

Nov. 12, 1940.

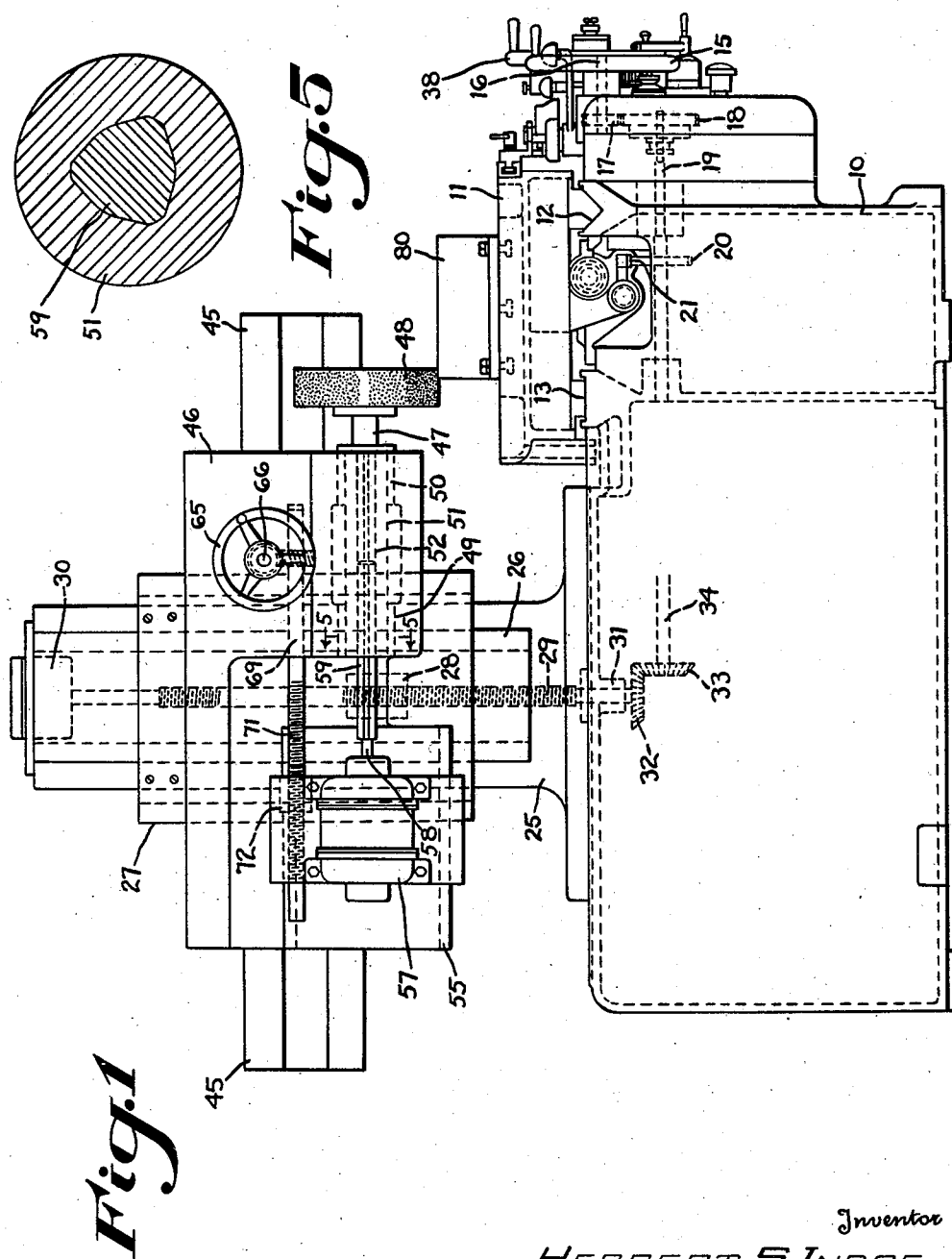
H. S. INDGE

2,221,638

GRINDING MACHINE

Filed June 15, 1940

2 Sheets-Sheet 1



Inventor
HERBERT S. INDGE

By *Harold W. Eaton* Attorney

Nov. 12, 1940.

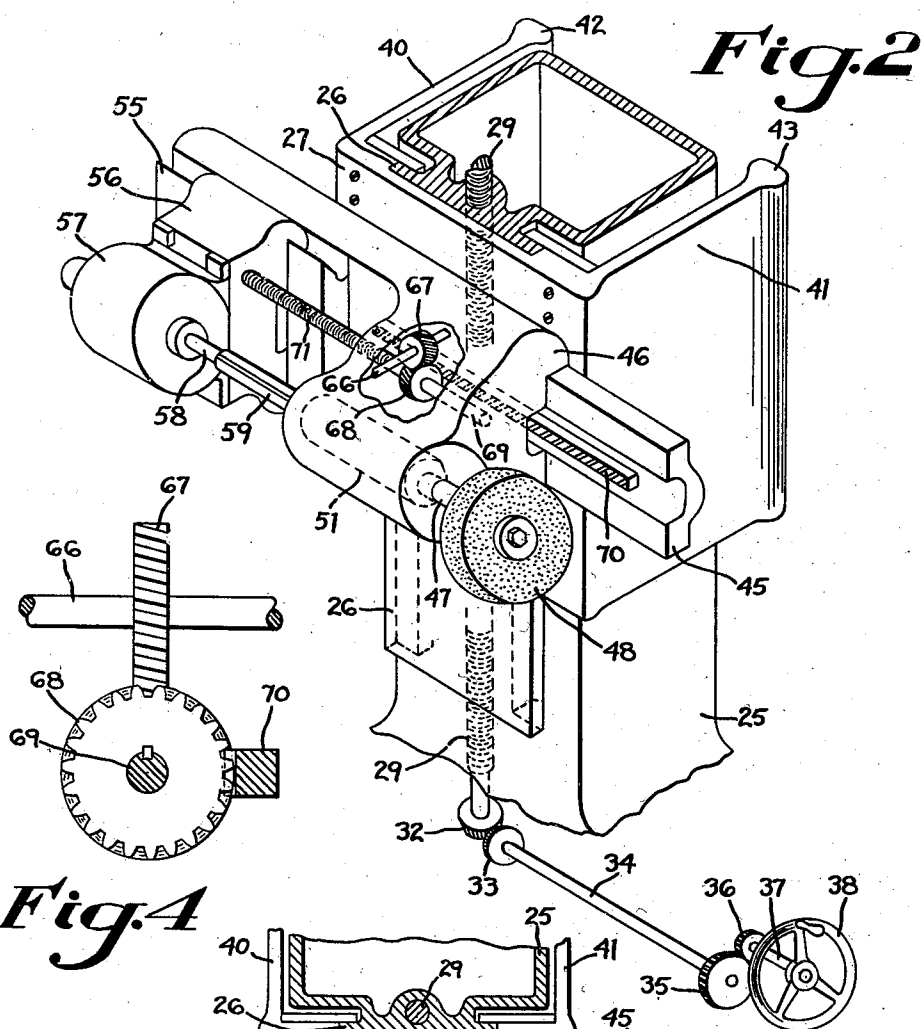
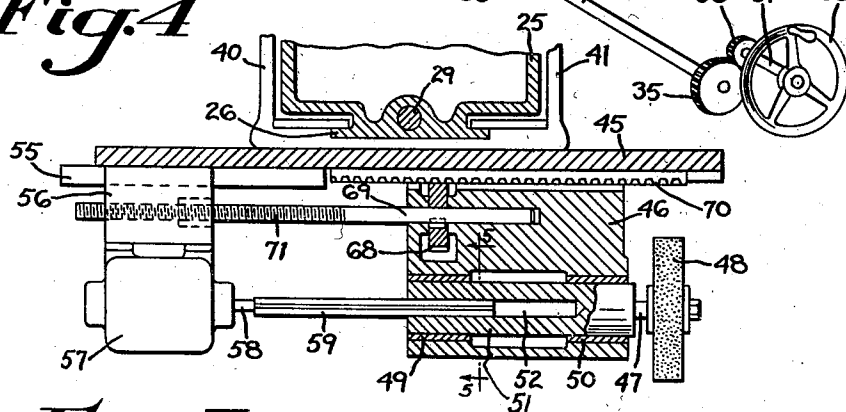
H. S. INDGE

2,221,638

GRINDING MACHINE

Filed June 15, 1940

2 Sheets-Sheet 2



Inventor

HERBERT S. INOGE

By Harold W. Eaton

Attorney

UNITED STATES PATENT OFFICE

2,221,638

GRINDING MACHINE

Herbert S. Indge, Westboro, Mass., assignor to
Norton Company, Worcester, Mass., a corpora-
tion of Massachusetts

Application June 15, 1940, Serial No. 340,761

6 Claims. (Cl. 51-92)

The invention relates to grinding machines, and more particularly to a grinding machine for grinding plane surfaces and the like.

One object of the invention is to provide a simple and thoroughly practical grinding machine. A further object of the invention is to provide a balanced grinding machine wheel slide construction. Another object of the invention is to provide a grinding wheel slide construction in which the wheel slide is at all times maintained in a substantially balanced condition.

Another object of the invention is to provide a vertically movable slide to support a wheel slide in such a manner that the weight of the wheel slide is counterbalanced. Another object of the invention is to provide a motor driven grinding wheel on a wheel slide in which the wheel slide is moved transversely and the motor together with its mounting is moved transversely on the wheel slide in the opposite direction automatically to counterbalance the weight of the slide and wheel during transverse adjustment thereof. Other objects will be in part obvious or in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts, as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the mechanical features of this invention,

Fig. 1 is an end elevation of a grinding machine embodying the invention;

Fig. 2 is a fragmentary perspective view, partly in section, showing the details of the wheel slide construction;

Fig. 3 is a fragmentary longitudinal sectional view through the grinding wheel spindle and the wheel slide traversing mechanism;

Fig. 4 is a fragmentary detail view of the traversing mechanism for the grinding wheel slide; and

Fig. 5 is a fragmentary cross-sectional view, on an enlarged scale, taken approximately on the line 5-5 of Fig. 3 through the wheel spindle.

As illustrated in the drawings, a surface grinding machine has been shown comprising a base 10 which supports a longitudinally reciprocable work supporting table 11 on a V-way 12 and a flat way 13.

The table 11 may be traversed longitudinally either manually or by power. For the sake of illustration, a manually operable traversing

mechanism has been illustrated comprising a hand wheel 15 which is supported on a shaft 16. The shaft 16 supports a gear 17 which meshes with a gear 18. The gear 18 is supported on a rotatable shaft 19 which carries a gear 20. The gear 20 meshes with a rack bar 21 which is fixedly mounted on the under side of the table 11. It will be readily apparent from the foregoing disclosure that a rotary motion of the hand wheel 15 will be transmitted through the gear mechanism above described to traverse the table 11 longitudinally. The direction of movement of the table 11 is dependent upon the direction of rotation of the manually operable traverse wheel 15.

A vertically extending column 25 is fixedly mounted on the rear portion of the base 10. The column 25 is provided with a substantially T-shaped slideway 26 which serves as a support for a vertically movable slide 27. The slide 27 is arranged so that it may be moved vertically by means of a feeding mechanism comprising a nut 28 which is formed integral with or fixedly mounted to the slide 27. A feed screw 29 is rotatably supported in bearings 30 and 31 and the screw meshes with or engages the nut 28. The bearings 30 and 31 are arranged to permit rotary motion thereof but to prevent endwise movement of the screw 29. A bevel gear 32 is mounted on the lower end of the feed screw 29 and meshes with a bevel gear 33 which is mounted on the left-hand end of a rotatable shaft 34.

The right-hand end of the shaft 34 (Fig. 2) is provided with a gear 35 which meshes with a gear 36 carried on the inner end of a rotatable shaft 37. A manually operable hand wheel 38 is mounted on the outer end of the shaft 36 by means of which the vertical adjustment of the slide 27 may be readily effected when desired. It will be readily apparent from the foregoing disclosure that a rotary motion of the hand wheel 38 will be transmitted through the gear 36, the gear 35, the shaft 34, the bevel gear 33, the bevel gear 32, to rotate the feed screw 29 and thereby transmit a vertical movement to the slide 27. The direction of movement of the hand wheel 38 determines the direction of movement of the vertical slide, that is, whether it moves up or down.

In order to provide a freely movable mounting for the vertical slide 27, it is desirable to counterbalance the weight carried thereby so that the slide will not cramp as the feed screw 29 is rotated to raise or lower the same. In order to counterbalance the slide 27 in one direction,

a pair of rearwardly extending plates 40 and 41 are provided which are preferably either fixedly mounted to the slide 27 or formed integral therewith. As illustrated in the drawings, the plates 40 and 41 are arranged on opposite sides of the column 25. At the rear end of each of the plates 40 and 41, enlarged members 42 and 43 are provided which are of sufficient size to counterbalance the weight of a wheel slide and its support to be hereinafter described, thus counterbalancing the weight of the slide in a direction normal to the axis of the grinding wheel.

A transversely extending slideway 45 is fixedly mounted on the vertical slide 27. The slideway 45 serves as a support for a transversely movable grinding wheel slide 46 which is provided with ways which mate with the ways 45. The wheel slide 46 serves as a support for a rotatable wheel spindle 47 which in turn supports a rotatable grinding wheel 48. The wheel spindle 47 is provided with an enlarged cylindrical portion 51 which is journaled within the bearings 49 and 50 on the wheel slide 46. The enlarged portion 51 of the wheel spindle 47 is provided with a central longitudinally extending aperture 52 which is of a non-circular shape preferably a tri-lobe shape (Fig. 5); such as that shown in the prior U. S. patent to Everard Stubbs, No. 1,912,412 dated June 6, 1933, to which reference may be had for details of disclosure not contained herein.

In order to maintain the wheel slide 46 in a balanced condition to facilitate free vertical movement of the slide 27, it is desirable to provide an automatically operated mechanism to counterbalance the wheel slide 46 during its transverse movement. As illustrated in the drawings, a longitudinally extending dovetailed way 55 is formed on the wheel slide 46. The dovetailed slideway 55 mates with a correspondingly shaped way formed on a slide 56 which in turn serves as a support for an electric motor 57. The motor 57 is provided with an armature shaft 58 which is fixedly connected to a tri-lobe shaft 59 which mates with the aperture 52 (Figs. 3 and 5) formed within the enlarged portion 51 of the wheel spindle 47. The tri-lobe shaft 59 and the aperture 52 provide a telescopic driving connection between the motor 57 and the wheel spindle 47 so that the motor 57 together with its supporting slide 56 may be adjusted along the dovetailed slideways 55 to counterbalance the weight of the wheel end of the wheel slide 46 during its transverse movement along the slideway 45.

A manually operable traversing mechanism is provided for traversing the wheel slide 46 transversely relative to the base 10 to position or index the grinding wheel 48 in grinding a plane surface of greater width than the operative face of the grinding wheel 48. This traversing mechanism may comprise a manually operable rotatable traversing wheel 65 which is mounted on the outer end of a rotatable shaft 66. The shaft 66 is journaled in suitable bearings (not shown) supported in the wheel slide 46. The shaft 56 supports a spiral gear 67 which meshes with a spiral gear 68 which is supported on a rotatable shaft 69. The spiral gear 68 meshes with a spiral rack bar 70 which is fixedly mounted on the slideway member 45. It will be readily apparent from the foregoing disclosure that a rotary motion of the manually operable hand wheel 65 will be transmitted through the shaft 66, the spiral gear 67, the spiral gear 68, to produce a transverse

movement of the wheel slide 46. The direction of rotation of the hand wheel 65 will determine the direction of movement of the wheel slide 46 and the grinding wheel 48.

In order to automatically maintain the wheel slide 46 in balance during its transverse indexing movement, it is desirable to provide a mechanism for automatically moving the slide 56 and the motor 57 relative to the wheel slide 46 in a direction opposite to the indexing movement of the slide 46 so that the weight of the motor 57 and its supporting slide 56 will at all times counterbalance the weight of the grinding wheel 48 and its supporting spindle and mounting. This is preferably accomplished by providing a mechanism which operates by and in timed relation with the wheel slide traversing mechanism. In the preferred form, the gear 68 is slidably keyed to the shaft 69. The gear 68 is arranged for a rotary motion but is held against longitudinal motion by thrust surfaces formed within the wheel slide 46. The shaft 69 is provided with a screw threaded portion 71 which meshes with or engages a nut 72 which is fixedly mounted within the motor supporting slide 56. The pitch of the screw 71 and the direction of the lead thereof is such that the motor supporting slide 56 together with the motor 57 moves at a desired and predetermined rate in the opposite direction to the movement of the wheel slide 46 so as to maintain the wheel slide 46 in substantial balance during its transverse feeding or indexing movement, thus facilitating vertical movement or adjustment of the slide 27.

The operation of this grinding machine will be readily apparent from the foregoing disclosure. A work piece 80 is mounted on the work supporting table 11, the vertical slide 27 is moved downwardly by rotation of the hand wheel 38 to bring the peripheral surface of the wheel 48 into engagement with the surface of the work, and the grinding operation proceeds during the traversing or reciprocating movement of the table 11. At one or both ends of the longitudinal movement of the table 11, the wheel slide 46 is indexed transversely by an amount equal to or less than the width of the operative face of the grinding wheel. During this transverse adjusting movement as produced by a rotary motion of the manually operable traverse wheel 65, a rotary motion is imparted to the screw 71 to move the motor supporting slide 56 and the driving motor 57 in a direction opposite to the direction of movement of the wheel slide so that the weight of the slide 56 and the motor 57 will at all times substantially counterbalance the weight of the grinding wheel 48 and its supporting spindle 47 so that the entire wheel slide assembly is maintained in substantial balance, thus facilitating free movement of the vertical slide 27 without clamping.

It will thus be seen that there has been provided by this invention apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a grinding machine having a base and a movable work table, a movable wheel slide on said base, a rotatable grinding wheel on said

slide, an electric motor, driving connections between said motor and said grinding wheel, a movable slide on said wheel slide to support said motor, a traversing mechanism to move said wheel slide, and means automatically to move said motor and its supporting slide relative to the wheel slide to maintain said wheel slide in balance.

2. In a grinding machine having a base and a movable work table, a movable wheel slide on said base, a rotatable grinding wheel on said slide, an electric motor, driving connections between said motor and said grinding wheel, a movable slide on said wheel slide to support said motor, a traversing mechanism to move said wheel slide, and means actuated by and in timed relation with said traversing mechanism automatically to move said motor and its supporting slide relative to and in a direction opposite to the movement of the wheel slide to maintain the wheel slide in balance.

3. In a grinding machine having a base and a longitudinally reciprocable work table, a transversely movable wheel slide thereon, a rotatable grinding wheel on said slide, an electric motor, driving connections between said motor and said grinding wheel, a traversing mechanism to move said slide, a movable slide on said wheel slide to support said motor, and means actuated by and in timed relation with said traversing mechanism automatically to move said motor and its supporting slide relative to the wheel slide to maintain said wheel slide in balance.

4. In a grinding machine having a base and a longitudinally reciprocable work table, a transversely movable slide thereon, a rotatable grinding wheel on said slide, an electric motor, telescopic driving connections between said motor and grinding wheel, a traversing mechanism to move said slide, a longitudinally movable slide

on the wheel slide to support said motor, and means actuated by and in timed relation with said traversing mechanism automatically to move said motor and its supporting slide in a direction opposite to the transverse movement of the slide relative to the wheel slide to maintain the wheel slide in balance.

5. In a grinding machine having a base and a longitudinally reciprocable work table, a transversely movable slide thereon, a rotatable grinding wheel on said slide, an electric motor, telescopic driving connections between said motor and said grinding wheel, a traversing mechanism including a manually operable gear and rack mechanism to move said slide, a longitudinally movable slide on said wheel slide to support said motor, and means including a nut and screw mechanism actuated by and in timed relation with said gear mechanism automatically to move said motor and its supporting slide relative to the wheel slide to maintain said wheel slide in balance.

6. In a grinding machine having a base and a longitudinally reciprocable work table, a transversely movable slide thereon, a rotatable grinding wheel on said slide, an electric motor, telescopic driving connections between said motor and said grinding wheel, a traversing mechanism including a manually operable gear and rack mechanism to move said slide, a longitudinally movable slide on said wheel slide to support said motor, and means including a nut and screw mechanism actuated by and in timed relation with said gear mechanism automatically to move said motor and its supporting slide in a direction opposite to the movement of the wheel slide relative to the wheel slide to maintain said wheel slide in a balanced condition.

HERBERT S. INDGE.

40