Johansson	241/259.1 X
3,158,333	11/1964	Asplund et al.	241/244
3,212,721	10/1965	Asplund et al.	241/37
3,717,308	2/1973	Reinhall	241/244

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[57] **ABSTRACT**

Grinding device, more especially a disc refiner for the paper industry; a rotor and a stator arranged in a housing; the stator guided radially but non-rotatably relatively to the housing and displaceable axially relatively to the rotor; a hydraulic servomotor provided for the displacement of the stator; on the servomotor an adjustable device for limiting the displacement of the stator in the direction to the rotor; the pressure chamber of the servomotor which is intended for moving the stator away from the rotor is provided with an axially displaceable abutment piston; means are provided for adjusting and keeping constant a required position of the abutment piston; the position of the abutment piston limits the displacement of the main piston of the servomotor and in that way the displacement of the stator.

7 Claims, 5 Drawing Figures

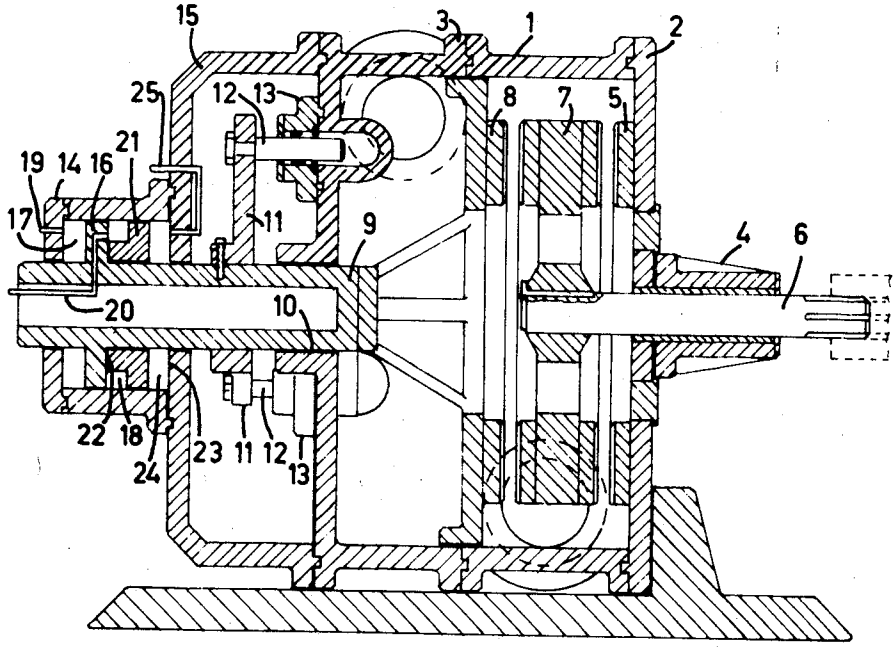

Fig. 1

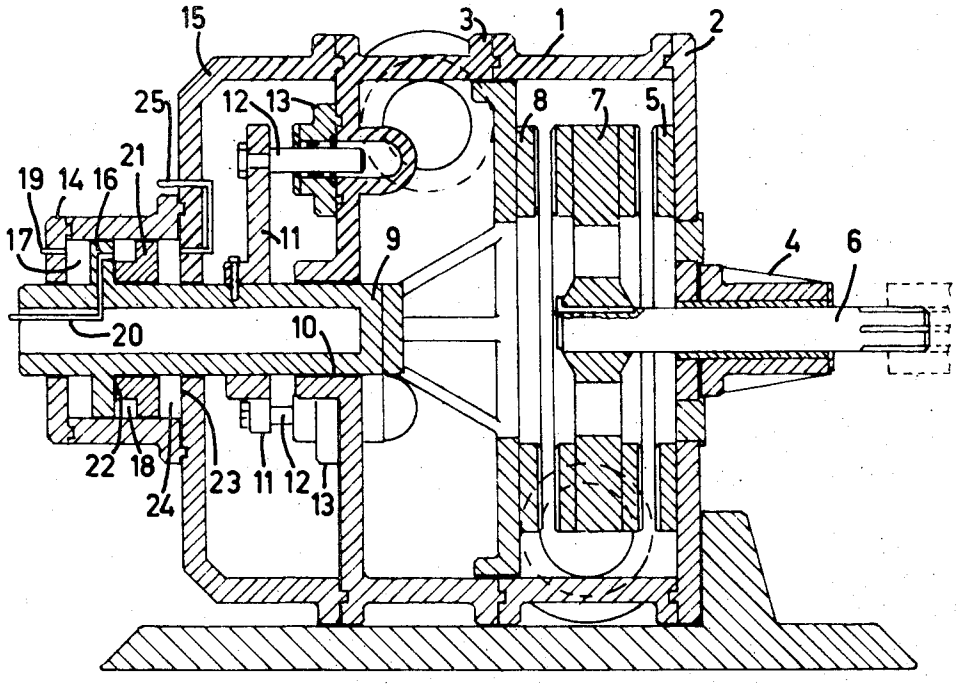

Fig. 2

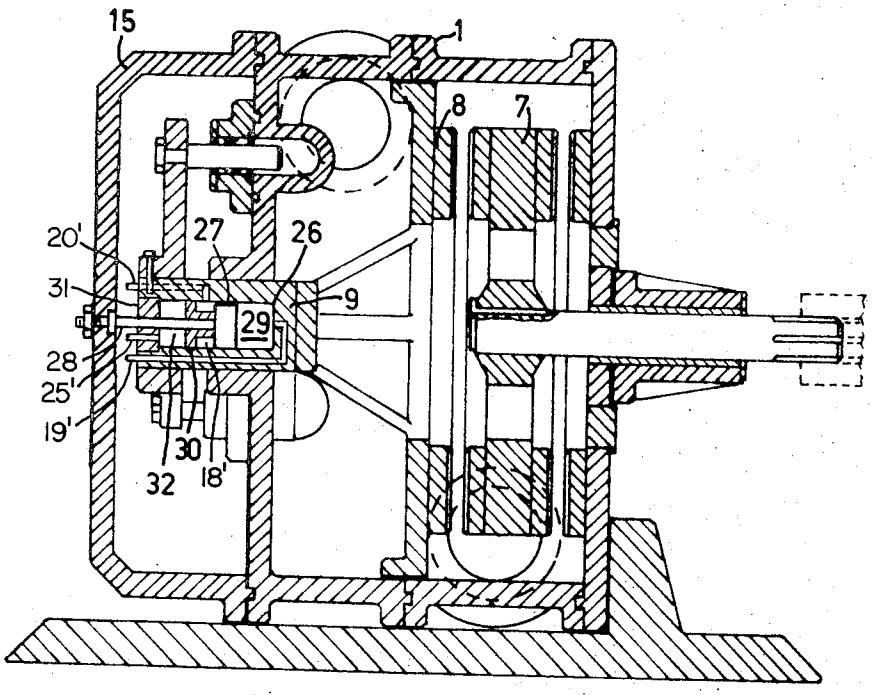

Fig.3

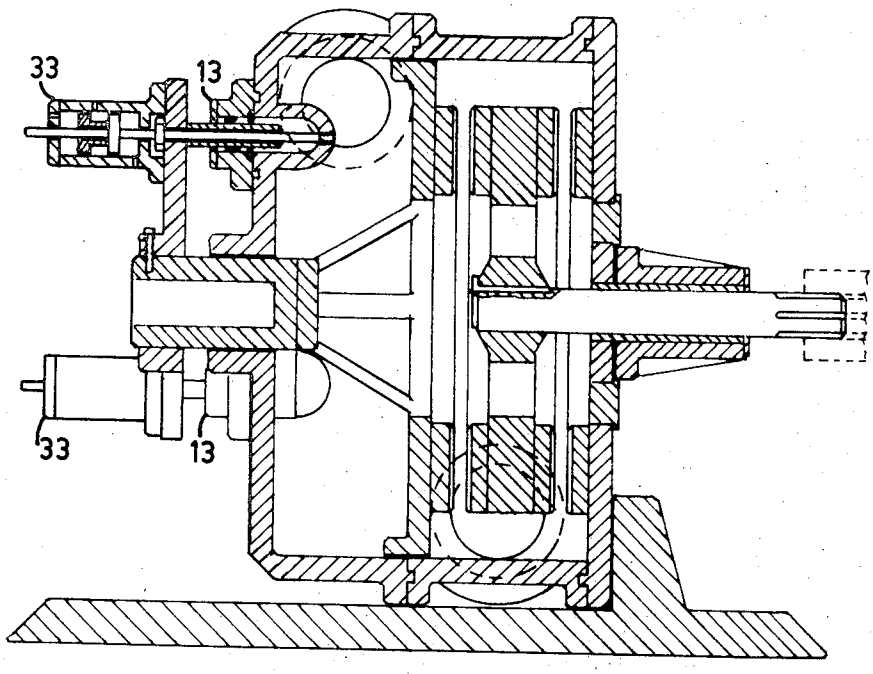

Fig. 4

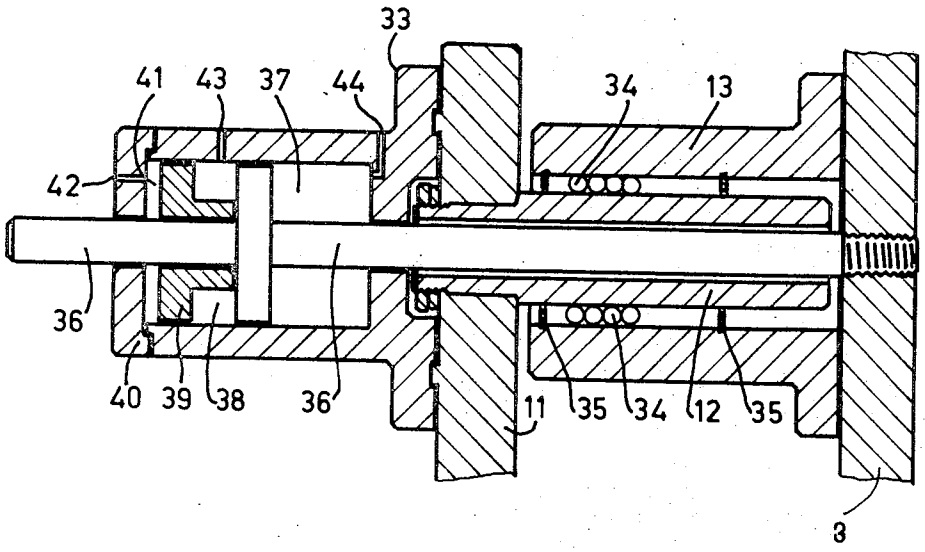
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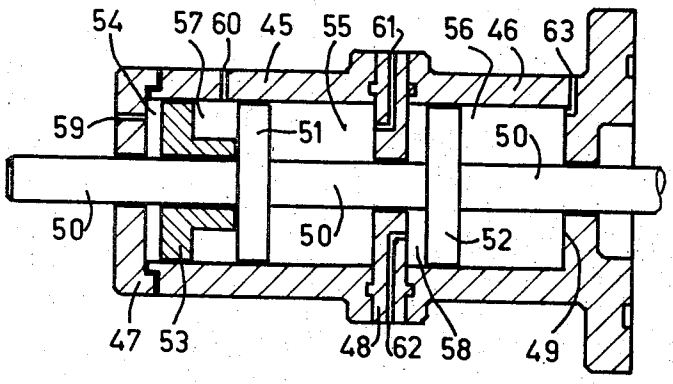
Fig. 5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GRINDING APPARATUS FOR FIBROUS MATERIAL

BACKGROUND OF THE INVENTION

The invention relates to a grinding device, more especially a disc refiner for the paper industry, which grinding device comprises a housing, in the housing a rotor and a stator which is guided radially but non-rotatably in guideways relatively to the housing and is displaceable axially relatively to the rotor, a servomotor being provided for the displacement of the stator, which motor is connected on one side to the housing and on the other side to the stator and comprises a main piston displaceable hydraulically backwards and forwards between a first and a second pressure chamber of a cylinder, an adjustable arrangement being provided for limiting the movement of the stator in the direction towards the rotor to a desired working position.

Such grinding devices are used in the paper industry for preparing the stock to be processed in a paper machine. The pressures which are to be applied by the servomotors for the mutual adjustment and holding of the two grinding members, the stator relatively to the rotor, are very high. As a consequence, the adjustable devices for limiting the displacement of the stator to the actually required working position are quickly damaged, since they have hitherto been constructed as screws with accurate and fine threads. It is then necessary as a consequence to stop the grinding device.

Hence, with one known hydraulic servomotor, the working position of the stator is adjustable by means of a setting screw which forms a stop. With another servomotor, the cylinder can be displaced axially by screws. Yet again, with another device, the overall length of the connecting parts between the servomotor and the stator can be altered by screws.

SUMMARY OF THE INVENTION

The invention has for its object to achieve a disruption-free operation and a longer effective life of the grinding device, also at high pressures.

According to the invention, this object is achieved by the fact that the second pressure chamber of the servomotor designed for displacing the stator away from the rotor is provided with an axially displaceable abutment piston, of which the side facing the main piston comprises an abutment surface and of which the other side in association with that end wall of the cylinder which is opposite to it, defines a sealed third pressure chamber in the said cylinder, means being provided for filling the third pressure chamber with a liquid and for maintaining the introduced quantity of the liquid in the pressure chamber.

BRIEF DESCRIPTION OF THE DRAWING

Embodiments of the invention are hereinafter more fully described by reference to the accompanying drawings, wherein:

FIG. 1 is a longitudinal section through a grinding device,

FIG. 2 is a longitudinal section through another embodiment,

FIG. 3 is a longitudinal section through yet another embodiment,

FIG. 4 is a longitudinal section of a servomotor to a larger scale,

FIG. 5 is a longitudinal section to a larger scale of another servomotor.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The grinding device which is illustrated is a tandem-disc refiner. The device comprises a housing **1** having a first end cover **2** and a second end cover **3**. A bearing block **4** and a stator disc **5** are fixed on the first end cover **2**. A shaft **6** is mounted to be longitudinally displaceable relatively to the housing **1** in the bearing block **2** and this shaft is sealed off. At one end, the shaft **6** is connected so as to be longitudinally displaceable to a driving motor (not shown), while it carries at its other end a rotor **7**. A second stator **8** is axially displaceable in the housing **1** relatively to the rotor **7**. The stator **8** is connected to a cylindrical part **9** which is coaxial with the grinding device and which extends outwardly through a central opening **10** in the second end cover **3** of the housing **1**. The part **9** is guided by means of arms **11** and bolts **12** on guideways **13**, whereby the radial but non-rotatable guiding of the stator **8** in relation to the housing **1** is assured. Provided for the displacement of the stator **8** is a hydraulic servomotor **14**, which is connected on one side by means of a cover **15** to the housing **1** and on the other side by means of the part **9** to the stator **8**. The part **9** is connected fast to a main piston **16** of the servomotor **14** and forms the piston rod of the said motor **14**. The main piston **16** is displaceable backwards and forwards hydraulically between a first and a second pressure chamber of a cylinder of the servomotor **14**. The first of the pressure chambers, i.e. the chamber indicated at **17**, is intended for the relative movement of the stator **8** towards the rotor **7**, while the second chamber indicated at **18** is intended for moving the stator **8** away from the rotor **7**.

Pipes **19** and **20** are provided for respectively filling the pressure chambers **17** and **18** with a liquid and emptying the liquid therefrom. The pressure chamber **18** of the servomotor **14** which is intended to displace the stator **8** in a direction away from the rotor **7** is provided with an axially displaceable abutment piston **21**, of which the side facing the main piston **16** comprises an abutment surface **22**, and of which the other side, in conjunction with that end wall **23** of the cylinder of the servomotor **14** which is facing the said other side of the abutment piston **21**, defines a sealed-off third pressure chamber **24** in the cylinder. Means (not shown) are provided by which a liquid is able to fill the third pressure chamber **24** through the pipe **25** and for maintaining the introduced quantity of the liquid in the third pressure chamber **24**.

In the drawing, the third pressure chamber **24** is filled with liquid and the quantity of the liquid which is introduced is maintained therein. A liquid is guided into the first pressure chamber **17** through the pipe **19**. The main piston **16** is moved up into the bearing position and against the abutment surface **22** of the abutment piston **21**. The movement of the stator **8** in the direction towards the rotor **7** is limited to a required working position by the abutment of **21** and **22**. If the stator is to be adjusted to another working position, it is necessary for the quantity of the liquid filling the third pressure chamber **24** to be altered, i.e. more liquid must be

introduced or liquid released and the actual quantity in the pressure chamber **24** must then again be maintained.

The hydraulic actuating arrangement (not shown) associated with the pipes **19, 20** and **25** is later explained.

As regards the grinding device according to FIG. **2**, the cylinder of the servomotor in the part **9** is constructed as a cavity **26** which is coaxial with the part **9**. A main piston **27** is fixed on a piston rod **28**, which is connected by means of a cover **15** to the housing **1**. That first pressure chamber of the servomotor which serves for moving the stator **8** in the direction towards the rotor **7** is indicated at **29**, and the second pressure chamber, which effects reverse movement of stator **8**, is indicated at **18'**. A third pressure chamber between an abutment piston **30** and an end wall **31** of the cylinder is indicated at **32** and, like the third pressure chamber **24** in FIG. **1**, serves to limit the forward displacement of the stator **8** in the direction towards the rotor **7** to the required working position. The fluid transfer passages for the three chambers of the servomotor are shown at **19'**, **20'** and **25'**.

With the grinding device according to FIG. **3**, three servomotors **33** according to the invention are arranged on the guideways **13**. More than three guideways can also be formed on the grinding device, for example, six such guideways, but only some of them, for example three, can be provided with servomotors. The motors are hydraulically connected in parallel.

A servomotor **33** on the one guideway **13** of FIG. **3** is shown in greater detail in FIG. **4**. The guideway **13** is fixed on the end cover **3** of the housing of the grinding device. The bolt **12** is fixed on the arm **11**. **34** represents balls and **35** represents Seeger rings of a displaceable mounting of the bolt **12** in the guideway **13**. On that side of the arm **11** remote from the guideway **13**, the servomotor **33** is flanged coaxially of the guideway **13**. A piston rod **36** extends from the servomotor **33** through the bolt **12**, without contacting the latter, as far as the end cover **3**, on which it is fixed. The first pressure chamber **37** is intended for the movement of the displaceable stator towards the rotor and the pressure chamber **38** defined in the second pressure chamber between the main piston and the abutment piston **39** for the movement of said stator away from the rotor.

Situated between the abutment piston **39** and the end wall **40** is the third pressure chamber **41** for limiting the advance of the stator up to the required working position. **42, 43** and **44** are openings or connections for pipes of a hydraulic operating installation.

A double motor according to the invention is shown in FIG. **5**. It is possible to visualise this motor, for example, in place of the servomotor **33** in FIG. **4**. Its two cylinders **45** and **46** are defined by end walls **47, 48** and **48, 49**, respectively. Fixed on a piston rod **50** are two main pistons **51** and **52**. One second pressure chamber **57** of the servomotor, i.e. the chamber of the cylinder **45**, is provided with a displaceable abutment piston **53**, between which and the end wall **47** is defined a third pressure chamber **54**. As with the servomotors already described, this third chamber **54** serves to limit the advancing of the displaceable stator up to the required working position. First pressure chambers **55** and **56** serve for the advance of the stator and the pressure chamber **57** defined in the second pressure chamber between the main piston **51** and the abutment piston **53** and the second pressure chamber **58** serve for the rearward displacement of the stator **9** relatively to the rotor. Indicated at **59, 60, 61, 62** and **63** are openings or connections for pipes of a hydraulic operating installation (not shown).

The not shown operating installation associated with the grinding device and the servomotor consists of known separate elements. The purposes of the operating installation are explained by the example shown in FIG. **1**.

The operating installation ensures:

a. The forcing of the main piston **16** by means of pressure in the first pressure chamber **17** into the bearing position against the abutment surface **22** of the abutment piston **21**. The pressure chamber **18** defined in the second pressure chamber between the main piston **16** and the abutment piston **21** is at this time relieved of pressure.

b. A rapid movement of the main piston **16** away from the bearing surface **22** by means of a quickly rising pressure in the pressure chamber **18**. At this time, the first pressure chamber **17** is relieved of pressure and the abutment piston **21** remains in its position. The rapid retraction (i.e. the quick relieving of the grinding device) occurs in the event of a sudden overloading of the driving motor, as for example when a foreign body penetrates into one of the gaps between the stator **5** or **8** and the rotor **7**. When the overload on the driving motor subsides, as a consequence of the resultant relieving of the grinding device, the main piston **16** is once again pushed back and applied with pressure in the bearing position against the stop surface **22**. The driving motor is then once again under a load such as corresponds to the position of the abutment piston **21**.

c. The adjusting and keeping constant the position, i.e. the spacing of the piston **21** from the wall **23**. For this purpose, a quantity of the liquid is introduced into the third pressure chamber **24** and the loaded value of the pressure chamber **24** is kept constant. It is not only a locking of the introduced quantity in this third pressure chamber **24** which is sufficient for this purpose. For example, if the introduced quantity, under the pressure of the main piston **16** on the abutment piston **21**, flows away into the pressure chamber **18** because of a leakage at the said piston **21**, the size of the pressure chamber **24** is reduced, that is to say, the distance of the abutment piston **21** from the wall **23** becomes smaller. The initially filled value of the pressure chamber **24** must therefore, in such a case, be produced again by replenishment of the liquid into the third pressure chamber **24**.

d. The altering of the position of the abutment piston **21**. For this purpose, more liquid is supplied into the third pressure chamber **24** and the first pressure chamber **17** is relieved of pressure, or liquid is released from the third pressure chamber **24** while the first pressure chamber **17** is under pressure load. The alteration is effected in dependence on an overloading or underloading of the driving motor of the grinding device, which lasts for a relatively long time.

I claim:

1. In a grinding device of the type including a housing containing a stator disc which is guided for axial movement toward and away from a cooperating rotor disc with which it defines a grinding gap, and a double-acting hydraulic servomotor for shifting the stator disc

and including a cylinder element containing a piston element which divides the cylinder element into a pair of opposed working spaces, one of said elements being connected with the stator disc, the other element being connected with the housing, and the servomotor being effective to shift the stator disc so as to decrease the width of said gap under the action of pressure in the first working space and to increase the width of said gap under the action of pressure in the second working space, the improvement comprising a reciprocable stop piston located in the cylinder element and defining therewith a sealed control chamber, the stop piston having one end surface which faces the second working space and is arranged to abut the servomotor piston element, and an opposite end surface which faces the control chamber; and transfer passage means through which liquid is introduced into and withdrawn from the control chamber.

2. A grinding device as defined in claim 1 in which said one element of the servomotor is connected with the stator disc through a cylindrical part which is coaxial with both the stator disc and the housing and projects from the housing through a central opening in a wall thereof.

3. A grinding device as defined in claim 2 in which the servomotor is coaxial with said cylindrical part; the piston element is connected with the cylindrical part; and the cylinder element is connected with the housing.

4. A grinding device as defined in claim 2 in which the servomotor is coaxial with said cylindrical part; the piston element is connected with the housing; and the cylinder element is connected with the cylindrical part.

5. A grinding device as defined in claim 2 which includes a plurality of said servomotors arranged parallel with and spaced around the axis of the cylindrical part, each servomotor being provided with said stop piston, control chamber and transfer passage means, and said one element of each servomotor being connected with the cylindrical part.

6. A grinding device as defined in claim 5 including a set of means for guiding the stator disc for said axial movement, each means of the set being coaxial with one of the servomotors and comprising a stationary member connected with the housing and cooperating moveable member which is connected with the cylindrical part through a common connection which also serves to join that part to said one element of the associated servomotor.

7. A grinding device as defined in claim 6 in which the piston elements of the servomotors are connected with the housing and the cylinder elements are connected with the cylindrical part.

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