April 5, 1938. C. H. AMIDON 2,113,362

GRINDING MACHINE HEADSTOCK

Filed Jan. 21, 1937

Fig. 2

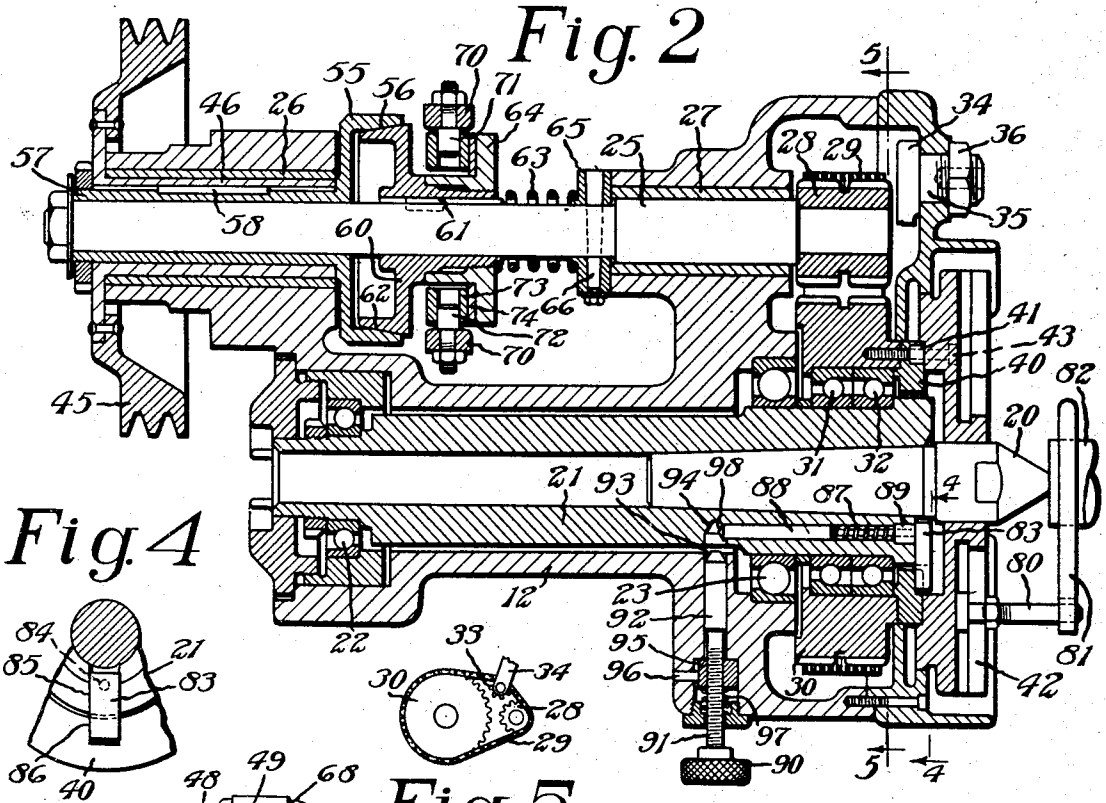


Fig. 4

Fig. 5

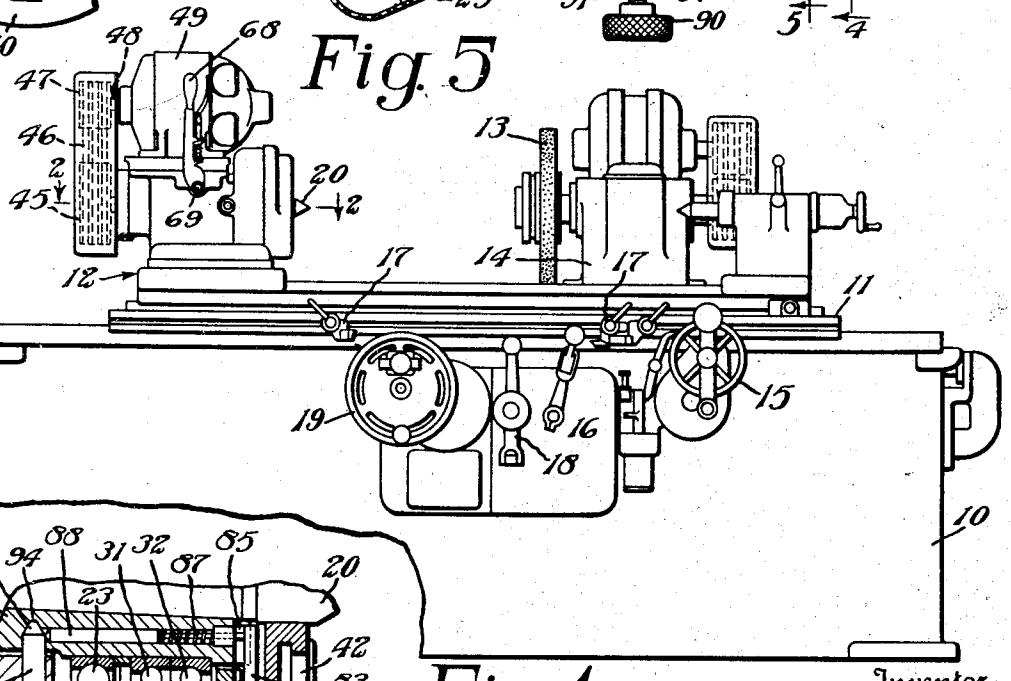


Fig. 1

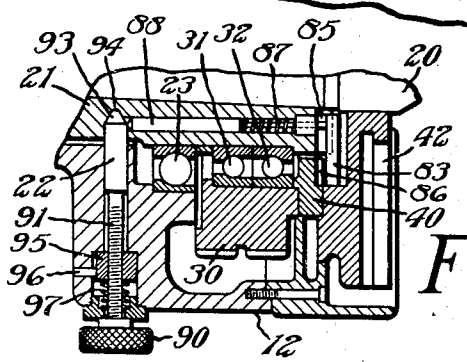


Fig. 3

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Patented Apr. 5, 1938

2,113,362

UNITED STATES PATENT OFFICE

2,113,362

GRINDING MACHINE HEADSTOCK

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Application January 21, 1937, Serial No. 121,616

5 Claims. (Cl. 82—28)

This invention relates to machine tools, and more particularly to a headstock for use in grinding machines and the like.

One object of this invention is to provide a simple and thoroughly practical headstock construction for a machine tool. Another object of the invention is to provide a machine tool headstock in which the face plate and center may be readily changed from a "live" center to a "dead" center. A further object of the invention is to provide a simplified headstock construction whereby manipulation of a single control member serves readily to shift the headstock from a "live" center to a "dead" center headstock. 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 drawing, in which is shown one of various possible embodiments of the mechanical features of this invention,

Fig. 1 is a fragmentary front elevation of a grinding machine embodying the improved headstock;

Fig. 2 is a horizontal sectional view, taken approximately on the line 2—2 of Fig. 1, on an enlarged scale, showing the details of the head stock construction as a "live" spindle and center headstock;

Fig. 3 is a fragmentary sectional view of the control mechanism, showing the parts in position to render the spindle and center stationary to produce a "dead" center headstock;

Fig. 4 is a fragmentary sectional view, taken approximately on the line 4—4 of Fig. 2, showing the key for locking the face plate and spindle so that they rotate together for setting up the headstock as a "live" center type; and

Fig. 5 is a fragmentary view, on a reduced scale, of the drive to the headstock spindle, on a reduced scale, taken approximately on the line 5—5 of Fig. 2.

In accordance with one embodiment of this invention, a grinding machine is provided having a base 10 upon which is slidably mounted a work table 11 with a headstock 12 adjustably positioned thereon. The base 10 may be provided with a suitable mechanism to reciprocate or traverse the work table 11 longitudinally relative to the base 10 and relative to a rotatable grinding wheel 13.

The rotatable grinding wheel 13 is supported on a transversely movable wheel slide 14 which is arranged to be moved transversely either toward or from the work table 11 by means of a manually operable feed mechanism 15.

The table 11 may be reciprocated longitudinally by means of a hydraulically operated mechanism controlled by a reversing lever 16 and a pair of adjustable table dogs 17. A control lever 18 is connected to actuate a speed control and stop and start valve (not shown). The hydraulically operated table reciprocating mechanism is not considered to be part of the present invention and, therefore, has not been illustrated in detail. For further details of construction of the table operating mechanism, reference may be had to the prior United States Patent No. 2,071,677 dated February 23, 1937.

The table 11 may be traversed manually, if desired, by means of a manually operable traverse wheel 19 which operates a manually operable table traverse mechanism such as illustrated in the prior United States Patent to Norton et al. No. 1,299,765 of April 8, 1919, which is suitably connected to a rack (not shown) underneath the work table 11 to move the same.

In the preferred construction, the headstock comprises a frame or base 12 which is adapted to fit or mate with the upper surface of the work table 11 and to support the other parts of the self-contained electric motor driven headstock. To attain the main object of this invention, the headstock is arranged so that it may be readily used as either a "dead" center or a "live" center type. The headstock 12 comprises a center 20 mounted in the spindle 21 which is rotatably supported in anti-friction bearings 22 and 23 in the headstock. A second shaft 25 is mounted in suitable bearings 26 and 27 parallel with the spindle 21. A sprocket 28 is mounted on the end of the shaft 25 and is connected by a link chain 29 with a sprocket 30 which is journaled on anti-friction bearings 31 and 32 on the spindle 21. An idler sprocket 33 is rotatably mounted on the end of an arm 34 which is supported on a stud 35 and is arranged to be locked to the headstock casing by means of a lock nut 36 to facilitate taking up any slack in the driving chain. A plate 40 is fixedly mounted on the sprocket 30 by means of screws 41, and a face or driving plate 42 is fastened to the plate 40 by screws 43, so that the driving chain 29 transmits a rotary motion from the shaft 25 and the sprocket 28 to rotate sprocket 30, the plate 40 and the face plate 42.

In the preferred construction, the shaft 25 may be driven by means of a pulley 45 which is fixedly mounted on the end of a rotatable sleeve 46 which is journaled to rotate within the bearing 26. The pulley 45 is connected by driving belts 46 with a pulley 47 mounted on the outer end of an armature shaft 48 of an electric motor 49, which is mounted on the upper portion of the headstock 12.

In order readily to stop and start the headstock without stopping the motor 49, a suitable clutch mechanism is connected to the pulley 45 and arranged to connect the sleeve 46 with the shaft 25 to transmit a rotary motion thereto. The clutch may be of any suitable type but, as illustrated, comprises a member 55 having an internal cone shaped aperture 56. The clutch member 55 is provided with an integral sleeve 57 which is rotatably supported on the shaft 25 and is slidably keyed by a key 58 to the sleeve 46, so that rotation of the pulley 45 is transmitted through the sleeve 46, the key 58 and sleeve 57 to rotate the clutch member 55. A movable clutch member 60 is slidably keyed to the shaft 25 by means of a key 61. The clutch member 60 is provided with an external frusto-conical surface 62 which is adapted to mate with the internal clutch surface 56 to transmit a rotary motion from the pulley 45 to the shaft 25.

A compression spring 63 surrounds the shaft 25 and is interposed between a flange 64 carried by the clutch member 60 and a collar 65 which is fixedly mounted on the shaft 25 by means of a pin 66. The spring 63 normally tends to hold the clutch member 60 in engagement with the clutch member 55. In order to control the movement of the movable clutch member, a manually operable control lever 68 is mounted on the front of the headstock 12 and on the outer end of a rotatable shaft 69. A yoked member 70 is carried by the shaft 69 and is provided with opposed pins 71 and 72 which engage holes in a collar 73 which surrounds a portion of the clutch member 60.

When it is desired to disengage the clutch member 60 from the clutch member 55, the yoked member 70 is rocked so that the pins 71 and 72 move toward the right (Fig. 2) which serves to throw the clutch shifting ring 73 into engagement with a braking element 74 which in turn serves to disengage the clutch element 60 from the clutch member 55, and at the same time the brake element 74 serves quickly to stop the rotation of the shaft 25 and thereby to stop the rotation of the work piece.

For certain grinding operations, it is desirable to utilize a live spindle or live center headstock in which the driving or face plate 42 and the center 40 are rotated together, so that an adjustable driving pin 80 carried by the face plate 42 will engage a dog 81 which is clamped on the end portion of a work piece 82, to rotate the work piece 82 with the face plate 42 and the center 20. In order readily to connect the spindle 21 to rotate with the face plate 42, a clutch is provided comprising a movable clutch member, such as a key 83 mounted on the end of a pin 84 which is slidably supported in the spindle 21. The movable clutch member or key 83 is arranged to engage a radially extending slot 85 in the end of the spindle 21 and a radially extending slot 86 in the driving plate 40. A spring 87 surrounds the pin 84 and is interposed between a portion 88 of the pin 84 and a sleeve or bushing 89. The spring 87 tends to move the key 83 into engagement with the slots 85 and 86 so that when the clutch is engaged, a rotary motion will be transmitted through sprocket 28, the chain 29, the sprocket 30, the driving plate 40, the face plate 42, the key 83, and spindle 21, simultaneously to rotate the driving or face plate 42, the spindle 21 and the center 20.

For other types of grinding, it is desirable to utilize a dead center type of headstock in which the work piece is mounted on a non-rotatable headstock center and the other end supported on a non-rotatable footstock center, while the face plate is rotated to drive the work piece on the fixed or non-rotatable center during the grinding operation. To facilitate setting up the machine for a dead center grinding operation, it is desirable to provide a readily accessible control member whereby by the manipulation of a single control element, the spindle 21 may be disconnected from the driving mechanism and the spindle 21 and center 20 locked against rotation for a dead center grinding operation. A readily accessible knurled knob 90 is mounted on the outer end of a screw 91. The screw 91 is formed as an integral part of a plunger 92 which has a frusto-conical end portion 93 adapted to mate with a correspondingly shaped hole or depression 94 in the spindle 21. A floating nut 95 is screw threaded onto the screw 91 and is held against rotation by a key 96. A spring 97 normally holds the nut 95 in the full line position indicated in Fig. 2. When it is desired to lock the spindle against rotation, the screw 91 is turned to move the conical surface 93 of the plunger 92 into engagement with the correspondingly shaped depression 94 in the spindle 21. If the depression 94 is not aligned with the plunger 93, the screw 91 may be rotated and the end of the frusto-conical portion 93 bears against the periphery of the spindle 21, and continued rotation of the screw 91 serves to move the nut 95 downwardly (Fig. 2) to compress the spring 97 so that when the spindle is rotated so that the depression 94 comes into alignment with the frusto-conical plunger 93, the released tension of the spring 97 will rapidly seat the frusto-conical member 93 in the depression 94, thereby locking the spindle 21 against rotation.

At the same time, it is desirable automatically to throw the key 83 out of engagement with the slot 86 so that the driving plate 40 and the face plate 42 may be rotated while the spindle 21 is held locked in a stationary position. This is accomplished by providing a frusto-conical end portion 98 on the end of the pin 88 so that when the frusto-conical portion 93 of the locking pin 92 enters the depression 94, the frusto-conical surface 93 engages the conical surface 98 of the pin 88 and serves to move the pin 88 and key 83 toward the right (Fig. 2) so that it is thrown out of engagement with the radial slot 86 in the plate 40, thereby disconnecting the spindle 21 from the driving plate 40 and allowing free rotation of the face plate 42 while the spindle 21 and the center 20 are held stationary for a dead center grinding operation.

The operation of the headstock will be readily apparent from the foregoing disclosure. The motor 49 is set in rotation by a well-known control mechanism, such as a push button (not shown). The control lever 68 is then moved to throw the clutch member 60 into engagement with the clutch member 55 to transmit the rotary motion of the motor 49, through the pulley 45, the

belt 46 and the pulley 47 to the shaft 25 to rotate the driving plate 40 and the face plate 42. As shown in Fig. 2, the rotation of the shaft 25 is transmitted to rotate the spindle 21 and the center 20 for a live spindle or live center grinding operation.

When it is desired to grind a work piece by the dead center method, the knurled knob 90 is rotated to throw the frusto-conical portion 93 of the pin 92 into the position shown in Fig. 3, thereby locking the spindle 21 against rotation and simultaneously moving the driving key 83 out of engagement with the slot 86 in the end of the spindle 21, so that the spindle 21 and the center 20 are held stationary while the driving plate 40 and face plate 42 are rotated by the motor driving mechanism above described, so that the work piece 82 is rotated on a pair of opposed non-rotatable centers during the grinding operation.

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 drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:—

1. In a machine tool headstock, a base, a rotatable spindle thereon, a work supporting center carried by said spindle, spaced anti-friction bearings to support said spindle, a rotatable face plate, an anti-friction bearing rotatably to support said face plate on said spindle, means to rotate said face plate, and a manually operable clutch which is operative during rotation of the face plate to connect said face plate with said spindle, whereby the spindle and center may be rotated with said face plate.

2. In a machine tool headstock, a base, a rotatable spindle thereon, a work supporting center carried by said spindle, a rotatable face plate, means to rotate said face plate, a movable driving member carried on the end of said spindle, a slot in the face plate which is arranged to mate with said driving member to rotate said spindle and center with said face plate, and manually operable means to move said driving member in a direction parallel to the axis of said spindle during rotation of the spindle to move said member out of engagement with said slot so that the spindle and center remain stationary while the face plate is rotated.

3. In a machine tool headstock, a base, a rotatable spindle thereon, a work supporting center carried by said spindle, a rotatable face plate, means including a clutch to rotate said face plate, a movable radially extending driving member carried by and adjacent to the end of said spindle, a radially extending slot in said face plate which is arranged to mate with said driving member to rotate said spindle and center with said face plate, means including a plunger which is arranged to move said driving member out of engagement with said slot and to lock said spindle and to hold the same against rotation, and manually operable means to actuate said plunger without stopping the rotation of the face plate to lock or release said spindle and center.

4. In a machine tool headstock, a base, a rotatable spindle thereon, a work supporting center carried by said spindle, a rotatable face plate, means to rotate said face plate, a movable radially extending key mounted on the end of said spindle, a keyway in said face plate which is arranged to mate with said key to rotate said spindle and center with said face plate, yieldable means to maintain said key in driving position in said keyway, and manually operable means which is operable during rotation of said face plate to move said key against the tension of said spring to disengage said key from said keyway so that the spindle and center remain stationary while the face plate is rotated.

5. In a machine tool headstock, a base, a rotatable spindle thereon, a work supporting center carried by said spindle, a rotatable face plate, means including an electric motor drive and a clutch to rotate said face plate, a radially extending driving member on the end of said spindle, a slot in said face plate which is arranged to mate with said member to rotate said spindle and center with said face plate, means including a plunger carried by said frame and a mating recess in said spindle to facilitate locking said spindle, and a manually operable nut and screw mechanism arranged simultaneously to engage said pawl with said recess and to disconnect said key from said keyway so as to hold said spindle and center stationary while the face plate continues to rotate.

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