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Koide et al.

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[54] APPARATUS FOR PREVENTING CIRCUMFERENTIAL OVERSPEEDING OF GRINDING WHEEL

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[52] **U.S. Cl.** .....**51/134.5 R**

[51] **Int. Cl.**.....**B24b 55/00**

[58] **Field of Search**.....51/72, 134.5, 166, 268, 269

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[57] **ABSTRACT**

An apparatus for preventing circumferential overspeeding of a grinding wheel in a grinding machine wherein the rotating speed of the grinding wheel spindle is made variable through pulley exchange comprises a grinding wheel head with the grinding wheel spindle rotatably mounted thereto and a motor connected to drive the spindle. For the purpose of averting the hazard of circumferential overspeeding of the grinding wheel a large-diameter grinding wheel rejecting pin obstructs the space to be occupied by a large-diameter grinding wheel when a small-diameter high-speed pulley is connected to drive the grinding wheel spindle. This prevents the mounting of a large-diameter grinding wheel. A high-speed pulley rejecting pin is mechanically interlocked with the large-diameter grinding wheel rejecting pin and each moves in the same direction. The high-speed pulley rejecting pin obstructs the space to be occupied by the high-speed pulley when a large-diameter grinding wheel is connected to the spindle thereby preventing the mounting of the high-speed pulley.

4 Claims, 3 Drawing Figures

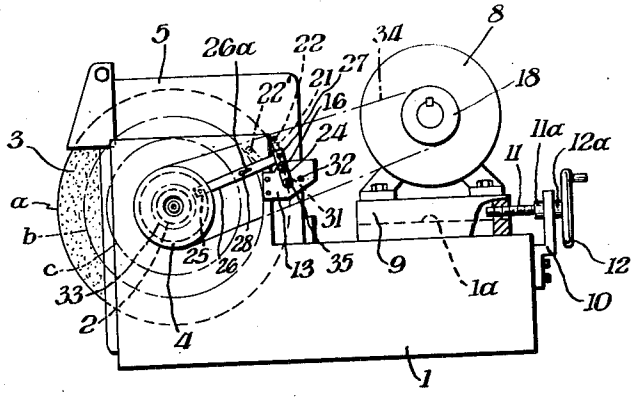
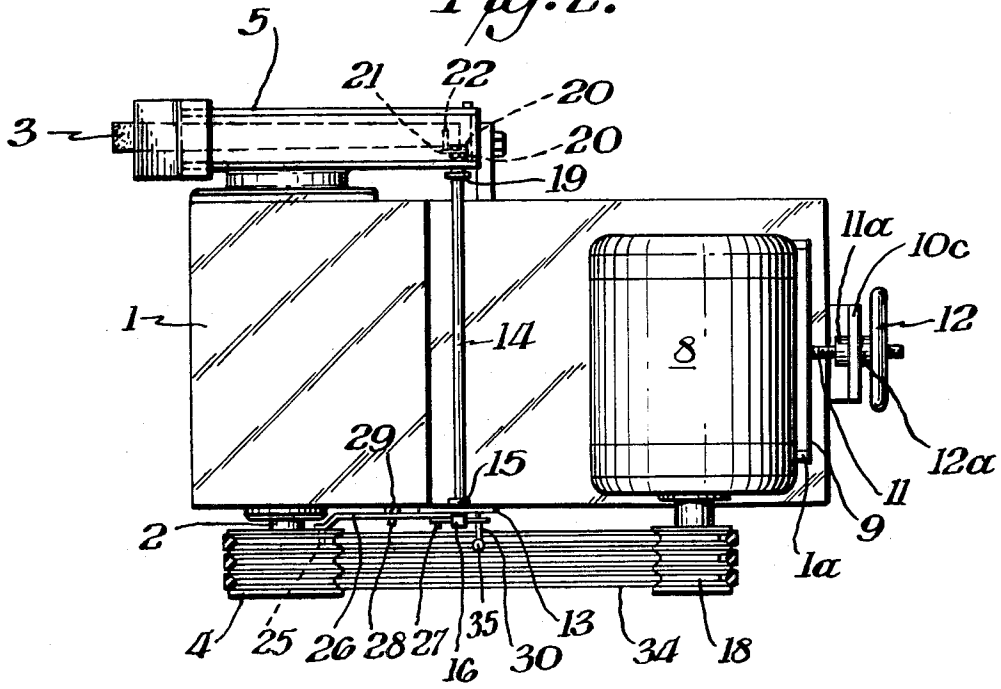


Fig. 2.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19
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8
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10c
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12a
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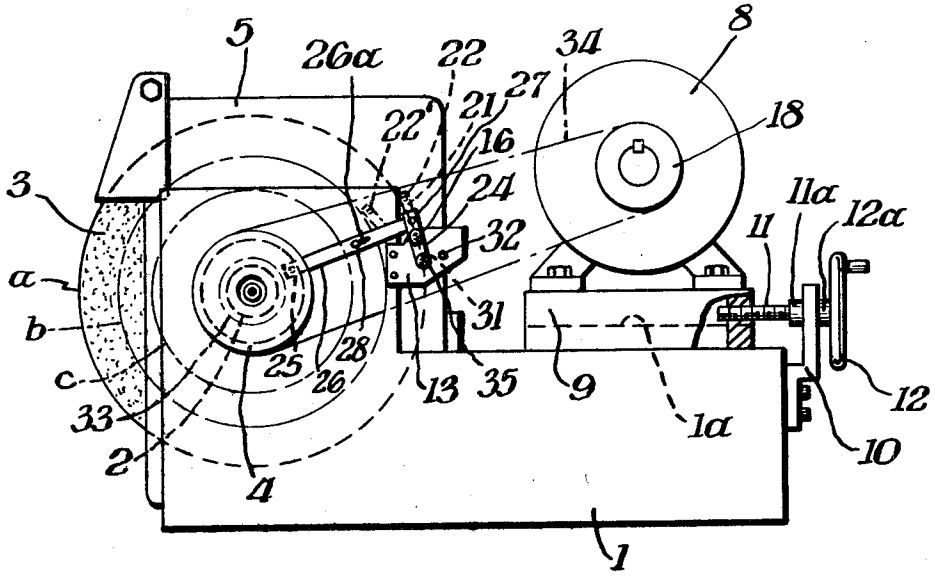
5
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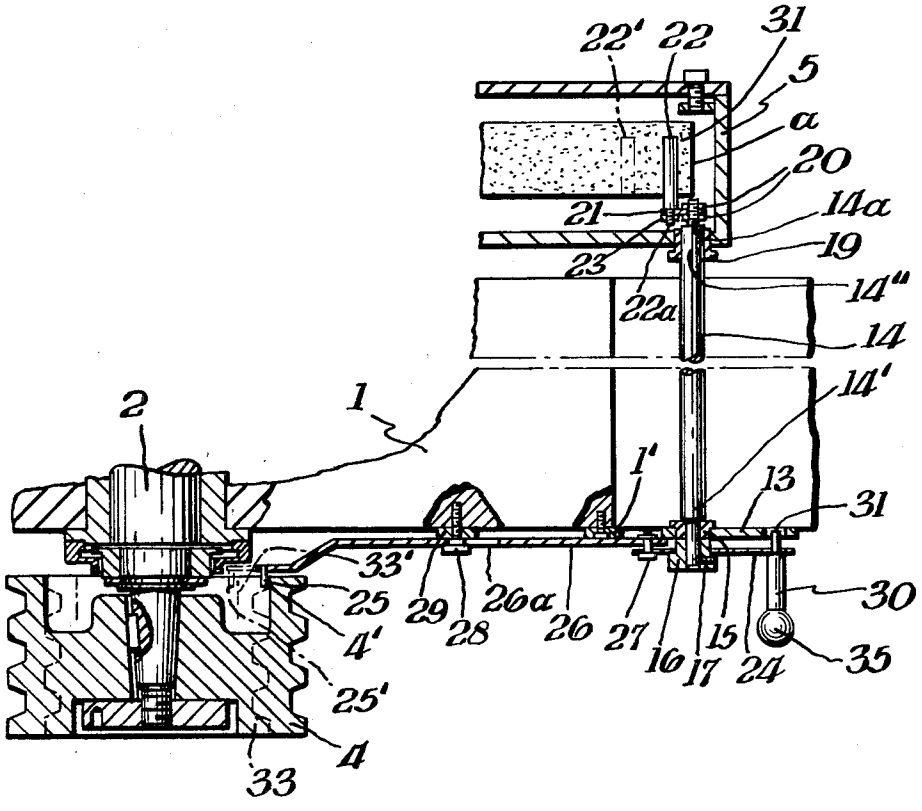
Fig. 1.

Fig. 3.


22'
22
31
5
a
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21
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14"
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26a
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APPARATUS FOR PREVENTING CIRCUMFERENTIAL OVERSPEEDING OF GRINDING WHEEL

BACKGROUND OF THE INVENTION

The present invention relates to a novel device for simply and reliably preventing circumferential overspeeding of a grinding wheel thereby avoiding the hazard of the grinding wheel being broken with a resultant drop in work efficiency.

In the conventional grinding of a work piece on the periphery of a grinding wheel, the grinding wheel is usually driven by the motor pulley and the grinding wheel spindle pulley linked by V-belts for transmission of the motion from the motor. The rotary speed of the grinding wheel spindle is constant when the diameter combination of the two pulleys is given. As the grinding wheel is worn away and its diameter reduced, the circumferential speed of the grinding wheel drops and in consequence the grinding efficiency falls. For compensation of the drop in the circumferential speed it is common practice to exchange the pulley. With reduction of the grinding wheel diameter, either the motor pulley or the grinding wheel spindle pulley is changed from a low-speed one to a high-speed one thereby speeding up the grinding wheel rotation. At the time when a reduced-diameter grinding wheel is replaced with a large-diameter wheel, the rotation of the large-diameter grinding wheel will be excessive due to the high-speed spindle or the motor shaft. And it will cause an overspeeding of the grinding wheel with the hazard of breaking the grinding wheel. If the construction is such that the grinding wheel and the pulley are separately changeable, an overspeeding of the grinding wheel can easily occur. A safe overspeed prevention device free from such hazard has been strongly demanded from industrial circles.

SUMMARY OF THE INVENTION

The object of this invention is to provide a mechanism for making it impossible to mount a large-diameter grinding wheel on the grinding wheel spindle while a small-diameter pulley of the grinding wheel spindle matching a reduced-diameter grinding wheel is left on, thereby averting the destruction of the grinding wheel due to overspeeding. Another object of the invention is to make this mechanism simple and low-priced.

According to this invention, the grinding wheel spindle is rotatably mounted on the grinding wheel head. The motor rotation is transmitted to the grinding wheel spindle via pulleys and V-belts. The rotating speed of the grinding wheel spindle can be varied by a change in the pulley combination. In continued grinding with a large-diameter grinding wheel and a low-speed pulley the circumference of the grinding wheel wears away with the result that the diameter diminishes, the circumferential speed drops and the work efficiency falls. A high-speed pulley is then substituted for the low-speed pulley to drive the grinding wheel at a higher rotary speed. Eventually, the grinding wheel with its diameter reduced to a certain limit must be replaced with a large-diameter one. If this replacement is done with the pulley unchanged, the circumferential speed of the new grinding wheel will become excessive and may break the grinding wheel. According to this invention, when the high-speed pulley is on the grinding wheel spindle, the mounting of a large-diameter grinding wheel is obstructed by a large-diameter grinding wheel rejecting pin. Also, when the large-diameter grinding wheel is on, the mounting of a high-speed pulley is prevented by a high-speed pulley rejecting pin.

BRIEF DESCRIPTION OF THE DRAWING

Novel features and advantages of the present invention in addition to those mentioned above will become apparent to one skilled in the art from a reading of the following detailed description in conjunction with the accompanying drawing wherein:

FIG. 1 is a side elevational view of an embodiment of the present invention;

FIG. 2 is a top plan view of the embodiment shown in FIG. 1; and

FIG. 3 is an enlarged fragmental sectional view of the embodiment of FIGS. 1 and 2 illustrating the details of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As shown in FIGS. 1 and 2, a grinding wheel 3 is fixed to one end of a grinding wheel spindle 2 rotatably mounted on a grinding wheel head 1. A pulley 4 or 33 is fixed to the other end of the spindle 2. A new large-diameter grinding wheel, indicated by reference character *a*, is mounted on the grinding wheel spindle 2. As the grinding wheel is reduced in diameter to the diameter indicated by reference character *b*, a pulley exchange is required for rotating the grinding wheel until it reaches the diameter indicated by reference character *c*. Thereupon, the low-speed pulley 4 matching the large-diameter grinding wheel is replaced by the high-speed pulley 33 for a reduced-diameter grinding wheel. A grinding wheel guard 5 is attached to the grinding wheel head 1 to protect the grinding wheel 3. A motor 8 is attached opposite the grinding wheel 3 on the grinding wheel head 1. The shaft end of the motor is fitted with a motor pulley 18 whose axis runs parallel to the grinding wheel spindle 2. The motor 8 is fixed to a motor base 9 slidably mounted along a guide surface 1*a* formed on the grinding wheel head 1 perpendicular to the grinding wheel spindle 2 so that appropriate tension can be maintained on the V-belts 34 stretched between the pulley 4 or 33 mounted on the grinding wheel spindle 2 and the motor pulley 18 mounted on the motor shaft. A hand wheel 12 moves the motor 8 via the motor base 9 in relation to the grinding wheel spindle 2. A feed screw 11 penetrates a feed screw support 10 fixed to the grinding wheel head 1 and the feed screw is manipulated by the hand wheel 12. A step 11*a* of the feed screw 11 and an end face 12*a* of the hand wheel 12 squeeze the side faces of the feed screw support 10 and in this condition the feed screw 11 is axially immovable during rotation. When the hand wheel 12 is turned, the motor base 9 is shifted along the guide surface 1*a* and the slack in the V-belts 34 caused through exchange between the large-diameter low-speed pulley 4 and the small-diameter high-speed pulley 33 is removed. The hand wheel 12 is manipulated until the V-belts are adequately tensioned.

A plate 13 is fixed to the side face 1′ on the pulley side of the grinding wheel head 1. A link shaft 14 is supported by the plate 13. The shaft 14 is rotatably passed through a fixing member 15 fixed on the plate 13 and the shaft is parallel to the grinding wheel spindle 2. A rotatable boss 16 is solidly secured to the pulley side end 14′ of the link shaft 14 by a set screw 17. Meanwhile, the other end 14″ of the link shaft 14 is rotatably passed through a bushing 19 secured to the side face of the grinding wheel guard 5, as shown in FIG. 3. The threaded end portions 14*a* of the link shaft 14 projects into the grinding wheel guard 5. A lever 21 is fixed with nuts 20, 20 to the threaded end portions 14*a* and a large diameter grinding wheel rejecting pin 22 is fixed on the lever 21 by means of the threaded portion 22*a* and a nut 23, as shown in FIG. 3. At the pulley side end 14′ of the link shaft 14, a rotatable arm 24 acting as a leaf spring is fixed to the rotatable boss 16. On one end of the rotatable arm 24 a safety arm 26 is rotatably mounted by means of a support pin 27. A high-speed pulley rejecting pin 25 which extends into a recess in the pulley 4 or 33 is secured to the safety arm 26, as shown in FIG. 3. Approximately midway on the safety arm 26 a guide slot 26*a* is formed for slidably receiving a guide pin 28. The guide pin 28 is fastened on the grinding wheel head 1 through a support 29, as shown in FIG. 3.

Turning of the link shaft 14 can be accomplished by an operating lever 30. This motion is transmitted by the rotatable arm 24 via the support pin 27 to the safety arm 26. When a knob such as 35 is used, the operating lever 30 is made to fit into an engaging hole 31 or 32 provided on the plate 13 and the safety arm 26 slides along the guide slot 26*a*. Thereby the high-speed pulley rejecting pin 25 provided at the end of the safety arm 26 occupies the position 25 or 25′, as shown in FIG. 3. When the operating lever 30 fits into the engaging hole

31, the large-diameter grinding wheel rejecting pin 22 occupies the position 22, and when the lever 30 fits into the hole 32, the pin 22 occupies the position 22', shown in FIGS. 1 and 3.

Safety is attained with the present arrangement in the following manner. During the grinding operation in the state of FIG. 1, when the grinding wheel is reduced in diameter from diameter *a* to diameter *b*, a pulley exchange is required and the operating lever 30 is turned to the position at which it fits into the hole 32 bored on the plate 13. The high-speed pulley rejecting pin 25 shifts to the position where it does not obstruct the small-diameter high-speed pulley 33 (position 25' in FIG. 3). On the other hand, the large diameter grinding wheel rejecting pin 22 as the result of the link shaft 14 being turned stops at the position 22' in FIGS. 1 and 3 thereby matching the reduced diameter *b* requiring the pulley exchange. In this condition it is impossible to mount a large-diameter (diameter *a*) grinding wheel 3. In order to dismount the low-speed pulley, mount the high-speed one, and retighten the V-belts 34, the positions of the motor 8 and the pulley 18 mounted on its shaft relative to the grinding wheel spindle 2 may be adjusted by the hand wheel 12.

As the grinding wheel is further reduced in diameter from diameter *b* to diameter *c*, another pulley exchange is required before a new large-diameter wheel replaces the worn out wheel. The large-diameter grinding wheel rejecting pin 22 at the position 22' impedes the mounting of large-diameter (diameter *a*) grinding wheel 3. The pin 22 must be moved to the position 22 in FIG. 1. For this purpose, the operating lever 30 is turned to the position where it fits into the hole 31 bored on the plate 13. However, the high-speed pulley rejecting pin 25 of the safety arm 26 is restricted to the position 25' in FIG. 3 by the inside surface 33' of the small-diameter high-speed pulley 33 and thereby prevents the turning of the link shaft 14. In other words, the mounting of a large-diameter (diameter *a*) grinding wheel 3 is only possible after the small-diameter high-speed pulley 33 is replaced by the large-diameter low-speed pulley 4, thereby permitting the high-speed pulley rejecting pin 25 to be displaced up to the inside surface 4' of the low-speed pulley 4. This permits the large-diameter grinding wheel rejecting pin 22 to move from 22' to 22.

According to the present invention, the hazard in a grinding operation is easily eliminated by a safety device simple in construction and easy to operate. When the small-diameter high-speed pulley 33 is on, the high-speed pulley rejecting pin 25 is obstructed by the high-speed pulley 33. Accordingly, the mounting of a large-diameter grinding wheel having a diameter *a* is impossible because of the positions of the safety arm 26 and the large-diameter grinding wheel rejecting pin 22. Therefore, the low-speed pulley 4 must be mounted before a large-diameter (diameter *a*) grinding wheel 3 can be mounted. Thus, circumferential overspeeding of a large-diameter (diameter *a*) grinding wheel 3 caused by operation with a high-speed pulley 33 is absolutely impossible. Meanwhile, it is possible to secure an adequate circumferential speed of a reduced-diameter grinding wheel, if the pulley is changed to a high-speed pulley 33. However, it is impossible to mount a high-speed pulley 33 for a large-diameter wheel whereby dangerous overspeeding is prevented.

What is claimed is:

1. An apparatus for preventing circumferential overspeeding of a grinding wheel through exchange of small and large-diameter grinding wheel spindle pulleys in a grinding machine wherein the rotary speed of the grinding wheel spindle is variable by pulley exchange comprising a grinding wheel head with the grinding wheel spindle rotatably mounted thereto and a motor connected to drive the grinding wheel spindle, operating means supported by a mounting plate secured to the pulley side end face of the grinding wheel head, a large-diameter grinding wheel rejecting pin fixed to the operating means and constructed and arranged relative to the grinding wheel spindle to obstruct the space to be occupied by a large-diameter grinding wheel on the spindle and thereby prevent the mounting of a large-diameter grinding wheel when the small-diameter high-speed pulley is on the grinding wheel spindle, and a high-speed pulley rejecting pin fixed to the operating means and mechanically interlocked with the large-diameter grinding wheel rejecting pin constructed and arranged relative to the grinding wheel spindle to obstruct the space to be occupied by a high-speed pulley on the spindle when the large-diameter grinding wheel is on the spindle thereby preventing the mounting of the high-speed pulley.

2. An apparatus as in claim 1 wherein the operating means is constructed and arranged to move the interlocked large-diameter grinding wheel rejecting pin and high-speed pulley rejecting pin in the same direction, and the mounting plate is provided with holes for fixing the operating means in positions for fitting the high-speed pulley and the low-speed pulley.

3. An apparatus as in claim 2 wherein the operating means includes a rotatable link shaft parallel to the grinding wheel spindle about midway between the grinding wheel spindle and the motor with the small-diameter high-speed pulley rejecting pin at the pulley side end of the link shaft and the large-diameter grinding wheel rejecting pin at the other end of the shaft.

4. An apparatus as in claim 3 wherein the operating means further includes an operating lever secured to the link shaft and arranged to be fixed to said holes, and a safety arm, one end of the safety arm is connected to the operating lever and the other end thereof has the high-speed pulley rejecting pin.

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