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[54] **AUTOMATIC ADJUSTING APPARATUS FOR FRONT COVER OF GRINDING WHEEL GUARD AND COOLANT NOZZLE**

[75] Inventors: **Ichizo Kakumu**, Nagoya-shi; **Teruyuki Ito**, Kariya, both of Japan

[73] Assignee: **Toyoda Koki Kabushiki Kaisha**, Aichi-ken, Japan

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[52] **U.S. Cl.** **51/267**, 51/268

[51] **Int. Cl.** **B24b 55/04**

[58] **Field of Search** 51/268, 269, 267, 51/272, 165.87, 165.88

[56] **References Cited**

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Primary Examiner—Harold D. Whitehead
Assistant Examiner—Nicholas P. Godici
Attorney—Norman F. Oblon, Stanley P. Fisher and C. Irvin McClelland et al.

[57] **ABSTRACT**

A diameter of a grinding wheel is continuously being decreased by dressing operations performed thereon. Depending upon a decrease in the diameter of the grinding wheel, the position of a front cover of a grinding wheel guard and a coolant nozzle therefor, and the angle of the coolant nozzle for spraying are automatically adjusted by a link coupling mechanism pivoted to the front cover and to the coolant nozzle.

5 Claims, 5 Drawing Figures

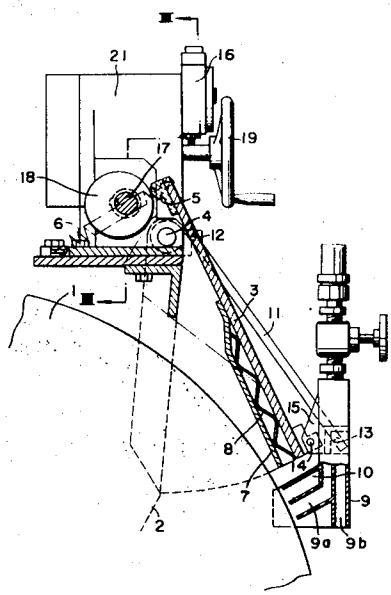

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FIG. 1

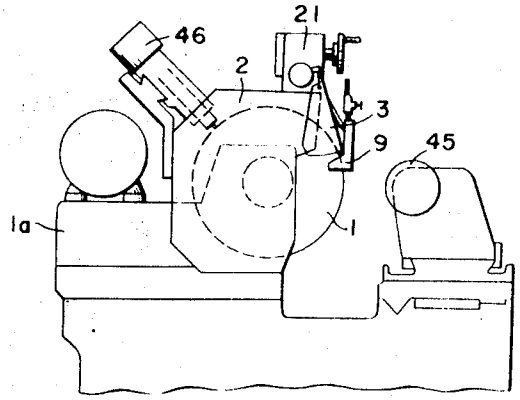
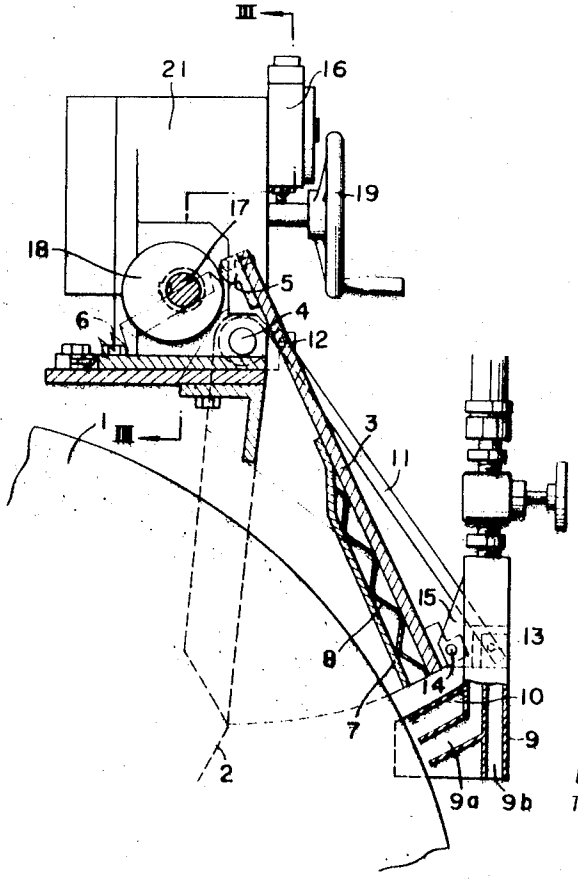


FIG. 2



INVENTORS
ICHIZO KAKUMU
TERUYUKI ITO

BY Olson, Fisher and Spivak
ATTORNEYS

FIG. 3

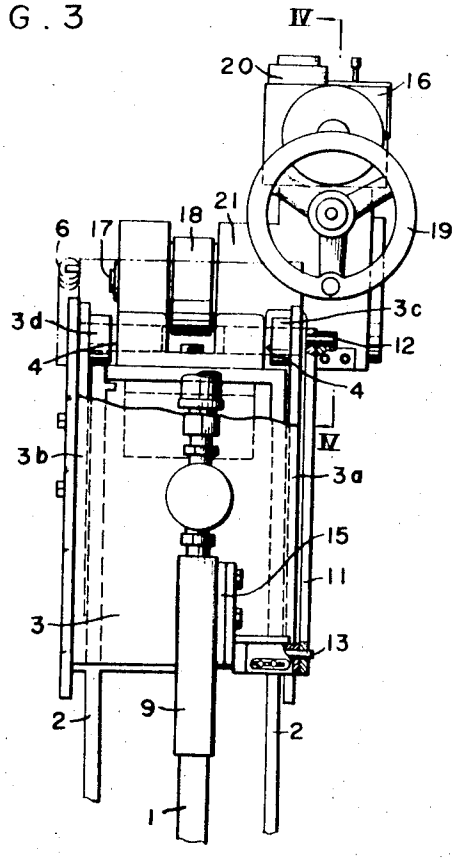


FIG. 4

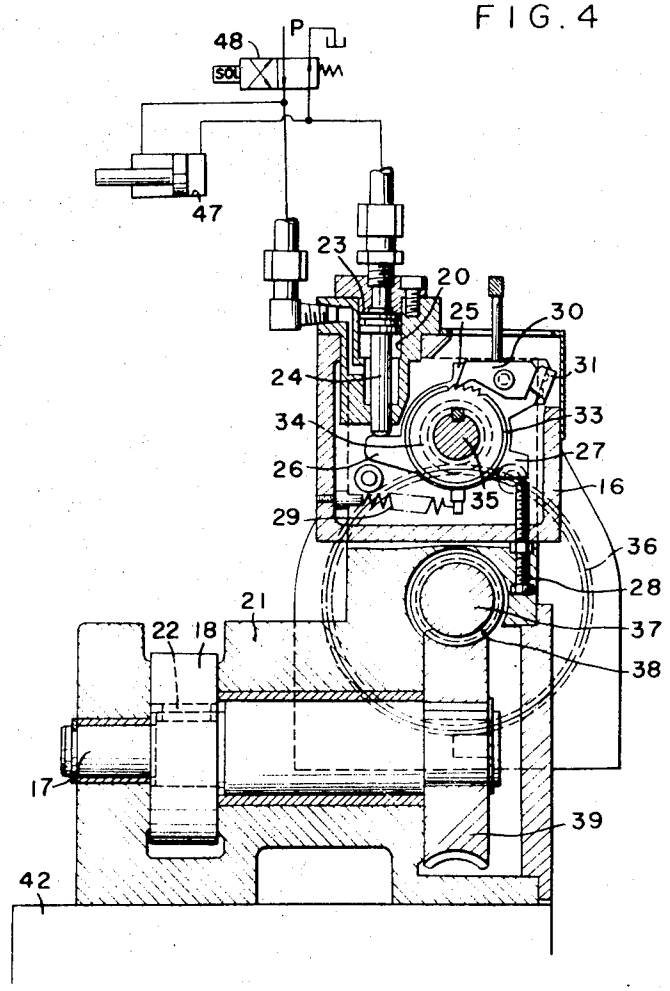

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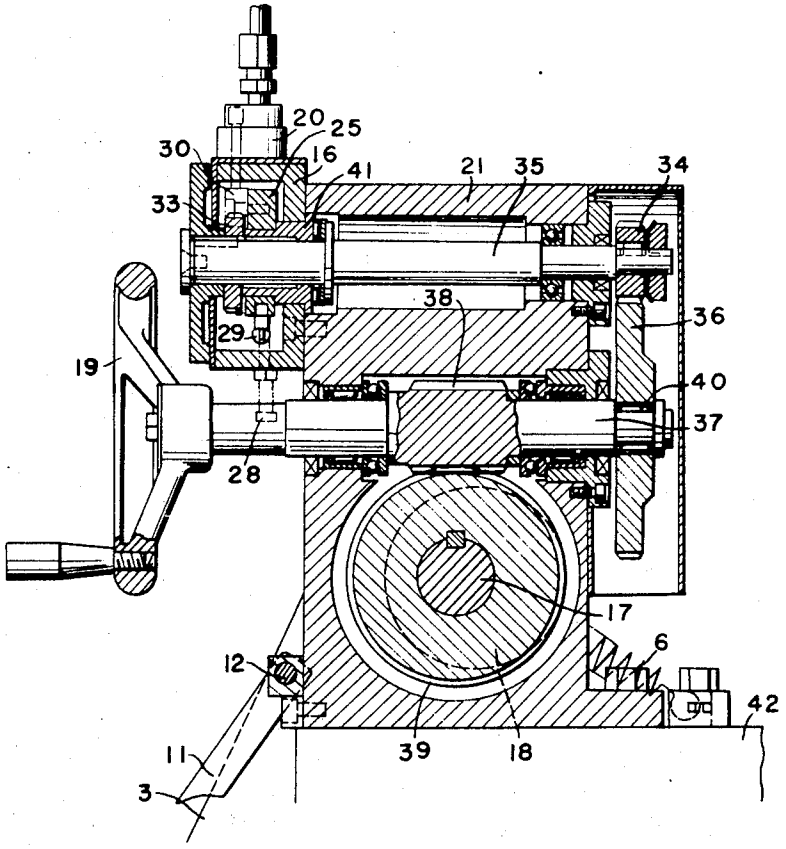
FIG. 5



AUTOMATIC ADJUSTING APPARATUS FOR FRONT COVER OF GRINDING WHEEL GUARD AND COOLANT NOZZLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an automatic adjusting apparatus for a coolant nozzle and a front cover of a grinding wheel guard which guards the operator and automatically adjusts the positions of the front cover and the coolant nozzle according to any decrease occurring in the diameter of the grinding wheel.

2. Description of the Prior Art

An adjustment of the position of a coolant nozzle and a front cover of a grinding wheel guard has heretofore been possible by a manual manipulation. Accordingly, since only a manual adjustment of the position of the coolant nozzle and the front cover of a grinding wheel guard has been made in the past in automatic line operations, it sometimes happens that one fails to make the necessary adjustment of the position in spite of decreases taking place in the diameter of the grinding wheel due to dressing operations being performed thereon.

When an operator fails to adjust the position, the front cover of the grinding wheel is displaced from the outer surface of the grinding wheel, whereby the safeguarding purpose is lost and the coolant is not supplied to the grinding point so as to cause rough grinding and, as a result, provide an inaccurate product.

When a workpiece is automatically supplied to the working position by a transferring apparatus, the position of the grinding wheel support is gradually compensated toward the workpiece in the working position in accordance with any decrease occurring in the grinding wheel diameter, However, if the position of the front cover of the grinding wheel and the coolant nozzle which are fixed to the grinding wheel support is not also adjusted, certain problems of interference of the transferring apparatus are caused.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an apparatus for automatically adjusting the position of a front cover for a grinding wheel and the angle of a coolant nozzle to an appropriate position depending upon any decrease occurring in the diameter of the grinding wheel.

This and other objects can be attained according to one aspect of this invention by automatically adjusting the position of the front cover of a grinding wheel and the coolant nozzle by a cam mechanism synchronously operable with a grinding wheel dressing mechanism, depending upon any decrease in the grinding wheel diameter, and connecting the coolant nozzle through two link couplings having four sides to the front cover so as to provide an appropriate angle of spray direction for the coolant being supplied thereto.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the accompanying drawings, wherein like reference characters designate like or corresponding parts throughout the several views, and in which:

FIG. 1 is a schematic view of a grinding machine having an automatic front cover and coolant nozzle adjusting apparatus formed according to this invention;

FIG. 2 is a sectional side view of one embodiment of the automatic front cover and coolant nozzle adjusting apparatus formed according to this invention;

FIG. 3 is a sectional front view of the automatic adjusting apparatus shown in FIG. 2;

FIG. 4 is a partial enlarged sectional view taken along the line III—III in FIG. 2; and,

FIG. 5 is a partial enlarged sectional view taken along the line IV—IV in FIG. 3.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIGS. 1, 2 and 3 thereof, a grinding wheel 1 being rotatably mounted on a grinding wheel support 1*a* is provided with a grinding wheel guard 2 covering both side surfaces of the grinding wheel 1 and a front cover 3 covering the upper part of the front edge of the grinding wheel 1 and having parallel side plates 3*a* and 3*b* on the sides thereof extending inward toward the grinding wheel.

A pair of bosses 3*c* and 3*d* is provided being disposed one each on the inner sides of the side plates 3*a* and 3*b* for rotatably mounting the front cover 3 about a pivot 4 on the grinding wheel guard 2.

A contact member 5 is mounted on the upper edge of the front cover 3 for the grinding wheel and a buffer plate 7 is mounted through an elastic member 8 on the lower inner surface of the front cover facing the grinding wheel.

A tension spring 6 is provided between the upper part of the front cover 3 for the grinding wheel and the outer surface of the grinding wheel guard 2 for normally providing a biasing action to turn the front cover 3 in a counterclockwise direction, as seen in FIG. 2, about the pivot 4 as a fulcrum, or away from the grinding wheel periphery.

On the other hand, a coolant nozzle 9 is carried by a support member 15 pivotally mounted by a pin 14 on the lower edge of the front cover 3, and is further pivotally mounted by a pin 13 on one end of an elongate bar 11 which is pivoted at its other end to the upper part of the grinding wheel guard 2 by a pIn 12, whereby the coolant nozzle 9 is connected to the front cover 3 through two link couplings defining four arms connected at pivot 4 and pins 12, 13 and 14 as fulcrums in the movement of the nozzle.

The coolant nozzle 9 has a coolant outlet 9*a* for spraying against the periphery of the grinding wheel 1, as shown in FIGS. 2 and 3, and a coolant outlet 9*b* for spraying the grinding point between the grinding wheel 1 and a workpiece 45.

A pocket 10 for decreasing air flow corresponding to the rotational velocity of the grinding wheel is provided at the upper part of the coolant outlet 9a spraying against the periphery of the grinding wheel.

At the front of a plummer block 21 mounted on the outer surface 42 of the grinding wheel guard 2, a driving mechanism 16 is provided for automatically adjusting the front cover 3 and the coolant nozzle 9.

The front cover 3 and the coolant nozzle 9 are adjusted to an appropriate position and angle by contacting the contacting member 5 mounted at the upper edge of the front cover 3 with a cam 18 mounted on a

cam shaft 17 of the driving mechanism 16, then turning the front cover 3 for automatically adjusting its position relative to the periphery of the grinding wheel by rotation of the cam 18 depending upon a decrease in the diameter of the grinding wheel, and adjusting the angle and position Of the coolant nozzle 9 by the combined rotation of the front cover 3 and the movement of the two link couplings having four sides which support the coolant nozzle 9.

The details of the driving mechanism 16 are shown in FIGS. 4 and 5, wherein the reference number 20 designates a cylinder which is synchronized with a cylinder 47 incorporated in a dressing apparatus 46 for dressing the grinding wheel 1. A piston 23 having a piston rod 24 thereon is disposed in the cylinder 20. The edge of the piston rod 24 contacts an actuating piece 26 projecting from a driving plate 25 which is rotatably fitted through a sleeve 41 to a transmission shaft 35 axiallY supported in the box of the driving mechanism 16.

A turning action is provided to the driving plate 25 by a spring 29 in the direction opposite to the moving direction of the piston rod 24.

A ratchet pawl 30 is pivoted on the surface of the driving plate 25. Moreover, a control piece 27 projects from the driving plate 25 and is contacted by a control member 28 screw-fitted to the box whereby the turning of the driving plate 25 by the spring 29 may be regulated. The ratchet pawl 30 contacts a plate spring 31 on its back edge, so that the ratchet pawl 30 is pressed to the ratchet wheel 33 keyed on one end of the transmission axis 35.

A gear 34 is keyed on the other end of the transmission shaft 35, being interlocked with a gear 36 provided through one way clutch 40 at the end of a handle shaft 37 which is axially fitted with the driving mechanism 16 in parallel relation to the transmission shaft 35. Notably, the gears 34 and 36 have different gear ratios.

A handle 19 is fixed on the other end of the handle shaft 37, and a worm 38 is provided on the center part thereof.

The worm 38 is interlocked with a worm wheel 39 keyed to the edge of a cam axis 17 rotatably fitted on the plummer block 21, and a reducing gear mechanism is provided with the worm 38, the worm wheel 39, and the gears 34 and 36. The cam 18 contacted to the contact member 5 mounted on the upper edge of the front cover 3 is fixed on the cam shaft 17 by a key 22.

The operation of the apparatus having the structure described herein according to this invention may be described as follows:

Each time the grinding wheel 1 is dressed by the dressing apparatus 46, the diameter of the grinding wheel 1 is proportionately decreased. As indicated before, it is indispensable that the positions of the front cover 3 and the coolant nozzle 9 then be adjusted, depending upon the decrease in the diameter of the grinding wheel.

A switching valve 48 is switched to feed hydraulic oil to the cylinder 47 of the dressing apparatus 46 for performing the dressing operation, and at the same time, the hydraulic oil is fed into the cylinder 20 being synchronized with the operation of dressing the grinding wheel, so that the piston rod 24 is driven downwardly in the cylinder 20.

The actuating piece 26 is pressed by the descending piston rod 24, turning the driving plate 25 in a counterclockwise direction. The ratchet pawl 30 pivotally mounted on the plate 25 turns the ratchet wheel 33 in the same counterclockwise direction as the driving plate 25, to in turn rotate the transmission shaft 35. The gear 36 of the handle shaft 37 is thus turned through rotation of the gear 34, and the rotation is transmitted to the handle shaft 37 by the action of one way clutch 40. The rotation of the handle shaft 37 is transmitted through the worm 38 and the worm wheel 39 to the cam shaft 17, so that a small rotation is provided to the cam 18. By the rotation of the cam 18, the front cover 3 is rotationally moved against the tension of the tension spring 6 through the contact member 5 in the peripheral direction of the grinding wheel 1 about the pivot 4 as a fulcrum. The distance of rotary movement of the front cover 3 controls the driving stroke of the ratchet pawl 30, that is the control is provided by the control piece 27 projecting from the driving plate 25, the control bolt 28 and the rotation of cam 18 reduced by the gears 34 and 36, the worm 38, and worm wheel 39, thereby adjusting the cover to the appropriate position, depending upon the decrease in the diameter of the grinding wheel.

At the same time as the front cover 3 for the grinding wheel is being automatically adjusted, the coolant nozzle 9 is automatically adjusted to an appropriate position by pivot pin 14 at the end of the front cover 3, and the outlets 9*a* and 9*b* of the coolant nozzle 9 are automatically adjusted to an appropriate angle by the turning of the bar 11 in the same direction of rotation as the front cover 3 about pin 12 as a fulcrum.

The front cover 3 for the grinding wheel, having been automatically adjusted, is returned to its original position under the tension of tension spring 6, by rotating the handle 19 in the same direction as the driving mechanism for returning the front-cover 3 to its original position, such as during changing of grinding wheels.

The rotation of the handle 19 is not transmitted to the ratchet wheel 33 because of the one way clutch 40 on the handle shaft 37.

Accordingly, with the apparatus of this invention, the front cover for a grinding wheel and the coolant nozzle are automatically adjusted to predetermined positions, depending upon the decrease in diameter of the grinding wheel caused by dressing the grinding wheel, whereby the front cover for the grinding wheel is positioned to an appropriate position corresponding to the diameter of the grinding wheel.

A full automatic operation in the automatic grinding processing line can thus be provided, and the disadvantageous possibility of forgetting to control the position by making a manual operation can be avoided. Moreover, as the turning operation of the front cover is made by the cam mechanism, it is possible to provide a fine adjustment of turning and high power for cam operation.

The position of the coolant nozzle is appropriately adjusted together with the front cover, and the angle is always appropriately held by the link coupling mechanism having four arms, whereby the coolant is sprayed to the appropriate position so as to provide processing with high accuracy, without improper processing such as grinding temper.

When the link coupling mechanism is constituted by a parallelogram as described, the coolant nozzle 9 may be maintained at a constant angular position.

Moreover, as the buffer plate 7 is provided on the inner surface of the front cover, even if the grinding wheel should be broken, the damage of the front cover of the grinding wheel can be prevented by the buffer plate under impact buffering action.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is to be understood therefore that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by letters patent of the United States is:

1. An automatic adjusting apparatus for a front cover of a grinding wheel guard and a coolant nozzle which comprises:

means for pivotably supporting a front cover for a grinding wheel on the grinding wheel guard;

a connecting bar pivoted to the grinding wheel guard at one end thereof;

a link coupling mechanism for pivotably mounting a coolant nozzle on both the front cover and the other end of said connecting bar;

a transmission cylinder responsively operable with a dressing device for said grinding wheel;

ratchet means operable by the actuation of said transmission cylinder;

a cam shaft drivingly connected to said ratchet means;

a cam mounted on said cam shaft; and,

resilient means for turning the front cover away from the periphery of said grinding wheel to cause the front cover to contact the cam, said cam being adapted to turn the front cover toward the periphery of the grinding wheel against the force of said resilient means upon the actuation of said transmission cylinder.

2. An automatic adjusting apparatus for a front cover of a grinding wheel guard and a coolant nozzle according to claim **1**, further comprising:

a handle shaft driven by said ratchet means through a one-way clutch for driving said cam shaft through a worm and a worm wheel.

3. An automatic adjusting apparatus for a front cover of a grinding wheel guard and a coolant nozzle according to claim **1**, wherein said link coupling mechanism has four pivots constituting a parallelogram.

4. An automatic adjusting apparatus for a front cover of a grinding wheel guard and a coolant nozzle according to claim **1**, further comprising:

a buffer plate on the inner surface of said front cover of said grinding wheel.

5. An automatic adjusting apparatus for a front cover of a grinding wheel guard and a coolant nozzle according to claim **1**, wherein:

the position of the front cover and the coolant nozzle is adjusted by rotating the front cover through said cam; and,

the angle of said coolant nozzle is adjusted by said link coupling mechanism.

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