E. R. CONNERS.

MECHANISM FOR TRUING AND DRESSING GRINDING WHEELS.

APPLICATION FILED OCT. 7, 1920.

1,395,394. Patented Nov. 1, 1921.

2 SHEETS—SHEET 1.

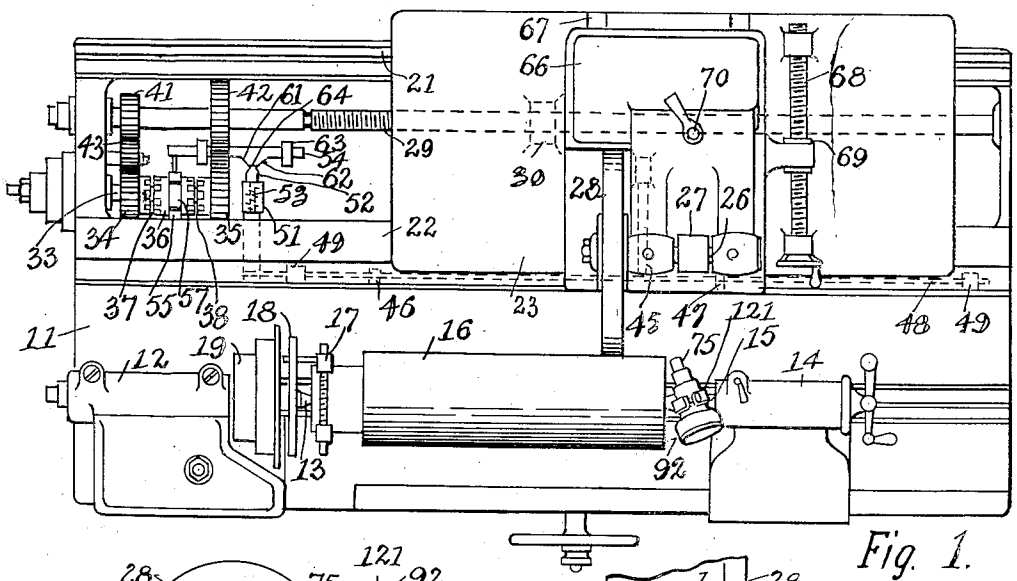


Fig. 1.

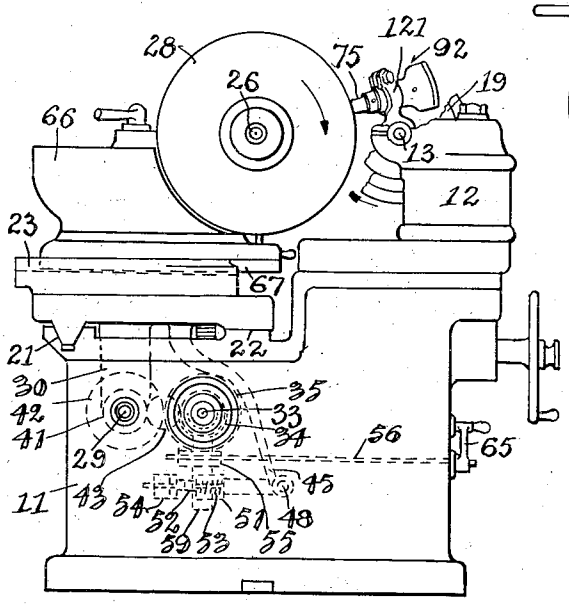


Fig. 2.

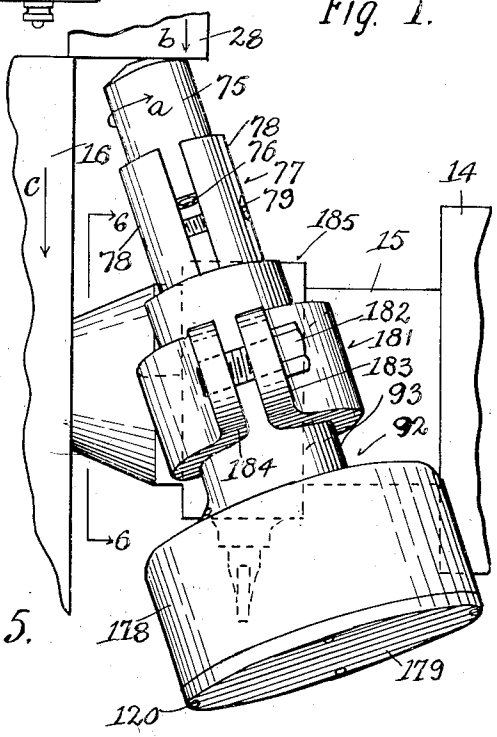


Fig. 5.

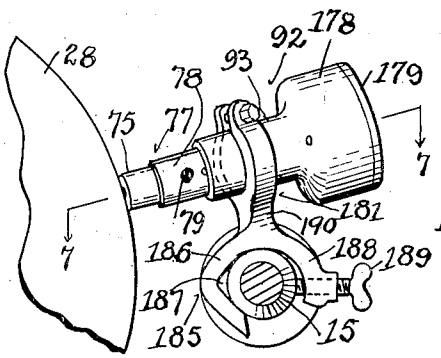


Fig. 6.

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2 SHEETS—SHEET 2.

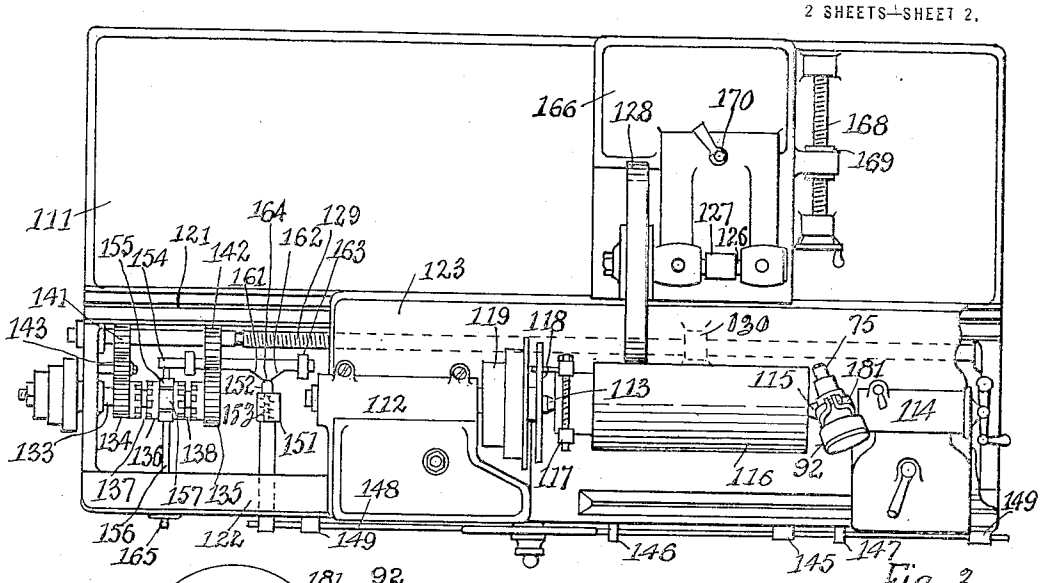


Fig. 3.

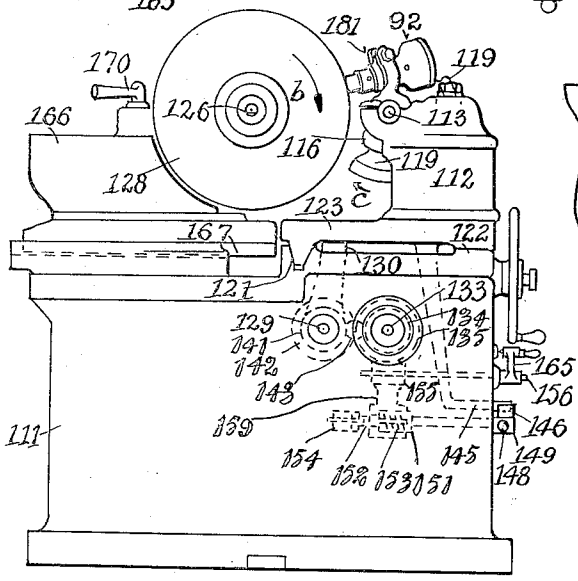


Fig. 4.

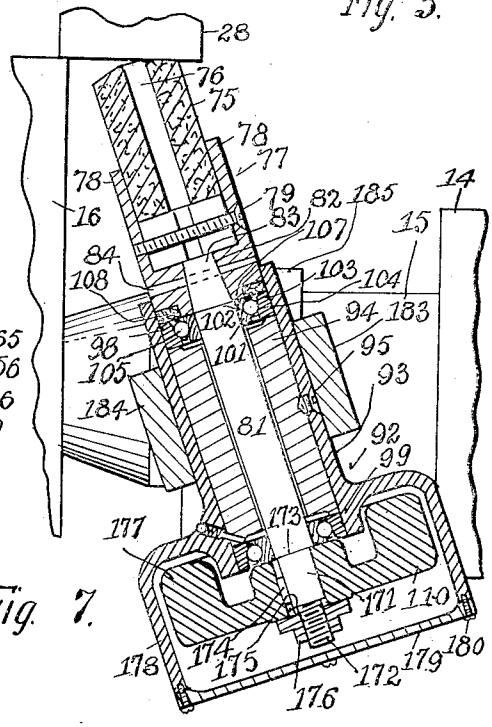


Fig. 7.

Inventor:

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UNITED STATES PATENT OFFICE.

EDWARD R. CONNERS, OF CINCINNATI, OHIO, ASSIGNOR TO THE PRECISION TRUING MACHINE AND TOOL COMPANY, OF CINCINNATI, OHIO, A CORPORATION OF OHIO.

MECHANISM FOR TRUING AND DRESSING GRINDING-WHEELS.

1,395,394. Specification of Letters Patent. Patented Nov. 1, 1921.

Application filed October 7, 1920. Serial No. 415,402.

To all whom it may concern:

Be it known that I, EDWARD R. CONNERS, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Mechanism for Truing and Dressing Grinding-Wheels, of which the following is a specification.

My invention relates to mechanism for truing and dressing grinding wheels, such as emery wheels, employed in grinding or polishing machinery for grinding or polishing the surfaces of metal in precision grinding. A usual means heretofore employed in truing and dressing operations has been a diamond tool, comprising a diamond made to contact the grinding surface of the grinding wheel, but diamonds have become very scarce and very expensive.

It is the object of my invention to provide means to dispense with the use of diamonds for these purposes.

My present invention is an improvement on the inventions shown, described and claimed in my copending applications for Letters Patent of the United States, Serial No. 199,889, filed November 2, 1917, and Serial No. 366,970, filed March 18, 1920, both for devices for truing and dressing grinding wheels, and is an elaboration of the invention shown, described and claimed in by copending application for patent on improvements in mechanism for truing and dressing grinding wheels, Serial No. 415,402, filed October 7, 1920.

It is the object of my present invention to provide novel means comprising a rotary abrading part so positioned that its axis of rotation is presented toward the grinding wheel with which it coacts so as to be rotatively actuated by the grinding surface of the grinding wheel, and, further, to provide means therefor for maintaining the rotary movement imparted thereto; further, to provide novel positioning means for a device of this character; and, further, to provide an abrading stub or pencil arranged for having end contact with the grinding surface of the grinding wheel being trued or dressed, and means rotated by said grinding surface for maintaining rotation of the rotary abrading part.

The invention will be further readily understood from the following description and claims, and from the drawings, in which latter:

Figure 1 is a plan view of my improved device applied to a grinding machine having a reciprocating carriage for the grinding wheel.

Fig. 2 is an end view of the same, partly broken away for better illustration of parts.

Fig. 3 is a plan view of my improved device applied to a grinding machine having a reciprocating carriage for the work.

Fig. 4 is an end view of the same, partly broken away.

Fig. 5 is an enlarged plan view of my improved device shown in connection with a grinding wheel to be trued or dressed, the latter partly broken away.

Fig. 6 is a perspective view of my improved device, showing the same mounted for truing and dressing a grinding wheel, partly broken away, and partly in cross-section on the line 6—6 of Fig. 5; and,

Fig. 7 is an axial section of my improved device taken on the line 7—7 of Fig. 6, and showing the device in position of use.

My invention is applicable to machines employing a grinding wheel carriage, or a work carriage, and in other relations than that herein particularly shown and described, for instance, in a relation in connection with a machine of the character shown and described in my aforesaid copending application, Serial No. 415,402, filed October 7, 1920.

A machine employing a grinding wheel carriage is one in which the grinding wheel is caused to have movements in reverse directions along the work being ground, and a machine employing a work carriage is one in which the work is caused to have movements in reverse directions lengthwise of the axis of rotation of the grinding wheel.

My invention is exemplified as applied to a machine of the former type in Figs. 1 and 2, and to a machine of the latter type in Figs. 3 and 4.

Referring to Figs. 1 and 2, 11 represents the machine frame, and has thereon a head-stock 12 comprising a head-center 13, and a tail-stock 14 comprising a tail-center 15, suitable well-known means being provided for causing approach and recession between the head-stock and tail-stock according to the length of work, and for moving the tail-center axially for supporting the piece of work. The work is represented as a heavy shaft 16 between said centers. Suitable means are provided for clamping the work to the head-spindle on which the head-center is located, as by a clamp 17 extending from the face-plate 18, fast on the head-spindle. The head-spindle is rotated by a suitable belt passing about a step pulley, 19, fast on the head-spindle.

The frame has guideways 21, 22, thereon, along which a carriage 23 is arranged to slide lengthwise of the axes of the head and tail spindles. The carriage has thereon a shaft 26 arranged to be suitably driven, as by a belt received about a pulley 27 fast on said shaft, the shaft also having releasably clamped thereon, a grinding wheel 28 which during the grinding operation moves with the carriage, the periphery of the grinding wheel in the present instance coacting with the surface of the rotating work for grinding or polishing the latter. Suitable means are provided for the movement of the carriage lenthwise of the work, exemplified as comprising a screw-rod 29, journaled in suitable bearings on the frame and having threaded connection with the carriage by means of a nut 30 fast on the carriage.

The screw-rod is arranged to be rotated in opposite directions by a shaft 33 having gears 34, 35, normally loose thereon, a clutch-collar 36 having suitable spline and key connection with said shaft. The clutch-collar is located between said gears, the said gears and said clutch-collar having the coacting teeth of clutches 37, 38, thereon.

Gears 41, 42, are fixed to said screw-rod. The gear 35 meshes with the gear 42. The gear 34 meshes with an intermediate gear 43, which in turn meshes with the gear 41. When the clutch 37 is in engagement, the screw-rod rotates in one direction, and when the clutch 38 is in engagement, the screw-rod rotates in the opposite direction, whereby the carriage is arranged to be moved lengthwise of the work-support in opposite directions.

Means are provided for automatically reversing the movement of the carriage, accomplished, for instance, by providing a carriage with a tappet-lug 45 arranged to engage tappets 46, 47, respectively adjustably secured to a tappet-bar 48, slidable in bearings 49 on the frame. The adjustments may be made by reaching through the front of the machine-frame, which may be open. A socket-piece 51 is on the tappet-bar and has a finger 52 extending therefrom. The finger is pressed outwardly by a spring 53 in the socket of the socket-piece against a slide-bar 54.

A fork 55 is fixed to a rock-shaft 56, and is received in an annular groove 57 in the clutch-collar 36. The slide-bar is articulated with a tail-piece 59 of the fork 55. The slide-bar is provided with oppositely inclined faces 61 and 62, with which the finger coacts to push the slide-bar lengthwise in its bearing 63, when the finger is moved off the apex-face 64 of the slide-bar into engagement with either inclined face of the tappet-bar, the spring pressing the finger along the inclined face for imparting a quick endwise movement to the slide-bar and a quick engagement and disengagement of the respective clutches.

When the carriage moves the tappet-bar in one direction, the clutch 27 will become disengaged and the clutch 38 engaged, whereas, when the tappet-bar moves in the opposite direction, a reverse relation in the clutches will take place. Stoppage of movement of the carriage is accomplished by means of a hand-lever 65 fast on the rock-shaft 56, by means of which the clutch-collar is positioned for disengaging both clutches, in which relation the finger 52 rests on the flattened apex of the slide-bar.

It is necessary in order to obtain continuously true, accurate and desirable grinding, that the grinding wheel be maintained in proper grinding condition, that is to say, true and sharp. The grinding wheel may in course of operation become out of true, that is to say, its periphery or grinding surface will for instance no longer be a perfect cylinder, when such form is employed, or the grinding surface may in whole or in part become polished or substantially inactive for grinding by having its cavities filled with the material being ground, for instance, metal, or with refuse or dirt, or having the grains of the granular grinding surface dulled, in either or any of which cases it is necessary to repair the grinding surface of the grinding wheel.

For accomplishing this, or for continuously maintaining the grinding wheel in trued and dressed condition, I provide a rotary truing and dressing abrading part, preferably of a texture much harder than the texture of the grinding wheel to be trued or dressed, and of a texture preferably coarser than the texture of said grinding wheel, and composed for instance of carborundum. The said rotary abrading part is exemplified as a rotary abrading stub or pencil, preferably provided with an axial bore, and so presented to the rotating grinding face, that rotary motion is imparted to the abrading stub or pencil, which latter is preferably ar-

ranged to make substantial end contact with the grinding surface, and is preferably presented toward the abrading surface, so that its axis is at an angle at one side of a right angle to the axis of rotation of the grinding wheel, or to the vertical plane in which said right angle is located.

The movement between the contact or impinging portion of the rotary abrading stub or pencil and the grinding surface is preferably a swirling movement at the line of contact, due for instance to the variations of distance along said line of contact from the axis of rotation of the abrading pencil. The motion between the contacting line of the abrading pencil and the contacting line of the grinding surface is a differential motion, resulting in a wiping effect of the abrading stub or pencil upon the grinding surface, for wiping or drawing out the grinding offal from the cavities or pores of the grinding surface, and acting, throughout a portion of its contact-line, on the grains of the granular grinding surface with a motion reverse to the direction of grinding motion of the grinding surface upon the work, for sharpening the grains of the granular grinding surface.

I prefer that the rotary abrading pencil shall have a bore coincident with its axis of rotation so that the rotary abrading pencil at and adjacent to its axis of rotation shall be free of contact with the grinding wheel. The rotary abrading pencil is of comparatively small diameter with relation to the diameter of the grinding wheel, and is arranged to make substantial end contact with said grinding wheel in such manner that this end-contact shall preferably be at one side only of said axis of rotation, whereby the end contact surface of the rotary abrading pencil is substantially frusto-conical.

I further provide means whereby relative movement lengthwise of the axis of the grinding wheel takes place between the rotary abrading stub or pencil and the grinding wheel during the truing or dressing operation, and I preferably provide means, which may be employed if desired, whereby the grinding wheel may be dressed during the grinding operation.

I prefer to provide means whereby the rotary movement imparted to the abrading stub or pencil by the rotating grinding wheel is maintained effectively between intervals of contact between the rotary abrading stub or pencil and the grinding wheel so that, when contact is again made between said pencil and said wheel after momentary cessation of such contact, the rotation of the abrading stub or pencil will be with sufficient force and speed to act effectively with a truing and grinding function upon the grinding wheel, and for again receiving additional rotation from the grinding wheel without interruption of the rotary movement of the abrading stub or pencil.

Referring again to Figs. 1 and 2, means are provided for adjusting the distance between the grinding wheel and the work, exemplified as accomplished by mounting the bearings of the shaft of the grinding wheel on a slide 66 adjustable crosswise of the carriage on guides 67, as by means of an adjusting screw 68, journaled to the carriage, and having threaded connection with the slide by means of a nut 69 fixed to the slide. A clamp-bolt 70 secures the parts in adjusted positions.

Exemplifying my improved device as applied to a grinding machine having a work-carriage, and referring to Figs. 3 and 4, parts are shown similar to those in Figs. 1 and 2, with the difference that the work is mounted on a carriage so as to move lengthwise in opposite directions with relation to the grinding wheel, which is stationarily located, but having adjustment to and from the work by being mounted on a slide to move transversely to the direction of reciprocating movement of the work-carriage. In this exemplification the parts are designated by reference numerals, similar to the numerals applied to the parts in Figs. 1 and 2, but raised to the series 100, the screw having connection with the work-carriage for moving the work-carriage lengthwise of the axis of rotation of the grinding wheel, and the tappet-bar being operated by the work-carriage.

The rotary abrading stub or pencil, hereinafter called a pencil, of my improved device is designated by the numeral 75. Its bore is shown at 76. The bore is preferably small compared with the diameter of the pencil. The abrading pencil is shown releasably secured in a chuck 77, provided with relatively compressible jaws 78, pressed toward each other by means of a screw 79 for clamping the abrading pencil between said jaws. The chuck is fixed to a shaft 81, as by being provided with a taper socket 82, the shaft having a taper end 83 received in the socket, a taper pin 84 passing through the walls of the socket and shaft to hold the parts securely together in centered relation.

The shaft is received in a casing 92, part of which is shown as a barrel 93. A bushing 94 is located in the barrel, and is fixed therein by means of a set-screw 95. Ball-bearings 98, 99, are located at the respective ends of the bushing, these ball-bearings being combined radial and end-thrust bearings and each comprising an inner ring 101, having an annular ball-groove 102 therein, and an outer ring 103, having an outer end-thrust groove 104. The latter rings are oppositely disposed, and the construction is

such that end movements of the shaft are prevented. The inner rings are fixed to the shaft 81. Balls 105 are located between the rings of the respective bearings. The chuck has an inward annular extension 107, which bears against the inner ring of the ball-bearing adjacent to the rotary abrading pencil. An absorbent washer 108, for instance of felt, is located between the chuck and the ball-bearing adjacent thereto.

The shaft also carries a fly-wheel 110, secured thereto, as by means of providing the shaft with a reduced end 171, having a threaded end 172. The fly-wheel has a central hole through which the reduced end of the shaft is received, the fly-wheel impinging the annular shoulder 173 on the shaft. A key 174 in the shaft is received in a slot 175 in the fly-wheel for holding the parts against relative rotation. A nut 176 clamps the fly-wheel in place. The fly-wheel has a heavy rim 177, which projects inwardly to surround the ball-bearing adjacent thereto, placing said ball-bearing in the cup of said fly-wheel to place said ball-bearing in the line of radial stresses of said fly-wheel, to provide ease and smoothness of running of the rotary abrading pencil. The fly-wheel maintains effective rotation of the rotary abrading pencil between intervals of contact in the truing or dressing operation.

The barrel is provided with an enlargement 178, forming a cup received over the fly-wheel, a cover-plate 179, being preferably releasably secured to the cup as by screws 180, in order to inclose the fly-wheel in the cup and to form a closed cover or casing for the fly-wheel, the shaft and its bearings, so as to hold the same free of contact by the water or other lubricant which may be used in connection with the grinding operation.

The casing is secured relatively to the grinding wheel, as by providing a clamp bearing 181 received about the barrel, a bolt 182 being received through a hole in one of the wings 183 of said clamp-bearing and having threaded engagement with the wing 184 of said clamp-bearing, the clamp-bearing surrounding the barrel and the bolt clamping the barrel firmly in said bearing. The clamp-bearing is provided with an affixing part 185, shown as a clamp about the tail-center, and comprising a jaw 186 having an inner recess 187, and an arm 188, in which latter a set-screw 189 is threaded. The set-screw is arranged to impinge the tail-center and clamp the tail-center between it and the converging walls of the jaw.

There is a connection between the clamp-bearing and the clamp for presenting the clamp-bearing and consequently the barrel and abrading pencil in angular relation to the grinding surface of the grinding wheel and preferably at an angle to the axis of rotation of the grinding wheel at one side of a right angle or the vertical plane in which said right angle is located. This connection is shown as a twisted shank 190.

The abrading pencil may also be presented toward the grinding wheel so that its axis of rotation is radial to the grinding wheel, as shown in Figs. 2 and 4, or as a chord to the circle of the grinding wheel. The position of the barrel in the clamp-bearing may also be adjusted lengthwise of the barrel, and the position of the barrel, pencil and clamp-bearing may be adjusted about the axis of the tail-spindle, so that the abrading end of the abrading pencil will make contact with the grinding wheel when presented with its axis of rotation in a chord to the circle of the grinding wheel, either above or below said radial line. These adjustments may further determine the firmness of contact between the rotary abrading pencil and the grinding wheel.

Different degrees of fineness of truing or dressing are obtained by the various relations stated. A positioning of the rotary abrading pencil so that its axis of rotation is proximate to a line radial to the axis of rotation of the grinding wheel and at right angles to the latter axis, will result in a dressing of the grinding wheel with a finer surface, whereas, if the rotary abrading pencil is positioned with its axis of rotation describing a chord to the circle of the grinding wheel or at an angle to the side of said right angle, or the vertical plane in which said right angle is located, the grinding surface will be trued or dressed with a coarser surface, the degree of coarseness depending on the degree which the axis of rotation of the abrading pencil departs from a radial position.

The grinding wheel is instanced as rotating in the direction of the arrow *b*, the work as rotating in the direction of the arrow *c*, rotation being imparted to the abrading pencil by the grinding wheel in the direction of the arrow *a*.

The rotary abrading pencil is normally quiescent. The grinding wheel is preferably reciprocated during the truing or dressing operation, so as to pass beyond the rotary abrading pencil in each direction of its reciprocating movement. The movement of the grinding surface of the grinding wheel and the contact therewith of the end of the abrading pencil, imparts rotation to the rotary abrading pencil. The fly-wheel maintains this rotation effectively between the time the grinding wheel passes beyond the rotary abrading pencil and the time that the grinding wheel next makes contact with said pencil, so that, when said contact is made, the rotary abrading pencil is rotating with force for effective truing and dressing action on the grinding wheel, further ro-

tative force being applied to the abrading pencil by such contact. The rotation of the rotary abrading pencil is equalized and maintained by the fly-wheel. The rotation of the rotary abrading pencil is also rendered even or uniform by the fly-wheel.

My improved device is such that a great saving in the durability of the grinding wheel is accomplished, and effectiveness of the grinding wheel is enhanced, accomplished by the abrading pencil drawing or brushing the foreign substances out of the recesses or pores in the grinding surface with a swirling motion, and presenting a device to the grinding wheel which eliminates the danger of gouging into the grinding surface.

A wiping movement is imparted between the impinging surfaces of the abrading pencil and the grinding wheel at the points of impingement, there being a differential movement between said contact surfaces at the points of contact which acts effectively to clean and sharpen the grinding surface.

The truing and dressing functions may if desired take place during the grinding, as the grinding wheel may be caused to come in contact with the abrading pencil at each reciprocating movement of the grinding wheel while performing its grinding functions.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is:

1. In mechanism for truing and dressing grinding wheels, the combination of a grinding wheel, means for rotating said grinding wheel, a normally quiescent rotary abrading pencil positioned with its axis of rotation presented toward said grinding wheel, means for causing reciprocation between said grinding wheel and said rotary abrading pencil, and a fly-wheel for said rotary abrading pencil, said rotary abrading pencil and said fly-wheel rotated solely by said grinding wheel.

2. In mechanism for truing and dressing grinding wheels, the combination, with a grinding wheel, a normally quiescent rotary abrading pencil, means for positioning said rotary abrading pencil with its end coacting with said grinding wheel, means for reciprocating said grinding wheel to pass beyond said rotary abrading pencil and whereby to rotate said normally quiescent rotary abrading pencil solely by contact of the rotating grinding wheel with said rotary abrading pencil, and a fly-wheel for said rotary abrading pencil arranged to maintain effective rotation of said rotary abrading pencil between the times of cessation and renewal of rotating force applied to said rotary abrading pencil by said grinding wheel.

3. In mechanism for truing and dressing grinding wheels, the combination, with a grinding wheel, of a rotary abrading part presented with its axis of rotation toward the grinding surface of said grinding wheel, said rotary abrading part being normally quiescent, and a fly-wheel acting on said rotary abrading part to maintain its rotation, said rotary abrading part and said fly-wheel rotated solely by the grinding surface being treated.

4. In mechanism for truing and dressing grinding wheels, the combination, with a grinding wheel, of a rotary abrading pencil of harder and coarser texture than the texture of the grinding wheel being treated, means for presenting said rotary abrading pencil with its axis of rotation toward said grinding surface for end-contact between the end of said rotary abrading pencil at one side of its axis of rotation and said grinding surface, and a fly-wheel for said rotary abrading pencil to maintain and equalize rotation thereof.

5. In mechanism for truing and dressing grinding wheels, the combination, with a grinding wheel, of a rotary abrading pencil provided with an axial bore, means for presenting the end of said rotary abrading pencil at one side of said bore to the grinding surface of the grinding wheel, and a fly-wheel for said rotary abrading pencil, said rotary abrading pencil and said fly-wheel being normally quiescent and rotated solely by said grinding surface.

6. In mechanism for truing and dressing grinding wheels, the combination, with a grinding wheel, of a rotary abrading pencil, a shaft therefor, a casing, a bearing for said shaft in said casing, and a fly-wheel in said casing on said shaft, said fly-wheel having a rim received about said bearing.

7. In mechanism for truing and dressing grinding wheels, the combination of a grinding wheel, a tail-center, a normally quiescent rotary abrading pencil, a fly-wheel therefor, and means for adjusting said rotary abrading pencil and said fly-wheel about the axis of said tail-center and axially toward and from said grinding wheel, said rotary abrading pencil and said fly-wheel rotated solely by said grinding wheel.

8. In mechanism for truing and dressing grinding wheels, the combination of a grinding wheel, a normally quiescent rotary abrading pencil, a fly-wheel therefor, and means for positioning said rotary abrading pencil with its axis of rotation at an acute angle to a plane perpendicular to the axis of rotation of said grinding wheel, said rotary abrading pencil and said fly-wheel rotated solely by said grinding wheel.

9. In mechanism for truing and dressing grinding wheels, the combination of a grinding wheel, a tail-center, a normally quiescent rotary abrading pencil, a fly-wheel

therefor, means for positioning said rotary abrading pencil with its axis of rotation at an acute angle to a plane perpendicular to to the axis of rotation of said grinding wheel, and means for adjusting said rotary abrading pencil and said fly-wheel about the axis of said tail-center and axially toward and from said grinding wheel, said rotary abrading pencil and said fly-wheel rotated solely by said grinding wheel.

10. In mechanism for truing and dressing grinding wheels, the combination of a casing comprising a barrel, a shaft in said barrel, a rotary abrading pencil secured to said shaft and located beyond the end of said barrel, a fly-wheel on said shaft, and an inclosure about said fly-wheel.

11. In mechanism for truing and dressing grinding wheels, the combination of a casing comprising an elongated barrel, a shaft therein, a rotary abrading pencil secured to said shaft and located within the cylindrical projection of said barrel, a clamp-bearing arranged to be clamped about said barrel in various positions lengthwise of said barrel, attaching means for said clamping means, and a connection between said attaching means and said clamp-bearing locating the axis of said clamp-bearing at an angle to said attaching means.

12. In mechanism for truing and dressing grinding wheels, the combination of a casing comprising an elongated barrel, a shaft therein, a rotary abrading pencil secured to said shaft and located within the cylindrical projection of said barrel, a clamp-bearing arranged to be clamped about said barrel in various positions lengthwise of said barrel, an attaching clamp for said clamping means, and a twisted connection between said clamp and said clamp-bearing locating the axis of said clamp-bearing at an angle to said clamp.

In testimony whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

EDWARD R. CONNERS.

In presence of—
J. E. MOLONEY,
C. J. HECKERT.