

April 14, 1953

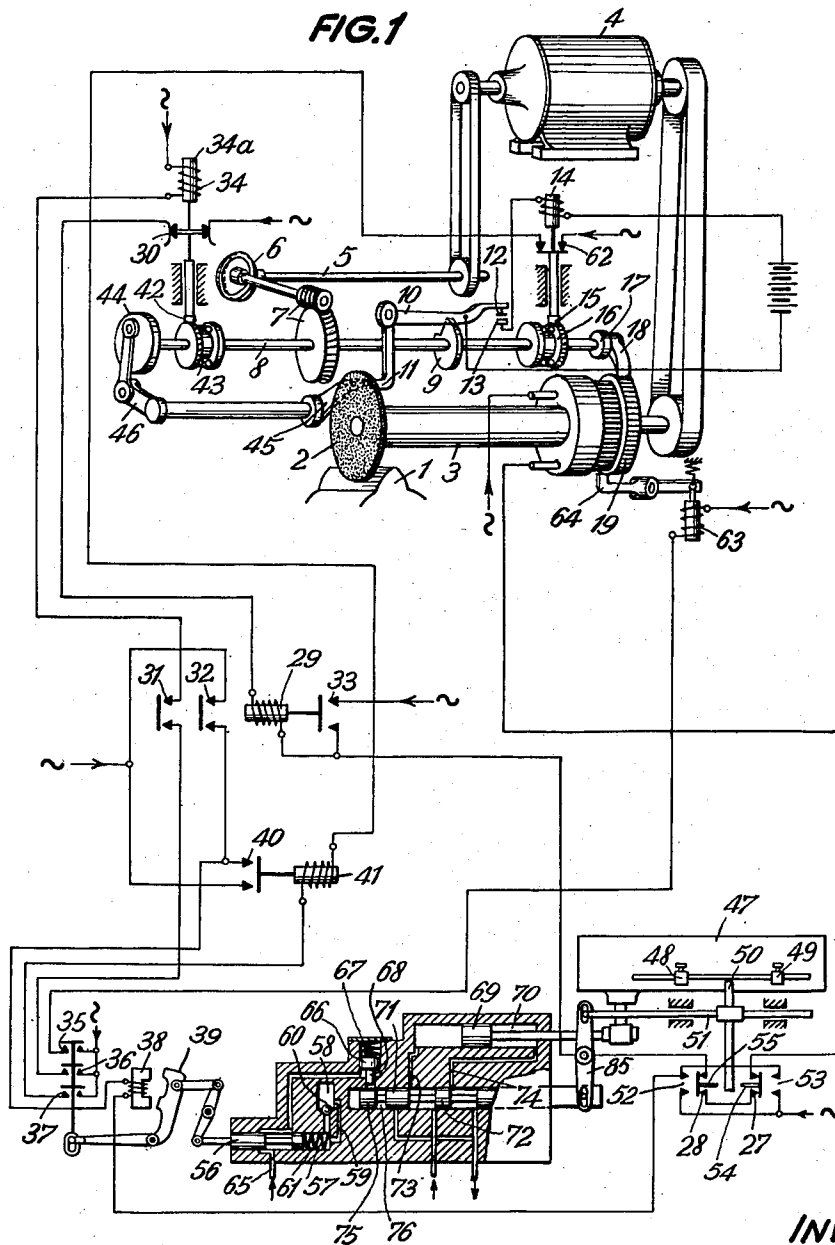
A. AEPPLI

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GRINDING WHEEL TRUEING DEVICE

Filed Feb. 18, 1947

2 SHEETS—SHEET 1



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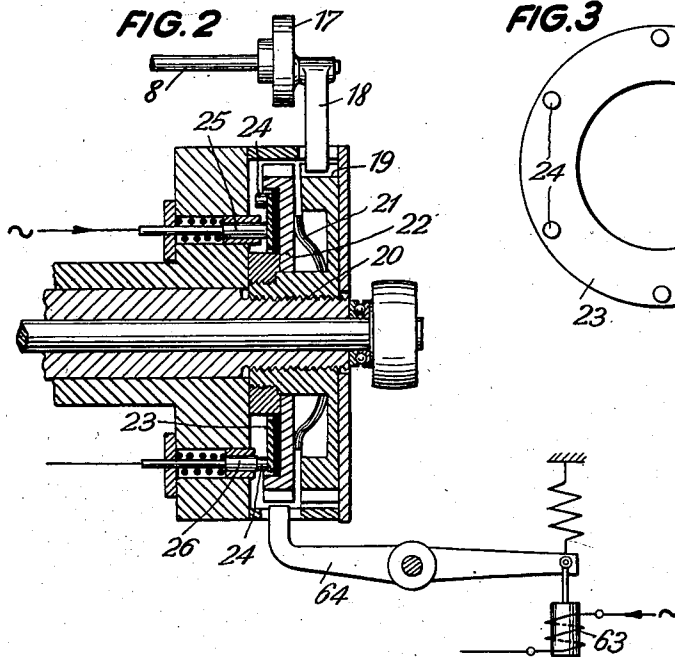
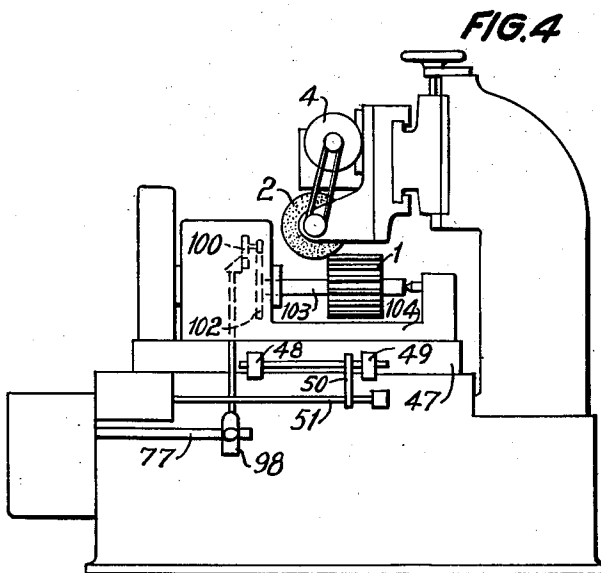
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2 SHEETS—SHEET 2



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UNITED STATES PATENT OFFICE

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GRINDING WHEEL TRUEING DEVICE

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Application February 18, 1947, Serial No. 729,322
In Switzerland March 1, 1946

3 Claims. (Cl. 51-5)

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My invention relates to improvements in devices for trueing grinding wheels or discs, e. g. forming part of gear-grinding machines. In contradistinction to trueing devices known in the art, the grinding wheel is automatically trueed whenever a certain number of functional operations of the machine have been performed, which operations bear on the wearing of the grinding disc. Such operations may include the readjustment of the disc, in accordance with the wear undergone in grinding, by small uniform rates at certain intervals of time. Other operations, essential for trueing, may consist of carrying out of a certain grinding operation, e. g. the finishing of a number of tooth flanks of a gear wheel in a gear-grinding machine. The individual functional operations may be numerically added by means of a counter and the trueing operation released by the latter after having attained the predetermined number.

Suitable arrangements may be made for not counting up the functions of re-adjusting the grinding disc by the trueing rate, and of resuming the grinding operation only after having finished the trueing operation and the re-adjustment of the disc brought about thereby.

Two forms of invention as applied to a gear-grinding machine, are illustrated, in the drawings, in which

Fig. 1 is a schematical view, partly in section, of the grinding disc and motor, the disc-readjusting gear, and the device for trueing the disc on the basis of the readjusting functions of the machine,

Fig. 2 is a sectional view through the counter for the readjusting functions of the machine,

Fig. 3 is a view of the contactor disc 23, 24 of Fig. 2,

Fig. 4 is a diagrammatic side elevation of the machine.

In Fig. 1, a grinding wheel 2, which serves for working the tooth-flanks of gear wheel 1, is mounted in a sleeve 3. The electric motor 4 driving wheel 2, is provided with two operative shaft ends. One of the latter drives the shaft 8 over a jack-shaft 5, a bevel gear 6 and a worm gear 7. Shaft 8, on one hand, operates the elements for resetting the grinding wheel by the amount of wear incurred in grinding or trueing, and, on the other hand, brings about the automatic trueing of the grinding wheel under predetermined conditions.

For resetting purposes, a cam disc 9 is keyed to shaft 8. One end of a bell-crank lever 10 is dropped into the notch of disc 9 at each revolu-

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tion of shaft 8. The lug-end 11 of lever 10 is spaced quite close to the narrow lateral working face of the grinding wheel 2. The said first end of lever 10 is provided with a contactor 12 spaced quite close to the counter-contactor 13. According to the rate of wear of disc 2, either the end 11 contacts the latter or contactor 12 abuts against contactor 13. In the latter case, an electromagnet 14 raises latch 15 of a friction clutch 16, an eccentric 17 thus making one revolution and slightly turning the ratchet wheel 19 by means of a pawl 18. Ratchet wheel 19 feeds grinding wheel 2 at a certain small rate, e. g. 0.00004 inch, by means of the fine threads 20 (Fig. 2). Such feed cycle is repeated until the wear of wheel 2 has been compensated.

Ratchet wheel 19 is coupled to a second ratchet wheel 22 by means of frictionally operating leaf springs 21. A contactor disc 23 (Fig. 3) is mounted insulated on wheel 22 and is circumferentially provided with spaced contactors 24. A current-lead brush 25 continuously contacts disc 23, while a second brush 26 contacts one of the contactors 24 when disc 23 is rotated. In the arrangement according to Fig. 3, such latter contact is established six times during one revolution of disc 23. When ratchet wheel 19, for example, possesses 120 teeth, brush 26 will be engaged by a contactor stud 24 after every 20 steps of pawl 18, each such step being brought about by one of said teeth.

A circuit then is completed across the contacts 27, 28, 30 and the electromagnet 29 which in its turn, now, makes the contacts 31-33. Contactor 33 serves as a holding contactor for the electro-magnet 29. As soon as contactor 33 is closed, 29 remains closed until contact 30 is closed. The carriage 47, on which the generating slide 104 with the work 1 is mounted on shaft 103 during the grinding operation is slowly fed in the direction of its longitudinal axis. In the terminal positions of carriage 47, a dog 48 or 49 is abutted against a follower 50 which is guided by a rod 51. Follower 50 contacts the make-and-break 54, 55 breaking contactors 27 or 28 and making either contactor 52, 53, thus completing the circuit of magnet 38 by way of break 32. Magnet 38 attracts the armature 39, thus making contactors 35-37. The circuit over contactors 36, 31 and magnet 34 now is completed, and the latter disengages the latch 42 of the friction clutch 43. The eccentric disc 44, therefore, is turned through one revolution by the continuously rotating shaft 8, and actuates the diamond-studded trueing arm 45 by way of

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the arm 46. Thus the operative marginal zone of wheel 2 is faced once. By raising the magnet armature 34a, contactor 30 and thus also contactors 31—33 are broken after disengaging clutch latch 42. The circuit of magnet 38 thus is interrupted by contactor 32 for the time being, and its armature 39 would be retracted under the action of a spring 57 biasing the valve piston 56, thus breaking contactor 35—37. Piston 56, however, is moving to the left in Fig. 1 only slowly, being subjected to a braking action. The cylinder 61, namely, is filled with oil which, upon armature 39 being attracted, is displaced through the valve 60 into the chamber 58. When, now, spring 57 enters into action, valve 60 is closed, and the oil is permitted to flow slowly through the narrow bore 59 back into cylinder 61. Before, now, armature 39 has covered a substantial portion of its deflection, bell-crank lever 10 drops into the recess of the continuously rotating disc 9, and makes contact 12, 13, thus bringing about a re-adjustment of grinding wheel 2. At the same time, break 62 is made, and magnet 41 makes contact 40 which feeds magnet 38 for a short time. Such impulse, however, is sufficient to restore armature 39 into its fully closed position. The cycle of operation of spring 57, starting with the slow backward pushing of the piston 56 and ending when the magnet 39 is energized, is started anew, until a further impulse, set forth by bell-crank lever 10, reaches magnet 38.

During such period of resetting wheel 2, contact 35 also remains made and magnet 63 is energized and drops the pawl 64 into an interdental space of ratchet wheel 22, so that the latter and contact disc 23 are stopped. This means that the resetting functions have not been counted up by the amount wheel 2 has been trued. When the operative lateral working face of grinding wheel 2 again has reached its normal position, the current pulses through bell-crank lever 10 cease (though its movement continues), armature 39 no longer is attracted, and spring 57 is given time to push piston 56 into its outer terminal position, i. e. to the left as shown in Fig. 1. Contacts 35—37, magnet 63 and pawl 64 thus are opened and the subsequent resettings again are counted up by the advance of contact studs 24.

Carriage 47 is moved by a pressure piston 69 which is controlled by a valve 71, 72. The latter is moved by means of the two dogs 43, 49 of carriage 47, which displace the follower 50 and thus the rod 51 in either of their terminal positions. Rod 51, by means of arm 85 moves the valve pistons 71, 72 to the left or to the right. The ducts 73, 74 thus alternately are opened to the cylinder 70 for the supply or discharge of oil.

During the trueing operation and the wheel-resetting brought about thereby, grinding, of course, has to be discontinued. To this end, the feed of carriage 47 in one terminal position is blocked in the following manner. During the grinding operation, interrupter 38, 39 remains open, piston 56 opens the pressure oil supply 65, and plunger 66 is pushed upward. When, now, the moment for trueing has arrived, switch 31—33 first is closed, as described above. As soon as carriage 47 has arrived at a terminal position, magnet 38 is energized over contactors 52 or 53, piston 56 is displaced to the right and shuts off oil feed 65, spring 67 pushes plunger 66 downward, and the pin 68 drops into the cylinder 76 to the left or right of piston 75, whereby the con-

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trol valve 71, 72 and thus the pressure piston 69 are blocked. Such blocking continues until the grinding wheel again has reached its normal operating position, upon which the emission of pulses on the part of lever 10 ceases, armature 39 drops off, and the pressure oil raises plunger 66 with pin 69, thus releasing the control for the movement of the carriage.

The counters or counting trains also may be of a design and construction different from those shown in the form illustrated; it only being essential for the invention that they bring about the effects set forth above.

What I claim and desire to secure by Letters Patent, is:

1. An automatic grinding wheel turning machine for gear grinding machines, comprising, in operatively assembled combination, a rotatable shaft on which said grinding wheel is mounted, rotary driving means drivably connected to said grinding wheel shaft, a rotatable cam disc operatively connected with said grinding wheel driving means to be rotated thereby, a pivotally mounted feeler lever, means operably connected with said lever for moving said lever to periodically engage said grinding wheel to test the wear thereof, a shifting means having an operation initiating part located in position to be engaged by said lever, upon a predetermined pivoting movement of said feeler lever taking place due to wear of the grinding wheel for engaging and axially shifting the grinding wheel by uniform steps, a counting mechanism having an operation control part located in a position to be engaged by said shifting means upon completion of a predetermined shifting movement for counting the shifting steps, a grinding wheel trueing tool, means operatively connected with said grinding wheel shifting means and operable upon completion of a predetermined number of shifting steps for moving said trueing tool into operative relation with the grinding wheel, and means operably connected with said trueing tool for restoring the tool to inoperative position after completion of a trueing operation.

2. An automatic grinding wheel trueing device as defined in claim 1 and including a locking member operative during a trueing operation to engage and lock said counting mechanism and prevent operation thereof until completion of the trueing operation.

3. In, operatively assembled, combination with a grinding machine having a work-carriage, actuating members for moving said work-carriage, a rotatably mounted grinding wheel, an automatic grinding wheel trueing device for gear grinding machines, comprising a rotatably mounted grinding wheel, means for driving the grinding wheel, a rotatable cam disc operatively connected with said grinding wheel driving means to be rotated thereby, a pivotally mounted feeler lever operated by said cam to periodically engage said grinding wheel to test the wear thereof, a shifting means having an operation initiating part positioned to be engaged by said lever upon a predetermined pivoting movement of said feeler lever due to wear of the grinding wheel for axially shifting the grinding wheel by uniform steps, a counting mechanism having a counting operation control part positioned to be engaged by said shifting means upon completion of a predetermined shifting movement of the grinding wheel for causing said shifting steps to be counted, a grinding wheel trueing tool, means operatively connected with said grinding wheel

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shifting means and operable upon completion of a predetermined number of shifting steps for moving said trueing tool into operative relation with the grinding wheel, means operably connected with said trueing tool for restoring the tool to inoperative position after completion of a trueing operation, and means for engaging and locking said work-carriage actuating members to prevent movement of the work-carriage during a trueing operation.

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