

Aug. 11, 1925.

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POSITIONING DEVICE FOR WHEELS OF GRINDING MACHINES

Filed Feb. 23, 1922

3 Sheets-Sheet 1

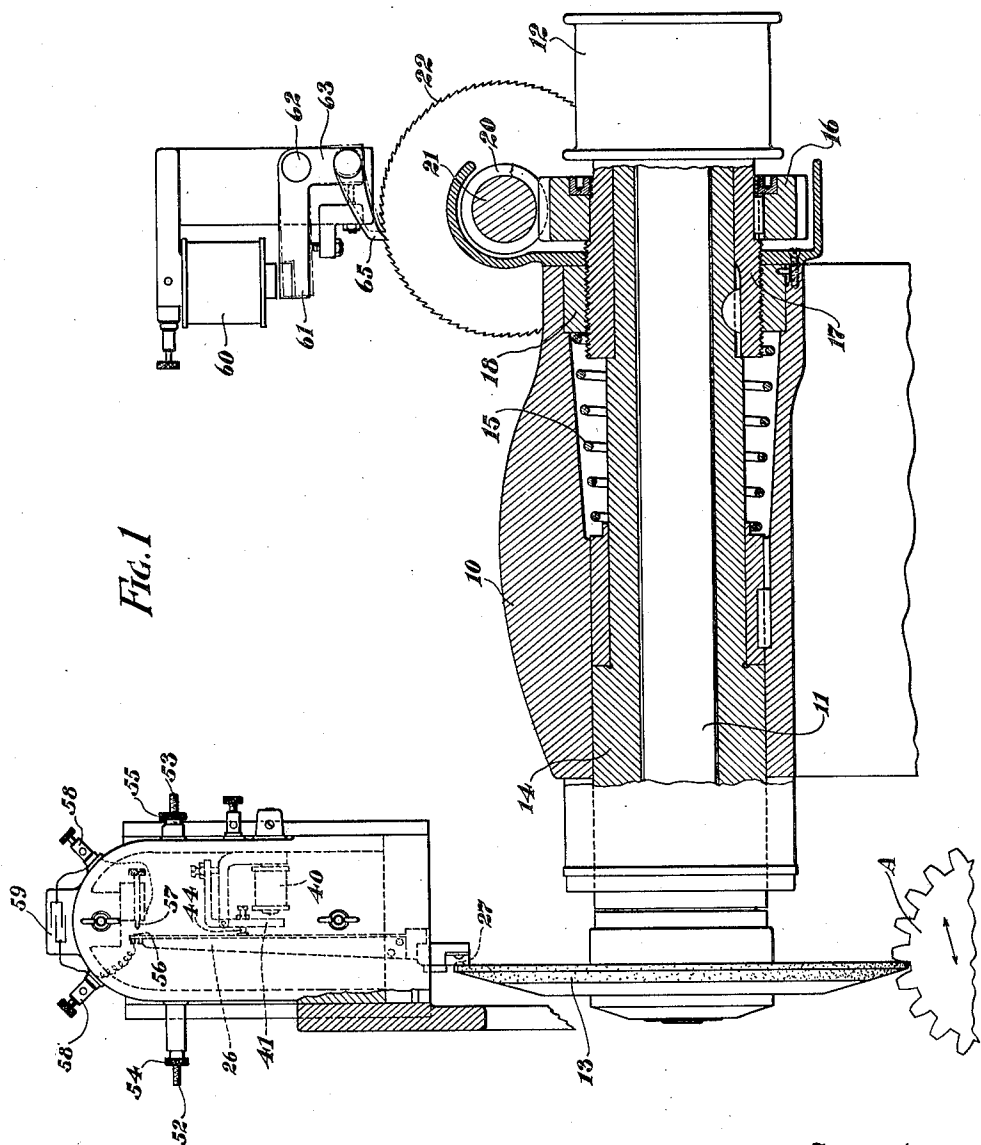


Fig. 1

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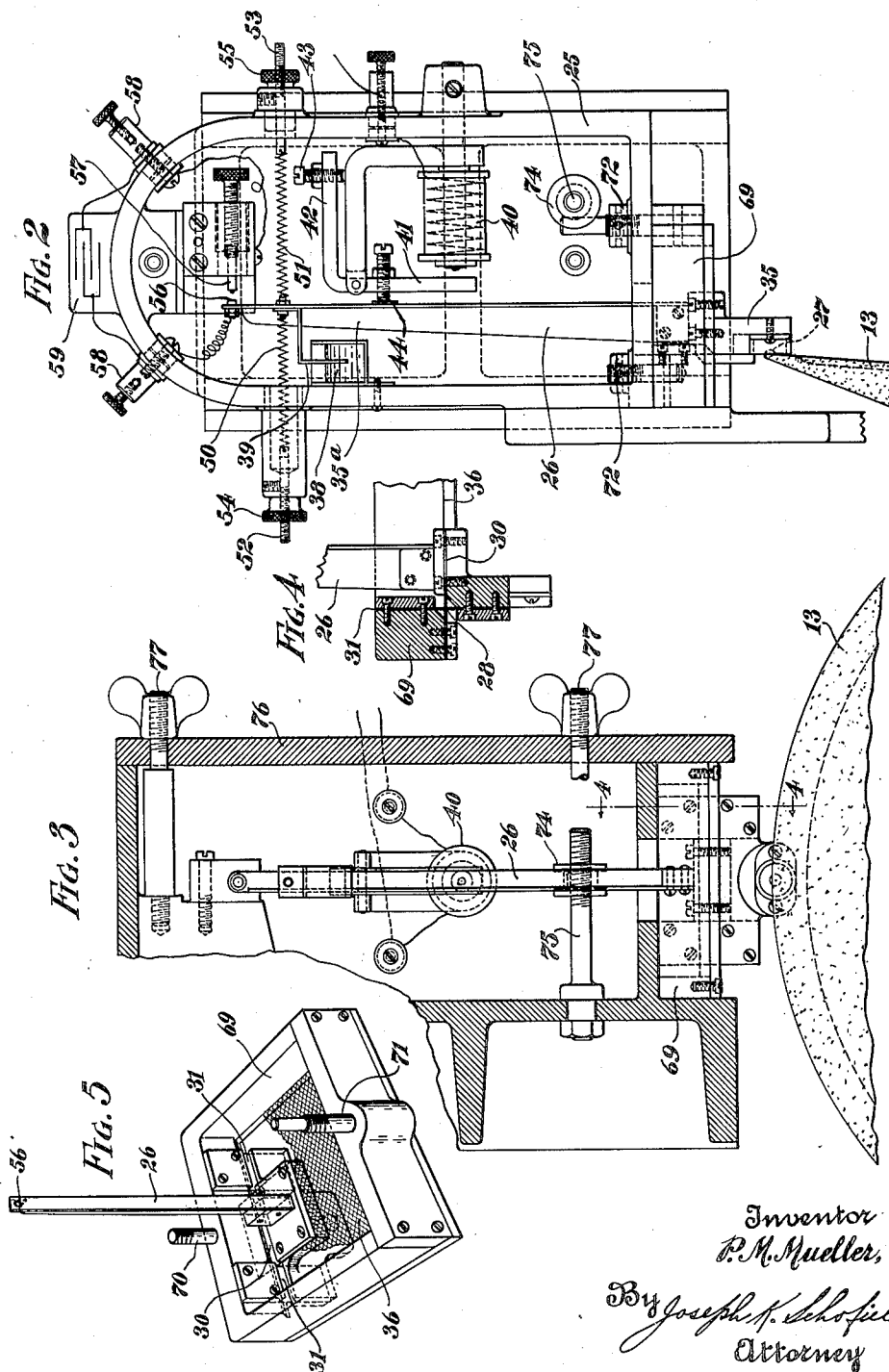
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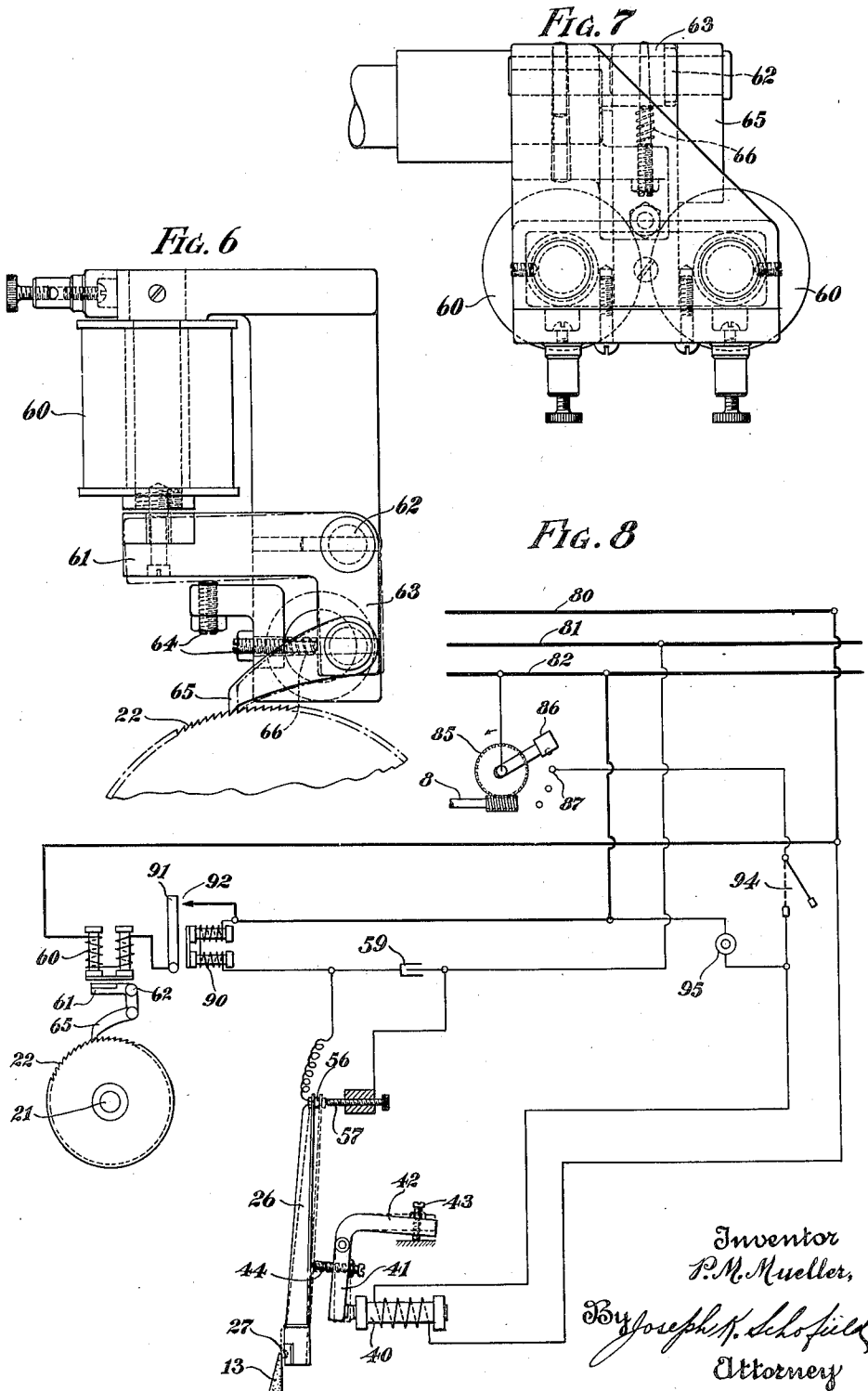
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE.

PAUL M. MUELLER, OF HARTFORD, CONNECTICUT, ASSIGNOR TO PRATT & WHITNEY COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

POSITIONING DEVICE FOR WHEELS OF GRINDING MACHINES.

Application filed February 23, 1922. Serial No. 538,592.

To all whom it may concern:

Be it known that I, PAUL M. MUELLER, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Positioning Devices for Wheels of Grinding Machines, of which the following is a specification.

This invention relates to a positioning device for the wheel of a grinding machine designed to maintain its work engaging surface in a predetermined precise position.

Particularly this positioning device is adapted for use in connection with a gear tooth generating machine and is used to periodically so move the wheel that its work engaging surface will be maintained, always in a fixed plane, and, as the wheel is worn, the amount worn away will be compensated for by this movement of the wheel.

An object of the present invention is to provide an improved construction of this type in which an abrasive wheel is moved along its axis of rotation a predetermined small amount as the wheel is worn away. Another object of the invention is to provide positive means for periodically moving the wheel axially fixed small distances which cannot be exceeded but which may be adjusted within small amounts.

Another feature of advantage is that a lever carrying a diamond adapted to be positioned against the wheel is fixed in such a manner that the axis about which it oscillates can have no lost motion and therefore its position cannot vary from time to time. This flexible mounting for the pivoted lever is preferably formed by two or more flexible metal strips, the members of which are set at right angles to each other. Upon the periodic oscillation of the lever, the diamond, or other contacting member, is moved into a predetermined exact position and, if not prevented from oscillating to that position by the wheel, makes a contact closing an electric circuit and forces the wheel to move an amount equal to that worn away. The closing of the circuit by the lever serves to actuate a pawl in contact with a ratchet wheel, rotation of which advances the wheel and thus but one movement of this

pawl is possible at each oscillatory movement of the lever.

With the above and other objects in view, my invention consists in the features of construction and operation set forth in the following specification and illustrated in the accompanying drawings.

In the accompanying drawings annexed hereto and forming a part of this specification, I have shown my invention embodied in a gear tooth grinding machine but it will be understood that the invention can be otherwise embodied and that the drawings are not to be construed as defining the scope of the invention, the claims appended to this specification being relied upon for that purpose.

In the drawings:

Figure 1 shows a general view of a grinding wheel mounting provided with the present invention.

Fig. 2 is a front view of the positioning lever and electrical mechanisms co-operating therewith.

Fig. 3 is a side view of the same.

Fig. 4 is a detail view on an enlarged scale of the flexible support for the oscillating lever.

Fig. 5 is an axiometric view of the lever.

Fig. 6 is a view of the ratchet wheel by means of which the wheel spindle is advanced axially, together with the electromagnet for operating the pawl in engagement with the ratchet wheel.

Fig. 7 is a top view of the same.

Fig. 8 is a diagrammatic view of the electrical circuits used in connection with the present invention.

In the above mentioned drawings, I have shown but one modification of the invention which is now deemed preferable but it is to be understood that changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

Briefly, my invention in its broadest aspect comprises the following principal parts; first, a mounting for a grinding wheel adapted to permit rotation of the wheel and also a movement axially of the wheel and its spindle; second, a wheel contacting lever adapted to be periodically oscillated to contact with one of the work engaging surfaces

of said wheel; third, an electric circuit closed upon movement of the lever beyond a predetermined critical position; fourth, electromagnetic means operated by the closing of said circuit to move a pawl relative to a ratchet wheel; and fifth, means associated with said ratchet wheel so that rotation of the ratchet wheel will advance the grinding wheel spindle a predetermined minute distance.

Referring more in detail to the figures of the drawings, in Fig. 1, I have shown a wheel head 10 having a wheel spindle 11 therein adapted to be rotated by means of a pulley 12 mounted at one end thereof. The wheel 13 is secured at the opposite end of the spindle 11 and engages the work upon one of its radial faces. The wheel spindle 11 is preferably contained within an elongated sleeve 14, the position of which may be axially varied. As shown clearly in Fig. 1, the sleeve is resiliently forced in one direction by a spring 15 and is bodily moved axially by rotation of a gear wheel 16 fixed to the member 17. A member 17 keyed to the sleeve 14 and rotated therewith is threaded into and operates in conjunction with a nut 18 fastened into the wheel head 10. Member 17 is also keyed to the gear 16 so that rotation of the gear 16 rotates member 17 within the nut 18 and moves the sleeve 14 axially a small distance. A worm 20 is in engagement with the gear 16 on the sleeve 17 and is mounted on a shaft 21 having a ratchet wheel 22 also mounted thereon. From the above description, it will be seen that rotation of the ratchet wheel 22 will rotate the sleeve 14 and therefore advance the wheel 13, the sleeve 14 and spindle 11 in an axial direction.

The construction as above described is particularly adapted for use in connection with a grinding wheel adapted to grind the tooth curves of a gear upon a generating principle. The wheel 13 which may be one of a pair of oppositely disposed wheels is adapted to engage the tooth flanks of a gear upon a radial face normal to the axis about which it revolves. This face, as shown in Fig. 2, comprises a narrow annular surface normal to the axis of rotation of the wheel. During the operation of the machine, the gear blank is rolled past the work engaging surface of the wheel 13 by any preferred mechanism to simulate the intermeshing action of a gear rolling upon a rack, the narrow annular cutting surface of the wheel 13 being disposed in the plane of one of the sides of a tooth on the rack.

It will be seen that continuous operation of the wheel 13 against the gear A will wear away its work engaging surface so that the tooth curve generated thereby will not be maintained precisely correct unless the wear of the wheel is compensated. It

is therefore the function of the present invention to provide positive means for periodically advancing the wheel 13 in an axial direction so that the axial movement of the wheel will compensate for the amount worn. This I accomplish by the means shown generally in Fig. 1 the parts of which are more clearly shown on an enlarged scale in the remaining figures.

Referring first to the mechanism described in Figs. 2 to 5, it will be seen that a housing 25 is provided in which is mounted an elongated lever 26 one end of which depends below the housing 25 and engages the narrow work engaging surface of the wheel 13. Preferably, a diamond 27 or other substance of great hardness is mounted at this lower end of the lever 26. The lever 26 is pivoted about an axis 28 formed by the planes of intersection of thin plates of flexible material such as thin steel strips 30 and 31. These as shown are disposed at right angles to each other, one plate 30 engages a portion of the housing 25 and extends horizontally to be engaged at its other end by the lever 26. Also strips 31 of which there are preferably two are disposed on each side of the horizontal strip 30 in a vertical plane and have one end fast to a portion of the housing 25 and another part fast to the lever 26. The above described flexible or hinged connection for the lever 26 avoids all possibility of lost motion and thus precisely defines an axis about which it may oscillate. This prevents any errors in positioning of the wheel 13 due to variations in positions of the lever 26 caused by its oscillating about slightly different axes.

For convenience of manufacture and for other purposes, the lever 26 is made up of two portions, one portion 35 being provided below the horizontal flexible strip 30 and the second part 35^a forming the elongated member extending into the housing above this strip 30. In order to prevent dust or other material entering the housing which might seriously affect the operation of the contacts and the precision of the mechanism, I mount a screen 36 to entirely enclose the lower opening of the lever mounting. This may be of any very fine mesh cloth or other material, and, as it is flexible it will not interfere with the oscillation of lever 26. It may conveniently be extended between the two portions of lever 26 namely 35 and 35^a.

To prevent slight oscillations of the lever 26 due to vibrations to which it may be subjected by the action of the machine and which would adversely affect the precision of the device, a small dash pot 38 is provided which may be mounted inside the housing 25 as shown in Fig. 2. This comprises a small receptacle fastened to the housing and which may be partly filled with a heavy liquid. An arm 39 having a broad

surface dipping into this liquid may be fastened, as shown, to the lever 26. By this means any slight oscillations to which the lever 26 may be subjected are prevented without interfering with the operation or precision of the device.

The lever 26 is periodically oscillated slightly so that the diamond 27 or other member placed in the lower end of the lever 26, may contact at short intervals of time with the work engaging surface of the wheel 13. In order to periodically oscillate this lever, an electromagnet 40 is energized, preferably from a time controlled mechanism which may be of any suitable form and which except in combination with the novel mechanism forms no part of the present invention. The energizing of this electromagnet 40 oscillates a weighted bell crank one limb 41 of which forms the armature of the electromagnet 40. The opposite end 42 is weighted and provided with adjustable means to limit the oscillatory movement of this member. This adjustment comprises a screw 43 and lock nut which are in threaded engagement with the armature member and limit the movement of this lever when the current through the electromagnet 40 is discontinued. At that time the armature 41 moves away from the ends of the coils due to the weight of the extension 42 of armature 41. This armature 41 also carries an adjustable screw 44 which in the view shown in Fig. 2 is in contact with one face of the lever 26. Movement of the armature 41 removes this adjustable stop 44 far enough to permit a very slight oscillation of the lever 26 which therefore permits the diamond 27 to contact with the work engaging surface of the wheel 13.

As shown most clearly in Fig. 2, springs 50 and 51 are provided fixed to opposite sides of the lever 26, their opposite ends being retained in threaded members 52 and 53 extending through opposite sides of the housing 25. By means of threaded nuts 54 and 55 engaging these adjusting members 52 and 53, the tension of the springs 50 and 51 may be varied. These springs 50 and 51 are so adjusted that the lever 26 is resiliently forced to oscillate slightly in a clockwise direction when permitted to oscillate by movement of armature 41. As soon therefore as the electromagnet 40 oscillates the armature 41 the springs 50 and 51 oscillate the lever 26 to permit contact of the diamond 27 with the wheel 13. Should the work engaging surface of the wheel 13 be worn away sufficiently to permit a maximum oscillation of the lever 26 contact at the upper end of the lever 26 is made between a member 56 on the lever 26 and an adjustable contact 57 mounted within the housing 25. This contact closes an electrical relay circuit which will be described more particularly later,

the wires of which are brought out to binding posts 58 fastened into the upper portions of the housing 25. Preferably, a small condenser 59 is interposed between the binding posts 58 as shown in Fig. 2 to protect the contacts from arcing at the repeated making and breaking of the circuit.

The closing of this contact between members 56 and 57 closes an electric circuit and through a relay switch closes a circuit and energizes the electromagnet 60 shown in Figs. 6 and 7. This electromagnet 60 when energized draws its armature 61 towards the coils, the armature 61 being pivoted about an axis formed by a pin 62 mounted adjacent the magnet support. Movement of the armature 61 oscillates an angular extension 63 of this armature in a direction at right angles to the movement of the armature 61. Preferably the movement of the armature 61 is limited by two stops 64 which are preferably made adjustable as shown. These are in the form of threaded members the position of which may be adjusted to allow a variable amount of oscillatory movement of the armature 61. A light spring 66 also is preferably placed adjacent the armature 61 to return it to its original position when the magnet 60 is de-energized. On the armature extension 63 is mounted a pawl 65 which, with each movement of the armature 61, is moved back and forth a variable distance which may be adjusted by adjustment of stops 64. Movement of this pawl 65 in one direction advances the ratchet wheel 22 above referred to and rotation of this ratchet wheel 22 advances the wheel 13 upon which the wheel spindle 11 is mounted an exceedingly small distance.

For convenience in setting up the mechanism so that the action of the contacting lever will maintain the work engaging surface of the wheel in a predetermined plane, the lever 26 and its mounting may be adjusted slightly relative to the housing 25. The means for adjusting the position of the lever 26 is shown in Figs. 2 and 5.

Preferably the lever support or mounting 69 shown detached in Fig. 5 is held to the lower face of the housing 26 by two screws 70 and 71. These screws 70 and 71 are engaged by nuts 72 within the housing 25, the screws passing through suitable slots in the lower wall of the housing. To adjust the mounting 69 and the lever 26 the nut 72 on screw 71 is first loosened and the mounting 69 turned about the screw 70 as a pivot. As shown in Fig. 5, screw 71 is extended and as indicated in Figs. 2 and 3 engages a grooved roll 74 rotatable on a fixed threaded rod 75 extending laterally through the housing 25. The mounting 69 for lever 26 may therefore be very accurately adjusted by manually rotating the roll 74 and after the adjustment has been completed the nuts 72

may be tightened and the mounting held securely in adjusted position. On one side of the housing 25 is a removable plate 76 detachably held in place by screws 77. By moving this plate 76 adjustment of the lever 26 about the axis of screw 70 is possible. Also inspection of the parts within the housing is facilitated. This adjustment of support 69 about screw 70 may be supplemented by adjustment of the contact 57. By adjustment of both these parts, the work engaging surface can be maintained in any critical plane relative to the position of the lever 26.

The electrical circuits for operating the above described mechanism are shown diagrammatically in Fig. 8 and will now be described in detail. Preferably two sources of electric current are provided so that circuits may be operated at two different voltages. These two sources comprise three main wires or bus bars 80, 81, and 82, the voltage between one pair 81 and 82 being about two or three volts, and the voltage between the outside bus bars 80 and 82 being six or eight volts. The positioning device as above stated preferably is operated periodically at regular intervals of time, and, to energize the circuits involved, I make use of a constantly operating mechanism including a worm 84 in engagement with a worm wheel 85. On the same shaft as the worm wheel 85 is a contact member or lever 86 adapted to make contact with a plurality of circuits, one for each positioning device on each machine. But one set of circuits for a single positioning device is shown in the diagram. It will be understood, however, that any number of positioning devices on the same or different machines may be operated by this time controlled device 84 and 85. When the lever 86 makes contact with the stud 87 shown, it closes a circuit energizing the electromagnet 40 previously referred to. This moves the armature 41 and permits oscillation of the lever 26 in a clockwise direction under the influence of springs 50 and 51 shown in Fig. 2. If the work engaging surface of wheel 13 is worn the lever 26 makes contact between parts 56 and 57 as above described and closing of this latter contact energizes a relay circuit between bus bars 81 and 82 and energizes an electromagnet 90 which then draws its armature 91 toward the coils. With the armature 91 in its position toward the coil, a relay switch 92 is closed completing a circuit between bar 80, the electromagnet 60 and the bus bar 82. This energizes electromagnet 60 which draws the armature 61 towards the coil 60. The pawl 65 is oscillated as above described.

A switch 94 is provided in the time operated circuit so that individual positioning devices may be thrown out of operation. Also, a connection is provided having a push

button switch 95 which may be used to close the circuit including the electromagnet 40 whenever it may be desired independently of the circuit being operated by the time controlled means 84 and 85. This may be used to test the circuits and the operation of the positioning mechanism independently of the mechanism 84 and 85.

Coming now to a description of the operation of this device, it will be seen that with each periodic energizing of the electromagnet 40 within the housing by the time controlled means 84 and 85, the contact lever 26 is oscillated. If the wheel has worn away sufficiently to permit oscillation of the lever 26 to an extent to close the contacts 56 and 57 at the upper end of lever 26, the wheel 13 is advanced axially an extremely small distance to compensate for that worn away by means of the magnet 60 and pawl 65. If, however, no wear of the wheel has occurred, the lever 26 is oscillated slightly but not sufficiently to close the contacts 56 and 57 and therefore the circuit including the magnet 60 is not closed and consequently no movement of the wheel spindle 11 takes place.

What I claim is:

1. A positioning device for the wheel of a grinding machine comprising in combination, a wheel, a wheel head, a longitudinally movable sleeve, a rotatable spindle for said wheel within said sleeve, means to advance said sleeve and wheel predetermined small distances comprising a ratchet wheel connected to said sleeve whereby rotation thereof axially advances said wheel and spindle, a pawl mounted adjacent said ratchet wheel, electromagnetic means to actuate said pawl and rotate said ratchet wheel, a lever adapted to contact with said wheel, and means operated thereby to energize said magnetic means when the wear of the wheel reaches a predetermined amount.

2. A positioning device for the wheel of a grinding machine comprising in combination, a wheel, a wheel head, a longitudinally movable sleeve, a rotatable spindle for said wheel within said sleeve, means to advance said sleeve and wheel predetermined small distances comprising a ratchet wheel connected to said sleeve whereby rotation thereof axially advances said wheel and spindle, a pawl mounted adjacent said ratchet wheel, electromagnetic means to actuate said pawl and rotate said ratchet wheel, and wheel contacting means adapted to close an electric circuit when the wear of the wheel reaches a predetermined amount, said circuit operating a relay switch and closing a circuit to energize said electromagnetic means.

3. A positioning device for the wheel of a grinding machine comprising in combination, a wheel head, a wheel rotatably mounted therein, means to adjust the position of the wheel axially comprising a ratchet wheel

and a pawl engaging therewith, a member adapted to contact with a work engaging surface of said wheel, means to periodically move said member toward said wheel, and
5 an electrical circuit adapted to be closed by extreme movement of said member to energize an electromagnet to actuate said pawl and thus advance said wheel.

4. A positioning device for the wheel of
10 a grinding machine comprising in combination, a wheel head, a wheel rotatably mounted therein, means to adjust the position of the wheel axially comprising a ratchet wheel and a pawl engaging there-
15 with, a member adapted to contact with a work engaging surface of said wheel, means to periodically move said member toward said wheel, an electrical circuit adapted to be closed by extreme movement of said
20 member, and a relay circuit closed thereby adapted to energize an electromagnet to actuate said pawl and rotate said ratchet wheel thus advancing said wheel.

5. A positioning device for the wheel of a
25 grinding machine comprising in combination, a casing, an oscillating lever therein having a wheel contacting member at one end and adapted to close a switch when oscillated to one position, and flexible means
30 connecting said lever to said casing, said flexible means comprising three thin flexible strips, two of said strips being in the

same plane, and the other strip being in a plane normal thereto whereby the axis about which the lever may oscillate is fixed. 35

6. In a positioning device for the wheel of a grinding machine, a flexible mounting for a lever therein comprising in combination, a casing, a lever adjacent thereto, flexible means connecting said lever to said casing
40 comprising three flexible metallic strips, two of said strips being in the same plane, and the other strip in a plane normal thereto, a wheel contacting member near one end of said lever, and a switch opened and closed
45 by oscillation of said lever.

7. In a positioning device for the wheel of a grinding machine, a flexible mounting for a switch closing lever comprising therein in combination, a casing, a lever adjacent there-
50 to, flexible means connecting said lever to said casing comprising three flexible metallic strips, two of said strips being in the same plane, and the other strip in a plane normal thereto, a wheel contacting member
55 near one end of said lever, a switch mounted near the opposite end, and means to periodically oscillate said lever to close said switch when said lever is oscillated beyond a critical position. 60

In testimony whereof, I hereto affix my signature.

PAUL M. MUELLER.