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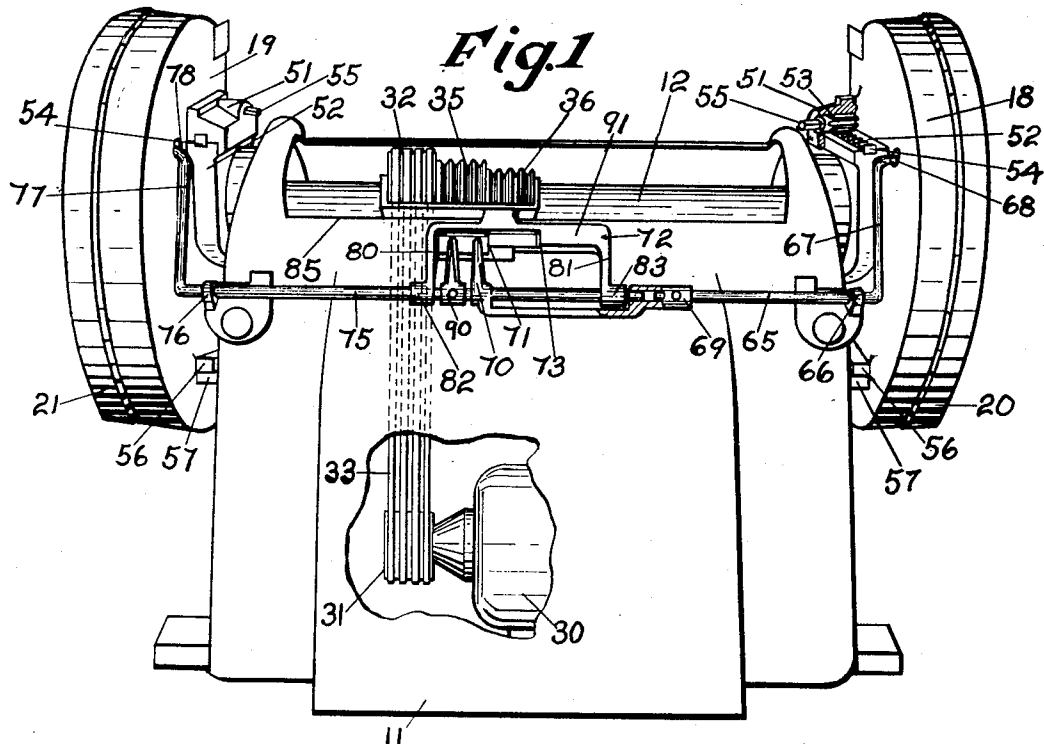
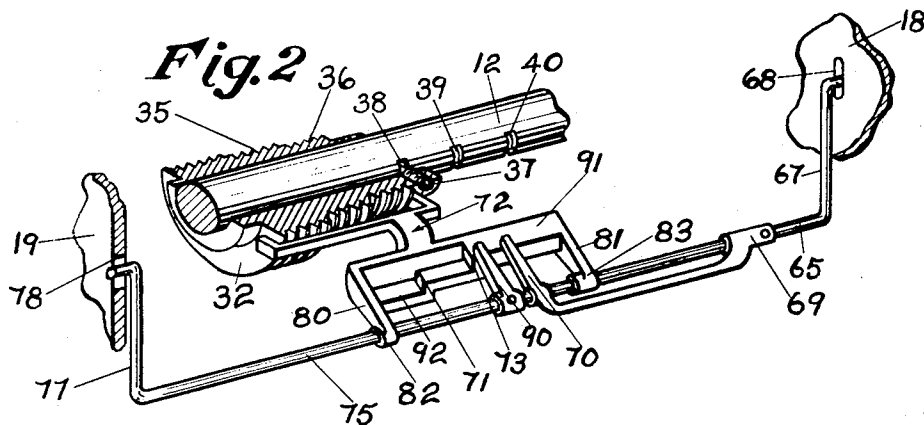
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SPEED CONTROL DEVICE FOR GRINDING MACHINES

Filed April 10, 1929

2 Sheets-Sheet 1



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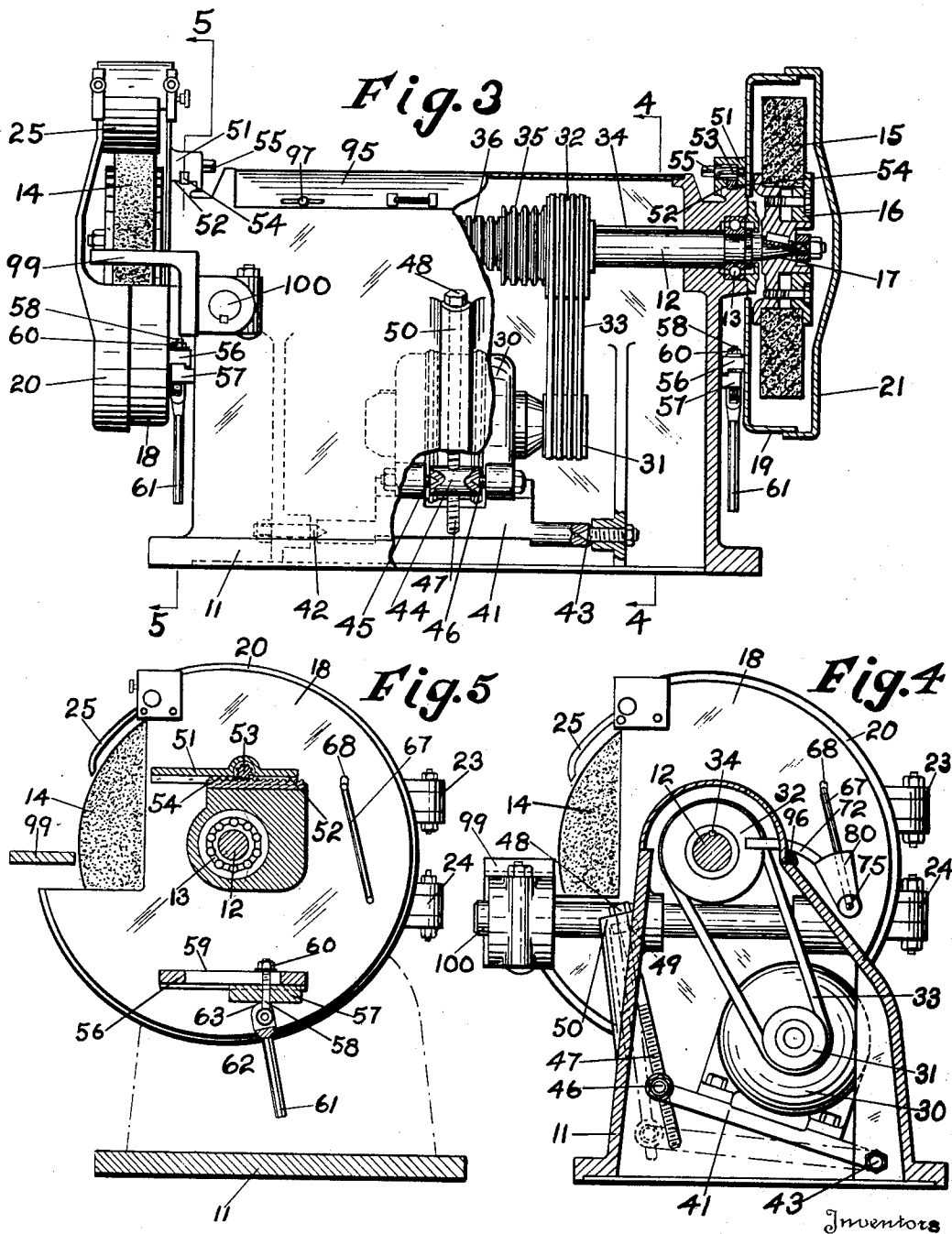
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## UNITED STATES PATENT OFFICE

1,927,655

## SPEED CONTROL DEVICE FOR GRINDING MACHINES

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7 Claims. (Cl. 51-166)

This invention relates to grinding machines and more particularly to a speed controlling device for the grinding wheel in such a machine.

In various types of grinding machines, it is desirable in order to obtain the maximum efficiency from the grinding wheel, that the surface or peripheral speed of the wheel be substantially constant. Floor stands for tool grinding and snagging have been constructed and arranged so that it is possible to change the speed of the wheel from a slow to a faster speed as it wears away. This has usually been accomplished either by shifting a driving belt from one cone of a pulley to another cone to step up the speed of the wheel or by means of a variable speed motor which is arranged so that the operator may turn a rheostat control to vary the speed as desired.

The modern grinding wheel is a high speed tool and is capable of rapid production, but is of a comparatively brittle structure so that a sudden blow on the operative periphery or side face of the wheel, or a too fast rotation of the wheel, is apt to cause a breakage of the wheel and a consequent injury to the work and possible serious injury to the operator. In most of these previous machines, the operator may as desired adjust the speed to increase the surface speed of the wheel. The operators find by experience that a rapidly rotating wheel gives a faster cutting action and, learning this fact, they speed the wheel up as fast as possible to increase their production. Hence it is advisable to provide such a machine with a safety device which prevents the operator from running the wheel at a speed greater than is found by experience to be safe; and in certain types of grinding machines, such as floor stands for snagging rough castings and the like, the speed change mechanism used to permit speeding up of the wheel as it is reduced in diameter should be controlled by a device which prevents the rotative speed of the wheel from being increased until the wheel has worn away a predetermined amount.

This feature is more important today than in the past, due to the development of the high speed wheel. In the past, the wheel structures have permitted rotation of the wheel at a peripheral speed of five to six thousand feet per minute which was considered a comparatively safe speed. Today, with the new wheel developments, the modern high speed wheels may be rotated at a peripheral speed of nine thousand feet per minute and upwards, depending on the size and type of wheel. It will be readily ap-

preciated that the centrifugal bursting strain of the wheel increases rapidly as the surface speed or R. P. M. is increased and it is highly desirable that a suitable speed control device be provided to prevent rotating the wheel at an excessive speed.

It is accordingly one object of this invention to provide a suitable driving mechanism for a grinding wheel which is arranged to permit a plurality of driving speeds depending upon the size of the wheel and to so arrange the parts that the speed cannot be advanced until the wheel has worn away a predetermined amount.

It is a further object of this invention to provide a suitable speed control mechanism which prevents the operator from replacing a worn-out wheel with a new wheel of larger diameter without first resetting the speed controlling mechanism.

It is still another object of this invention to provide a grinding machine with a speed changing mechanism which is normally inoperative due to the presence of a stop the position of which is controlled by a contact member movable towards and from the operative face of the wheel.

It is a still further object of this invention to provide a grinding machine having two grinding wheels with suitable mechanism for controlling the speed of rotation of the wheels which is arranged so that the larger diameter wheel will control the speed.

Other objects will be apparent from the following disclosure.

One embodiment of this invention has been illustrated in the drawings, in which like reference numerals indicate like parts:

Fig. 1 is a rear perspective view of a motor driven floor stand having parts broken away to show the speed control mechanism and showing the parts in position with a new wheel mounted on the spindle;

Fig. 2 is a fragmentary perspective view partly in section on an enlarged scale showing the speed control mechanism moved to the fast speed and the wheel guard removed to its rearward position;

Fig. 3 is a front elevation of a motor driven floor stand embodying this invention having part of the base broken away and shown in section to more clearly show the construction;

Fig. 4 is a cross sectional view of the machine taken approximately on the line 4-4 of Fig. 3 showing the driving mechanism for the grinding wheel spindle; and

Fig. 5 is a cross sectional view taken substantially on the line 5—5 of Fig. 3 showing the adjusting and locking mechanism for the wheel guard.

5 In accordance with this invention, a speed control device is provided which may comprise a contact member, such as a tool rest, a spark shield or a wheel guard, which is adjustable towards and from the face of the wheel and limited in its movement by engagement with the face thereof. This member is connected to actuate a stop which normally prevents adjustment of a speed control device until the wheel wears away to a predetermined size. In the preferred construction, an adjustable wheel guard controls the movement of a stop which normally prevents the operator from shifting, a rheostat control connected to a variable speed motor or a multi-step pulley directly connected to speed up the rotation of the grinding wheel.

As illustrated in the drawings, this machine comprises a base 11 which rotatably supports a grinding wheel spindle 12 in bearings 13. The grinding wheels 14 and 15 are mounted on the outer ends of the spindle 12 by means of clamping flanges 16 which support and engage the wheels 14 and 15 and are in turn fitted to a reduced tapered portion 17 on the spindle 12.

Suitable wheel guards 18 and 19 are provided surrounding the grinding wheels 14 and 15 respectively to serve as protective guards in case the wheels break or to confine the abrasive and metallic grit during the normal operation of the machine. These guards are preferably adjustably supported on the base of the machine and are provided with removable covers 20 and 21 which are supported on the guards 18 and 19 respectively by the hinges 23 and 24 so that it may be swung open when it is desired to change the grinding wheels. Each of the wheel guards is provided with a spark shield 25 which projects downwardly over the front peripheral face of the grinding wheel.

The grinding wheel spindle 12 may be driven from any suitable source of power, such as a constant speed motor 30 mounted within the base of the machine. It is desirable in a floor stand construction of this type to provide a suitable speed change mechanism so that the speed of the grinding wheel may be advanced as the wheel wears away and thus maintain a substantially constant surface speed of the wheel. This is desirable since the grinding wheel of a given structure grinds more efficiently at a given speed and as the wheel is worn away this speed gradually diminishes and the cutting efficiency of the wheel is impaired. A suitable speed change driving mechanism may include a driving pulley 31 mounted on the end of the motor shaft and arranged to drive a multi-step pulley 32, which is adjustably mounted on the spindle 12, by means of a belt 33. The belt 33 is preferably a multiple V-type belt which gives a maximum driving efficiency. The pulley 32 is slidably keyed to the spindle 12 by a key 34 and is arranged so that any one of the steps 32, 35 or 36 may be positioned in alignment with the driving pulley 31 on the motor shaft. The pulley 32 is provided with a set screw 37 which is arranged to engage one of the slots 38, 39 or 40 in spindle 12 to lock the pulley in adjusted position so that one of the steps 32, 35 or 36 is aligned with the motor pulley 31. This enables the operator to adjust the speed of rotation of the grinding wheel by removing

the driving belt and sliding the pulley 32 to bring the desired step into alignment with the pulley 31.

With this construction, it is desirable to provide a suitable tensioning device for properly tensioning the driving belt in any of the positions of the multi-step pulley 32. In the preferred construction, this may comprise a movable mount for the motor which is arranged so that the motor may be adjusted relative to the spindle to increase or decrease the distance between the axis of the motor and the axis of the grinding wheel spindle. A motor support 41 is pivotally supported on the screws 42 and 43 which are fixed relative to the base. The other end of the support 41 is adjustable relative to the base so that the motor may be swung to properly tension the driving belts 33. A nut 44 is pivotally supported on screws 45 and 46 on the front end of the support 41 and is engaged by an adjusting screw 47 which is screw threaded into the nut 44 and is rotatably supported and held against endwise movement by the head 48 and a collar 49 engaging opposite sides of the projection 50 of the base 11. It will be readily apparent from this construction, that the operator by turning the readily accessible screw 47 by means of the head 48 may adjust the position of the motor 30 so as to increase or decrease the distance between the axis of the motor shaft and the spindle shaft. The operator may shift the driven pulley 32 on the spindle 12 to align any desired step of the pulley with the motor driving pulley 31 and then by manipulation of the screw 47 give the driving belt 33 the proper tension.

To attain the principal objects of this invention, it is desirable to so construct and arrange the mechanism that the operator cannot increase the speed of the grinding wheel until the wheel has worn away to a predetermined size. To accomplish this a suitable contact member movable relative to the grinding wheel may be constructed and arranged to prevent movement of the speed changing device until the member has been adjusted to a predetermined position, this member being limited in its movement by the grinding face of the grinding wheel. As illustrated, the wheel guards 18 and 19, which serve as contact members, are provided with projecting guides 51 which engage the slide-ways 52 on the base 11. A pinion 53 is rotatably mounted in the projection 51 of each guard and engages a rack bar 54 which is adjacent the way 52 on the base of the machine. It will be readily apparent from this construction, that the operator may apply a wrench to a head 55 and turn the pinion 53 which is in engagement with the rack 54 to adjust the position of the guards 18 and 19 relative to the grinding wheels 14 and 15. By means of this construction, the operator may readjust the wheel guards to maintain the spark shields 25 in close proximity to the periphery of the grinding wheel.

It is desirable that the wheel guards 18 and 19 be locked rigidly to the base of the machine during the normal operation of the same. The lower portion of the guards 18 and 19 are provided with projections 56 which engage slide-ways 57 on the base of the machine. The ways 57 serve as a sliding support to steady the wheel guard during the adjustment of the same and as a rigid support for the guards during grinding. To lock the wheel guards 18 and 19 rigidly relative to the base 11, a suitable mechanism is

provided including eye bolts 58 passing through a hole in the slideways 57 and engaging elongated slots 59 in the projections 56 of the wheel guards 18 and 19. The upper end of the bolts 58 are screw threaded and are provided with nuts 60 engaging the upper surface of the projections 56. A clamping lever 61 is pivotally connected to each of the eye bolts 58 by studs 62 so that the lever may swing relative to the bolt. A cam surface 63 is formed on the upper end of the levers 61 so that when the operator swings the lever towards the left, as viewed in Fig. 5, the cam engages the under surface of the slideway 57 and draws downwardly on the bolt 58 and locks the wheel guard rigidly in engagement with the base 11.

A mechanism having a stop is provided which is actuated by movement of the wheel guard to prevent adjustment of the speed change mechanism until the grinding wheel has worn away to a predetermined size. This mechanism may comprise a shaft 65 supported in a bearing 66 on base 11 and having a projecting arm 67 engaging an elongated slot 68 in the guard 18. The other end of the shaft 65 is provided with a member 69 having a stop lug 70 which is positioned in the path of a shoulder 71 on a yoked member 72 which engages the end faces of the pulley 32. It will be readily apparent from this construction that the operator cannot slide the pulley toward the left, as viewed in Fig. 1, to speed up the wheel if the stop lug 70 is in the path of the shoulder 71 on the yoked member 72.

When the operator readjusts the guard 18 as the wheel wears away, movement of the guard 18 swings the arm 67 and rocks the shaft 65 and the stop lug 70. When this movement has been sufficient to swing the stop lug 70 out of the path of the shoulder 71 on the yoked member 72, the operator may shift the pulley on the spindle 12 and thereby increase the speed of the grinding wheel. This sliding movement of the driving pulley 32 may continue until the stop lug 70 contacts with a second shoulder 73 on the yoked member 72, thus permitting the operator to slide the pulley to position the next step 35 into alignment with the motor driving pulley 31.

The speed of rotation of the grinding wheel cannot be increased further until the wheel has worn away still more and the guard 18 has been adjusted relative to the wheel, so that the stop lug 70 is rocked out of the path of the shoulder 73 on the yoked member 72. When the lug 70 has been moved out of the path of the shoulder 73, pulley 32 may be adjusted towards the left so that the step 36 is in alignment with the driving pulley 31 on the motor (Fig. 2).

Due to unequal wheel wear caused by use of one wheel more than the other, the diameters of the two wheels may not remain constant. The speed control device should preferably be arranged so that the larger diameter wheel controls the wheel speed so as to prevent excessive speed of the larger diameter wheel. To accomplish this a separate shaft 75 is connected to the wheel guard 19 and it is arranged to control a separate stop. This shaft 75 is supported in a bearing 76 on the base of the machine and it has a projecting arm 77 engaging an elongated slot 78 in the wheel guard 19. The other end of the shaft 75 passes through an aperture in the stop lug 70 and engages an aperture in the member 69. It will be readily apparent from this con-

struction, that bearings 66 and 76 on the base of the machine serve to support the outer ends of the shafts 65 and 75 while the member 69 which is fixed to the shaft 65 loosely engages the inner end of the shaft 75 and serves as a support for the inner end of each shaft. The yoked member 72 is provided with projecting webs 80 and 81 having hubs 82 and 83 provided with holes, loosely engaging the shaft 75 which serves as a support for the outer end of the yoked member 72. The inner end of the yoked member engages the end surfaces of the pulley 32 and slidably engages the surface 85 of the base 11. The hubs 82 and 83 are loosely supported on the shaft 75 so that the yoked member may be readily moved longitudinally of the machine with the pulley 32 when permitted by the position of the stop lug. A second stop lug 90 is fixed on the shaft 75, so that when the wheel guard 19 is adjusted a swinging movement is imparted to the arm 77 and the shaft 75 to rock the stop lug 90 relative to the yoked member 73. It will be readily apparent from this construction, that the operator cannot shift the pulley 32 longitudinally to bring the second step 35 into alignment with the driving pulley 31 until both of the stop lugs 70 and 90 have rocked a sufficient distance to clear the shoulder 71 (Fig. 1). If only the stop lug 70 has been removed a sufficient distance, then the operator cannot slide the pulley 32 endwise on the shaft a sufficient distance to position the step 35 into alignment with the driving pulley 31 due to the stop lug 90 contacting with the shoulder 71. When each of the grinding wheels has worn away a sufficient amount and the wheel guards 18 and 19 adjusted so that the shafts 65 and 75 have rocked a sufficient amount to remove the stop lugs 70 and 90 from the path of the shoulder 71, then the pulley 32 and yoked member 72 may be moved longitudinally of the machine toward the left, as viewed in Figs. 1 and 2, until the stop lug 70 engages the shoulder 73 thereby limiting and preventing further adjustment of the pulley 32.

The machine continues in operation at the second speed with the driving belts 33 engaging the step 35 of the pulley 32 until the grinding wheels have worn away a sufficient distance to permit adjustment of the wheel guards 18 and 19 to swing the shafts 65 and 75 a sufficient amount to rock the stop lugs 70 and 90 out of the path of the shoulder 73 on the yoked member 72 and permit a further sliding movement of the pulley 32 and yoked member 72 toward the left, as viewed in Fig. 1, so that the step 36 of the pulley 32 is in alignment with the driving pulley 31.

When it is time to remove the worn-out wheel and to replace it with a new wheel, it is necessary for the operator to readjust the position of the wheel guard to permit the insertion of a wheel of larger diameter. The wheel must be moved toward the left as view in Figs. 1, 2 and 5 to permit the operator to insert the new wheel on the grinding wheel spindle. The operator cannot readjust the wheel guards 18 and 19 to return them to their initial positions, due to the stop lugs 70 and 90 striking the surface 91 on the yoked member 72, until the yoked member 72 and pulley 32 have been moved longitudinally towards the right (Figs. 1 and 2) to bring the larger step of the pulley 32 into alignment with the driving pulley 31. This movement of the pulley and yoked member positions the parts so that the stop lugs 70 and 90 may drop into the

recess 92 adjacent the shoulder 71 on the yoked member 72. When the pulley 32 has been readjusted into this position, the operator may then readjust the wheel guards 18 and 19 to their initial position and then mount the new wheels in place on the spindle 12.

A cover 95 is provided to enclose the grinding wheel spindle and speed change mechanisms. This cover is attached to the base by suitable hinges 96 and locked in position by screws 97. The operator may loosen the cover 95 and then swing it rearwardly to obtain access to the speed change mechanism. A suitable tool rest 99 is adjustably supported on a shaft 100 to support the work piece in operative relation with the grinding wheel.

The operation of this mechanism will be readily apparent from the foregoing disclosure. Assuming that new wheels have been mounted on the spindle and the parts are in the position as illustrated in Fig. 1, then as grinding proceeds the wheels are worn away and the operator at intervals adjusts the position of the wheel guards 18 and 19 relative to the base to maintain the spark shields 25 in proper relation with the peripheries of the wheels 14 and 15. When this adjustment has been sufficient to rock both of the independently movable stop lugs 70 and 90 out of the path of the shoulder 71, the operator may then open the cover 95 and loosen the set screw 37 in the pulley 32, remove the drive belts 33 and slide the pulley 32 longitudinally toward the right as viewed in Fig. 3 to bring the step 35 into alignment with the pulley 31 and then lock the pulley by tightening set screw 37 in groove 39 on the spindle. The operator must then readjust the position of the motor to tension the driving belt 33 by manipulation of the adjusting screw 47. The cover 95 may then be closed and grinding resumed. This adjustment repositions the yoked member so that the shoulder 73 is in engagement with the stop lug 70 to prevent further increase of speed until the grinding wheels have worn away to a predetermined but smaller diameter.

Grinding may be continued until the wheel guards have been adjusted a sufficient amount to swing the stop lugs 70 and 90 from the path of the shoulder 73 and the operator may then similarly remove the driving belts from the step 35, slide the pulley 32 longitudinally to position the step 36 in alignment with the pulley 31 and then tension the belt 33 as previously described. This setting of the speed change mechanism continues until the grinding wheel has worn away and must be replaced by a new wheel. Before a new set of wheels may be placed on the machine, the operator must reset the speed change pulley 32 to its initial position and then readjust the wheel guard.

Having thus described the invention, what is claimed as new is:

1. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on said spindle, an adjustable wheel guard surrounding said grinding wheel, a driving motor in said base, driving connections between said motor and spindle including a slidable multi-step pulley on said spindle, a multiple step device movable with the pulley means including a stop which cooperates with one step of said device to normally prevent adjustment of said pulley to speed up the grinding wheel, and

means including a rock shaft controlled by movement of said wheel guard for moving the stop away from the step as the wheel guard is adjusted for wheel wear to permit increasing the speed of the grinding wheel when the wheel has worn away to a predetermined size.

2. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on said spindle, a contact member movable relative to the wheel periphery, a change speed driving means to rotate said spindle including a multi-step pulley slidably mounted on said spindle, a yoked member engaging the end faces of said pulley, a stop normally preventing movement of said yoked member and said pulley, and connections between said stop and contact member arranged to move said stop when the wheel guard is adjusted to compensate for wheel wear which prevents sliding said yoked member and pulley.

3. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on said spindle, an adjustable wheel guard surrounding said wheel, a change speed driving means to rotate said spindle including a multi-step pulley slidably mounted on said spindle, a yoked member engaging the end faces of said pulley, a stop normally preventing movement of said yoked member and said pulley, and connections between said stop and wheel guard arranged to move said stop when the wheel guard is adjusted to compensate for wheel wear which permits said yoked member to slide the pulley and increase the speed of the grinding wheel.

4. A grinding machine comprising a grinding wheel spindle, a grinding wheel on each end thereof, two independently movable contact members, each being movable towards and from the periphery of a wheel and limited in its movement by contact with the wheel, a speed control device for regulating the wheel speed which has a movable control member, separate stop devices located in the path of said control member, and separate connections between each stop device and an associated contact member so arranged as to prevent operation of the speed control device to increase the wheel speed until both contact members have been moved through predetermined distances towards the wheel centers.

5. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on each end thereof, means for rotating the spindle, a contact member movable toward and from the periphery of each wheel and limited in its movement by contact with the wheel, a speed control device for regulating the wheel speed, including a movable control member, and two separate stops independently movable into or out of the path of the control member to prevent or permit movement thereof, each stop being operatively connected to be moved by one of the contact members and said parts being so arranged that both of the stops must be moved through a predetermined distance before the control device may be moved to increase the speed of the wheel.

6. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on each end thereof, a contact member movable towards and from the periphery of each wheel and limited in its movement by contact with the wheel, a speed control device for regulating the wheel speed including a movable

control member, and two separate pivotally mounted stops engageable with said control member, each being operatively connected to be rocked by movement of one of the contact members and so arranged that both of the stops must be rocked through a predetermined distance before the control device may be moved to increase the speed of the wheel.

7. A grinding machine comprising a base, a spindle rotatably mounted thereon, a grinding wheel on each end thereof, a guard surrounding each wheel, each guard being movable towards and from the periphery of a wheel and limited in its movement by contact with the wheel, a

speed control device including a multi-step pulley slidably keyed to said spindle, a yoked member engaging the ends of said pulley and movable therewith, a stepped surface on said yoked member, and two separate pivotally mounted stops engageable with said stepped surface each being operatively connected to be rocked by movement of one of the guards and so arranged that both of the stops must be rocked clear of a given step before the pulley may be moved to increase the speed of the wheel.

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| 25 | 90  |
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| 40 | 105 |
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| 65 | 130 |
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