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Koppenwallner

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[54] **CONTROL DEVICE FOR A GRINDING MACHINE**

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[51] **Int. Cl.** **B24b 49/00,** B24b 55/02

[58] **Field of Search** ..... 51/165.87, 165.89, 51/356; 125/11 R, 11 NT

[56] **References Cited**

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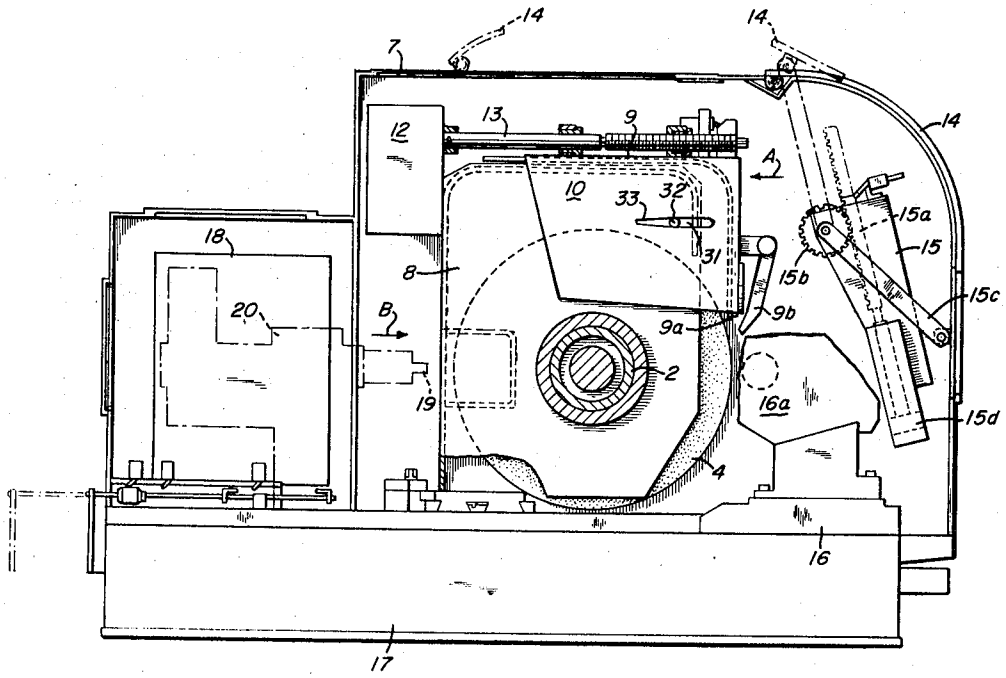
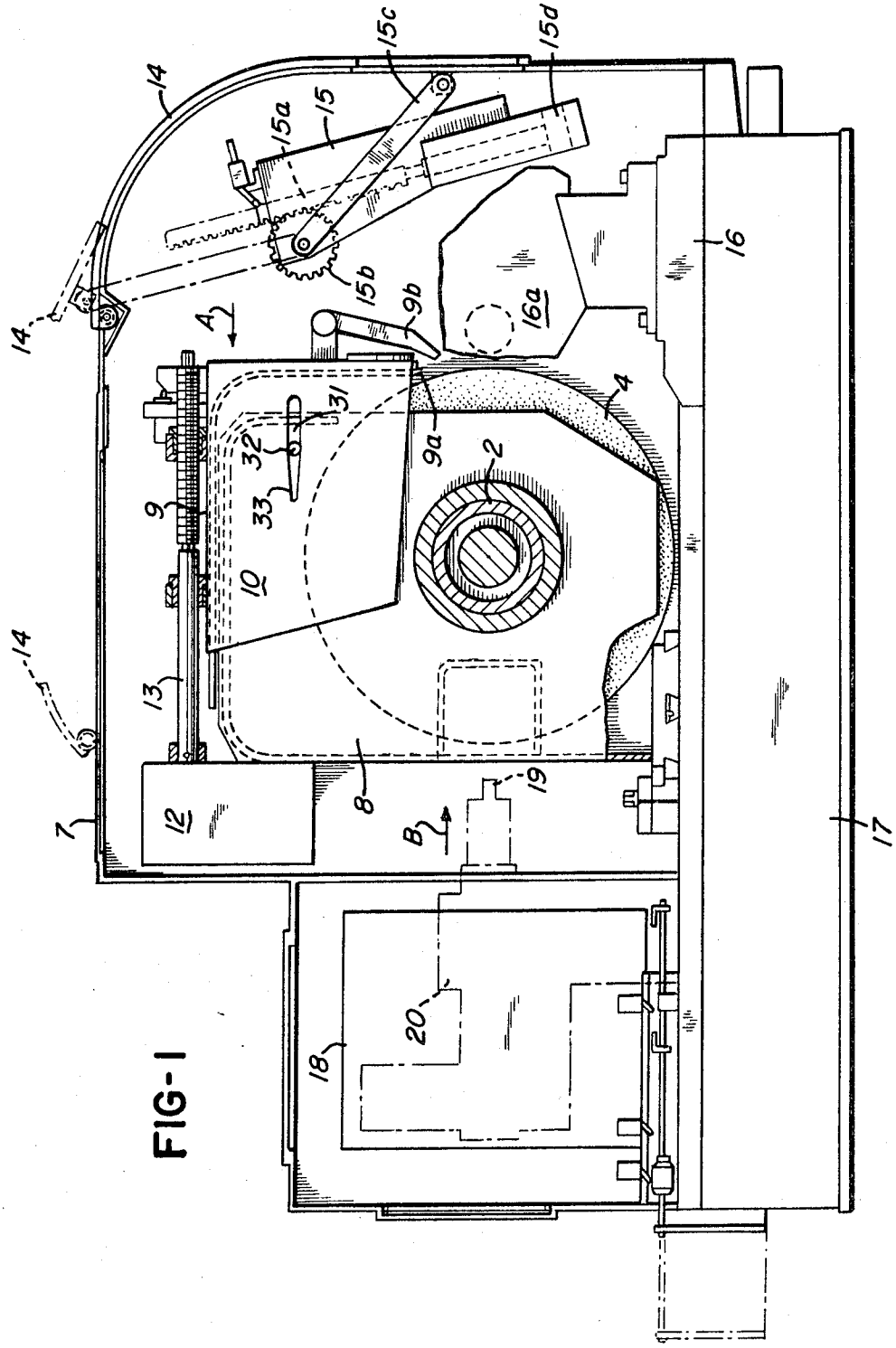
[57] **ABSTRACT**

A grinding machine having a grinding disc with a hood. A dressing device is associated with the disc and the hood has a moveable part with a coolant nozzle thereon which supplies coolant to the working region of the disc. Drives are provided to move the dressing device toward and away from the wheel and to adjust the position of the part of the hood and the coolant nozzle and are so interconnected that the coolant nozzle is adjusted in position each time the dressing device dresses the disc whereby the coolant is always directed to the proper region.

15 Claims, 3 Drawing Figures

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9b
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FIG-1

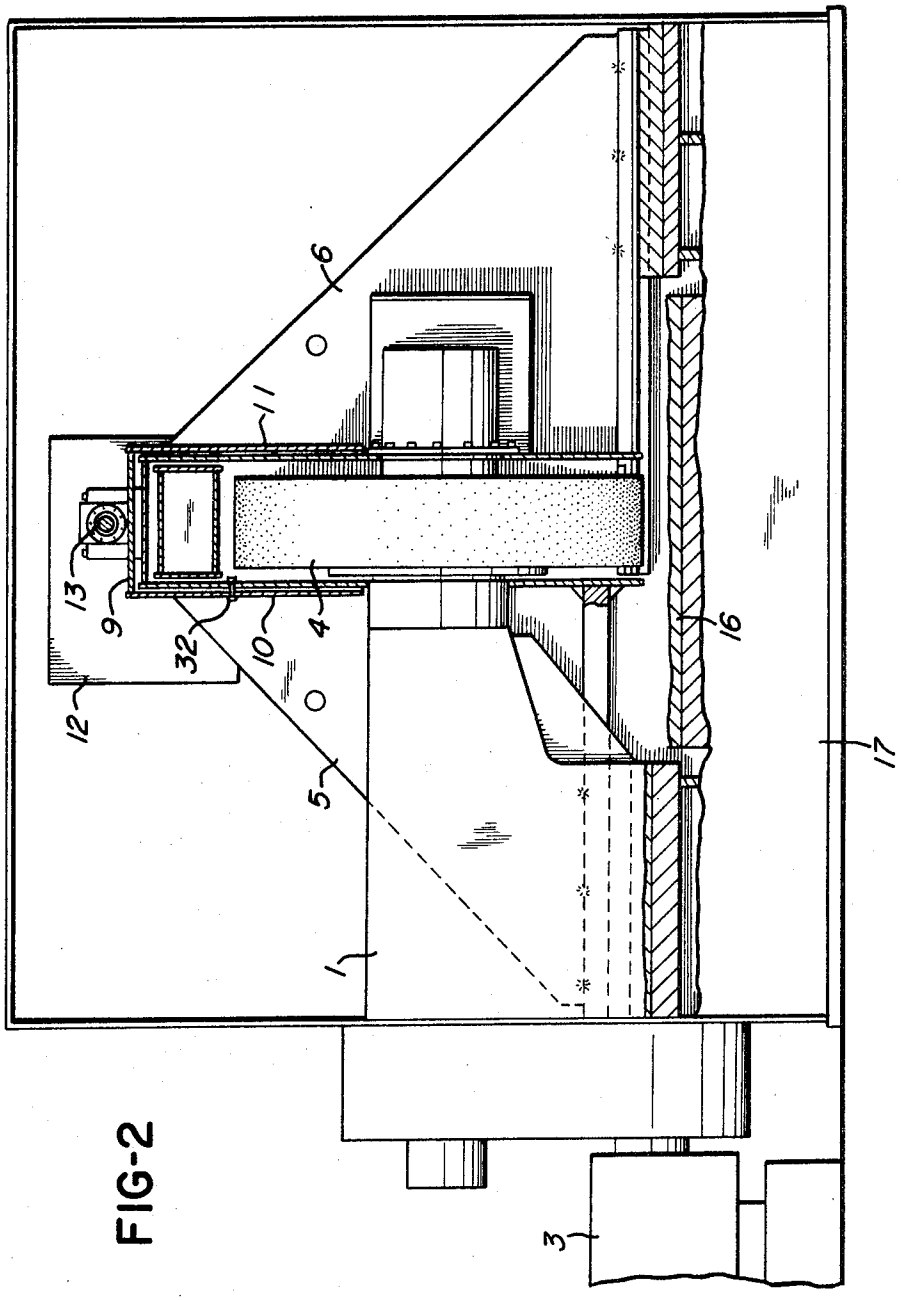
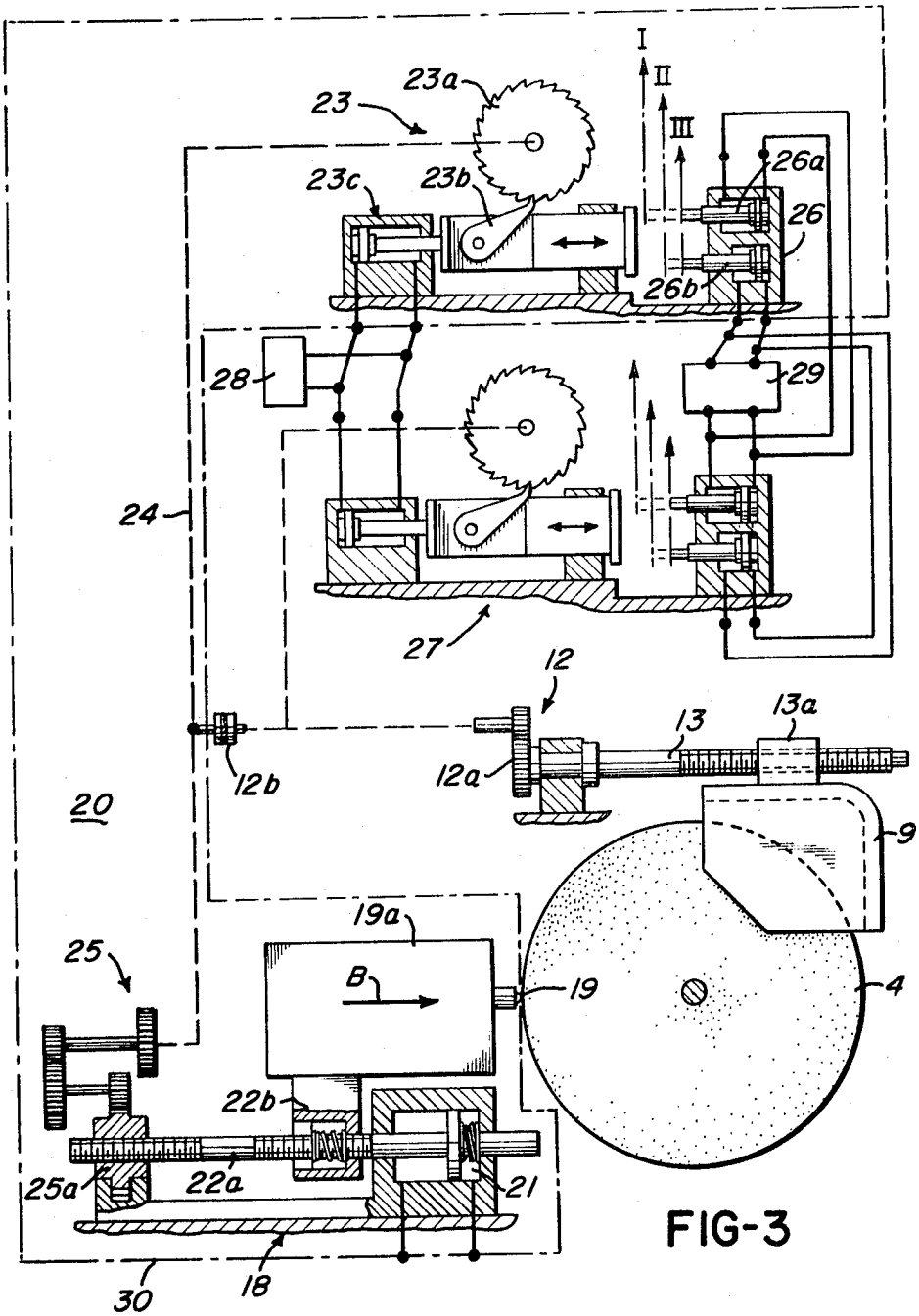


FIG-2


I
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III
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23b
23c
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26a
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19a
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22a
22b
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FIG-3

CONTROL DEVICE FOR A GRINDING MACHINE

The present invention relates to a control device for a grinding machine and, more specifically, for the feeding device of a dressing apparatus. Devices of this type, for instance, with dressing diamonds, diamond rolls, or steel rolls, are generally employed in grinding machines for restoring the sharpness and true shape of the grinding disc. The feeding of the dressing tool is with the individual post-machining operations respectively effected by relatively small amounts, but taking into consideration the life span of a grinding disc, correspondingly long total feeding strokes result in view of the generally high volume of wear.

Aside from the dressing apparatus, the grinding machines are equipped with various machine elements which have to be adjusted in conformity with the diameter of the grinding disc. In this connection there may be mentioned so-called cover elements, such as caps, slides, or the like, which are arranged within the region of the grinding disc and which are journalled on the protective hood for the grinding disc and are supposed always to maintain as slight a distance as possible from the circumference of the grinding disc. In this connection there may also be mentioned the customary feeding means for the coolant which likewise must have a predetermined distance from the circumference of the grinding disc. The post-setting of the above mentioned machine elements requires considerable service and sometimes even requires a stoppage of the operation while in addition thereto the operator has to pay considerable attention to these machine elements. Therefore, it would be desirable to have the adjustment of machine elements of the above mentioned type effected automatically in conformity with the respective diameter of the grinding disc.

Consequently, it is an object of the present invention to provide a control device which, while relatively simple in construction, will automatically adjust machine elements in conformity with the diameter of the grinding disc.

This object and other objects and advantages of the invention will appear more clearly from the following specifications in connection with the accompanying drawings, in which:

FIG. 1 diagrammatically illustrates a vertical section perpendicular to the grinding spindle axis through a circular grinding machine with a dressing device and with adjustable protective hood cap according to the invention.

FIG. 2 diagrammatically illustrates a section through the machine of FIG. 1 along a vertical plane.

FIG. 3 is a control and operating diagram of the control device according to the invention for adjusting a dressing device and a protective hood cap according to FIG. 1 and 2.

The control device according to the invention for the feeding device of a dressing apparatus is characterized primarily in that the feeding device is with regard to its movement relative to the grinding device coupled to the adjusting device of a machine element, especially a hood and/or a coolant supply means, in conformity with the diameter of the grinding disc.

In other words, the invention takes advantage of the high precision of the already present control device for feeding the dressing means for adjusting other machine parts or elements in conformity with the diameter of the grinding disc. The required additional structural elements are relatively few because, aside from the adjusting device necessary at any rate in connection with automation with pertaining drive of the adjustable machine element, only a coupling or synchronization of the dressing-feeding device on one hand and the adjusting device of the adjustable machine element on the other hand are additionally required.

Referring now to the drawings in detail and FIGS. 1 and 2 thereof in particular, the cylindrical grinding machine illustrated therein comprises a head stock 1 which is fixedly arranged on the machine bed 17 and has a grinding spindle 2 inserted therein. Spindle 2 is coupled to a driving unit 3 and carries a grinding disc 4. The grinding disc 4 is arranged within a protective hood 8 which by means of supporting flanges 5 and 6 is connected to the machine bed 17. Those parts of the protective hood 8 which are connected to the two supporting flanges 5 and 6 are adapted in the axial direction of the grinding spindle to be separated from each other so that the supporting flange 6 after having been disconnected from the machine can be displaced in the right-hand direction with regard to FIG. 2 for purposes of exchanging the grinding disc. The outer machine cover 7 is at the right-hand operating side (with regard to FIG. 1) provided with an outer hood 14 which is adapted to be moved in upward direction to the position indicated by dot-dash lines. For purposes of opening and closing the hood 8, there is within the machine cover provided a transmission 15 with gear rack 15*a* and with a gear 15*b* which is stationarily journalled with regard to the frame, and with a pivotal arm 15*c* pivotally connected to outer hood 14 and with a driving cylinder 15*d*. As support for the work piece, according to the specific embodiment illustrated, there is provided a carriage 16 with a work piece support 16*a*. The carriage 16 is arranged below the stationary grinding wheel head 1 and is displaceable in a direction transverse to the grinding spindle axis.

As will be seen from FIGS. 1 and 2, a cap 9 is arranged on the protective hood 8 and has its lateral parts 10 and 11 extend around the upper and front section of the protective hood 8. Cap 9 is adapted to be displaced in the direction transverse to the grinding spindle axis as indicated by the arrow A in FIG. 1. The lower front edge 9*a* of cap 9 which is arranged within the region of the working opening of hood 8 on the work piece side should be kept at a predetermined slight distance from the circumference of the grinding disc 4 and, more specifically, in conformity with the decreasing grinding diameter in the direction of the arrow A. When inserting a new or larger grinding disc, cap 9 is returned to its corresponding starting position. On the front side of cap 9 there is within the region of the edge 9*a* provided a feeding device 9*b* for a coolant, the mouth of the cooling device which points downwardly should likewise be kept at a predetermined distance from the circumference of the grinding disc. The feeding device for the coolant will to this end take part in the adjusting movement of cap 9.

A separate adjusting device 12 with a threaded drive in the form of a threaded spindle 13 and a nut 13*a* connected to the cap 9 is provided for the latter. This adjusting device is, in a manner to be described further below, connected to the feeding device 20 of a dressing apparatus 18 which is arranged behind the grinding disc. The dressing tool 19 of the device 18 extends

through a cutout in the rear wall of the protective hood **8** and is adapted to be displaced in the direction of the arrow B (FIG. 1) for engagement with the circumference of the grinding disc.

As diagrammatically illustrated in FIG. 3, the feeding device **20** of the dressing apparatus **18** comprises a fast traverse feeding device **21** in the form of a fluid-operable cylinder piston system, and also comprises a fine adjusting device **22** in the form of a screw drive with threaded spindle **22***a* and nut **22***b* which is connected to the dressing tool carrier **19***a* and is connected to the piston rod of the fluid-operable cylinder piston system **21**. By means of the fast traverse feeding device, the tool carrier **19***a* is, in conformity with arrow B, advanced to a starting position for a dressing operation. This starting position is determined by a non-variable abutment position of the piston in the cylinder piston system **21** and by the respective relative position between spindle **22***a* and nut **22***b*. Inasmuch as the starting position for each dressing operation simultaneously represents the end position of the preceding dressing operation, which end position was reached by a corresponding rotation of the spindle, the fine feeding of the tool carriage **19***a* is effected during the dressing operations following each other always only in the direction of the arrow B and, more specifically, independently of the advance and return strokes of the fast traverse feeding device carried out between the individual dressing operations. For this reason, the fine feeding device also is suited as position indicator for a successive post-guiding of cap **9** in conformity with the decreasing diameter of the grinding disc.

As drive for the fine feeding device, according to the specific showing in the drawings, a pawl ratchet mechanism **3** with ratchet wheel **23***a* and pawl **23***b* as well as with a lifting element in the form of a fluid-operable cylinder piston system **23***c* is provided. The ratchet wheel **23***a* is through the intervention of a diagrammatically indicated drive connection **24** connected to a stepdown transmission **25** which latter comprises a drive wheel **25***a* for the spindle **22***a* of the fine feeding device.

For purposes of limiting the stroke of the pawl **23***b* in conformity with different feeding end positions of the dressing tool **19**, there is provided an adjustable abutment device **26** with two abutments **26***a*, **26***b* respectively adjustable by two fluid-operable cylinders between two positions. By means of these two abutments, it is possible to adjust a total of three different feeding end positions I, II and III of the pawl **13***b*.

The adjusting device **12** of cap **9** is as to its drive synchronous with the fine feeding device of the dressing apparatus. This may be realized, according to the specific showing in FIG. 3, by a direct connection of the spindle **13** through the intervention of a stepdown transmission **12** and a coupling **12***b* with the transmission connection **24** of the fine feeding device **22**. Inversely, as likewise indicated in FIG. 3, for the adjusting device **12** of cap **9** there may be provided a pawl ratchet mechanism **27** which, as assumed in the specific embodiment, may as to all details correspond to the ratchet mechanism **23** of the fine feeding device of the dressing tool so that a further description of the ratchet mechanism **27** does not appear to be necessary.

The synchronization between adjusting device **12** and fine feeding device **22** is in the last mentioned instance effected by a common feeding control device **28** of the fluid-operable cylinder piston systems pertaining to the two ratchet mechanisms **23** and **27**. A corresponding common control circuit **29** is provided for the equal stroke limitation of the pawls.

If the adjusting device **12** has a drive of its own, for instance in the form of a pawl ratchet mechanism **27**, the pawl ratchet mechanism or a corresponding different drive for the fine feeding device may be omitted. In such an instance the coupling **12***b* will take over the synchronization and will also simultaneously effect the drive of the fine feeding device. Such a design has the advantage that only one single driving device for the fine feeding device and for the adjusting device will be necessary and this holds true also for a plurality of exchangeable dressing devices. These dressing devices will in such an instance require primarily only the screw drive of the fine feeding device. The coupling **12***b* is for such exchange of the dressing device expediently designed as plug coupling or another easily detachable design. In certain circumstances, however, it may be necessary and expedient to provide the dressing device with fast traverse and fine feeding means including a pawl ratchet mechanism or the like in the form of exchangeable structural units as has been indicated in FIG. 3 by the dot-dash line **30**. For purposes of exchanging the grinding disc, it is merely necessary to open up the feeding and control connections of the pawl ratchet mechanisms.

In connection with the present invention, particular importance is attached to a safe mounting and guiding of the adjustable cap **9** in case the grinding disc should break. Inasmuch as it is practically impossible to provide such a rigid design of the anchoring of the cap **9** that it will be able to withstand or absorb such high load, an energy consuming anchoring or connection is to be preferred which in case of a break of spindle **13** or of another driving element of the cap **9** will convert into a deforming work the energy of movement of the cap which is thrown forwardly by pieces of the broken grinding disc. To this end, as shown in FIG. 1, the lateral part of cap **9** is provided with a guiding connection having a slot **31** and pin **32**. The pin **32** is connected to the lateral wall of hood **8** which wall is located below pin **32**. Pin **32** supports cap **9** in vertical direction. Within the region of the rear pin position within the slot, which position corresponds to the cap position farthest away from the grinding disc, there is provided a slot support **33** which tapers in a wedge-like manner to less than the diameter of the pin. It is into this slot section **33** that the pin will be pressed successively when cap **9** which is torn loose is thrown toward the front. In this connection a considerable amount of kinetic energy is converted into deforming work and is thus made harmless with regard to possible further damage to the machine.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims. What is claimed is:

1. In a grinding machine having a grinding disc, a dressing device for the grinding disc and an element separate from said dressing device and adjustable in conformity with the diameter of the grinding disc; first means connected to said dressing device for adjustment thereof, second means connected to said element for adjustment thereof, and third means operatively inter-

connecting said first and second means for correlating the adjustments of said dressing device and said element, a hood for the grinding disc respectively a coolant supply nozzle mounted to direct coolant to the working region of the grinding disc, said hood respectively said nozzle comprising said element.

2. In a grinding machine having a disc, a dressing device for the grinding disc and an element separate from said dressing device and adjustable in conformity with the diameter of the grinding disc, said element comprising a hood for the grinding disc and a coolant supply nozzle mounted to direct coolant to a working region of the grinding disc, first means connected to said dressing device for adjustment thereof, second means connected to said element for adjustment thereof, and third means operatively interconnecting said first and second means for correlating the adjustments of said dressing device and said element, said first means comprising a fast traverse feed means and a fine feed means operable sequentially, said third means operatively only connecting said second means to said fine feed means.

3. A grinding machine according to claim 2 in which said fast traverse feed means is in the form of a cylinder-piston system and said fine feed means is in the form of a screw drive system coupled thereto, said cylinder-piston system having fixed end positions, said third means operatively connecting said screw drive system to said second means.

4. In a grinding machine having a grinding disc, a dressing device for the disc and an element separate from said dressing device and adjustable in conformity with the diameter of the disc; first means connected to said dressing device for adjustment thereof, second means connected to said element for adjustment thereof, and third means operatively interconnecting said first and second means for correlating the adjustments of said dressing device and said element, a hood for said disc, said hood having a movable part and a coolant supply nozzle mounted thereon to direct coolant to the working region of the disc, said part and nozzle comprising said element, said second means comprising an adjusting screw threadedly engaging said element, said first means comprising a fast traverse feed means and a fine feed means, and said third means connecting said adjusting screw to said fine feed means.

5. A grinding machine according to claim 4 in which said fast traverse feed means comprises a cylinder and a piston reciprocable therein, a feed screw connected to the piston and a nut on the feed screw connected to the dressing device, said third means operatively interconnecting said feed screw and said adjusting screw.

6. A grinding machine according to claim 5 in which said third means comprises a geared transmission.

7. A grinding machine according to claim 5 which includes a ratchet wheel, a geared transmission connecting said ratchet wheel to said feed screw, a drive pawl for the ratchet wheel, and stroke drive means connected to said pawl for the actuation thereof.

8. A grinding machine according to claim 7 which includes adjustable abutment means operatively associated with said stroke drive means for controlling the stroke thereof thereby to control the fine feeding of said dressing device.

9. A grinding machine according to claim 8 in which said abutment means includes a plurality of abutments at least one of which is selectively moveable between effective and ineffective positions.

10. A grinding machine according to claim 5 which includes a ratchet disc connected to said adjusting screw, drive pawl means for said ratchet wheel, and stroke drive mechanism connected to said pawl means for the actuation thereof.

11. A grinding machine according to claim 10 which an adjustable abutment device operatively associated with said stroke drive mechanism to control the adjustment of said element.

12. A grinding machine according to claim 11 in which said abutment device comprises a plurality of abutment elements at least one of which is selectively moveable between effective and ineffective positions.

13. A grinding machine according to claim 5 which includes a ratchet wheel connected to each of said adjusting screw and feed screw, a drive pawl for each ratchet wheel, a stroke drive means connected to each pawl for the actuation thereof, and means for simultaneously controlling both of said stroke drive means.

14. A grinding machine according to claim 4 in which said dressing device and said fine feed means form a single exchangeable structural unit.

15. In a grinding machine having a grinding disc, a dressing device for the disc and an element separate from said dressing device and adjustable in conformity with the diameter of the disc; first means connected to said dressing device for adjustment thereof, second means connected to said element for adjustment thereof, and third means operatively interconnecting said first and second means for correlating the adjustments of said dressing device and said element, a hood enclosing at least a portion of said disc, said hood having a movable part and a coolant supply nozzle on said part, said movable part and nozzle comprising said element, pin and slot means guidingly connecting said hood and said part thereof, said slot extending in the direction of adjustment of said part and tapering inwardly in the direction in which the pin moves therein as said part moves away from said disc, said slot tapering inwardly to a dimension smaller than the diameter of said pin.

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