2 Sheets--Sheet 1.

J. WHEELOCK.

Improvement in Boring Mills.

No. 124,647. Patented March 12, 1872.

Fig. 1.

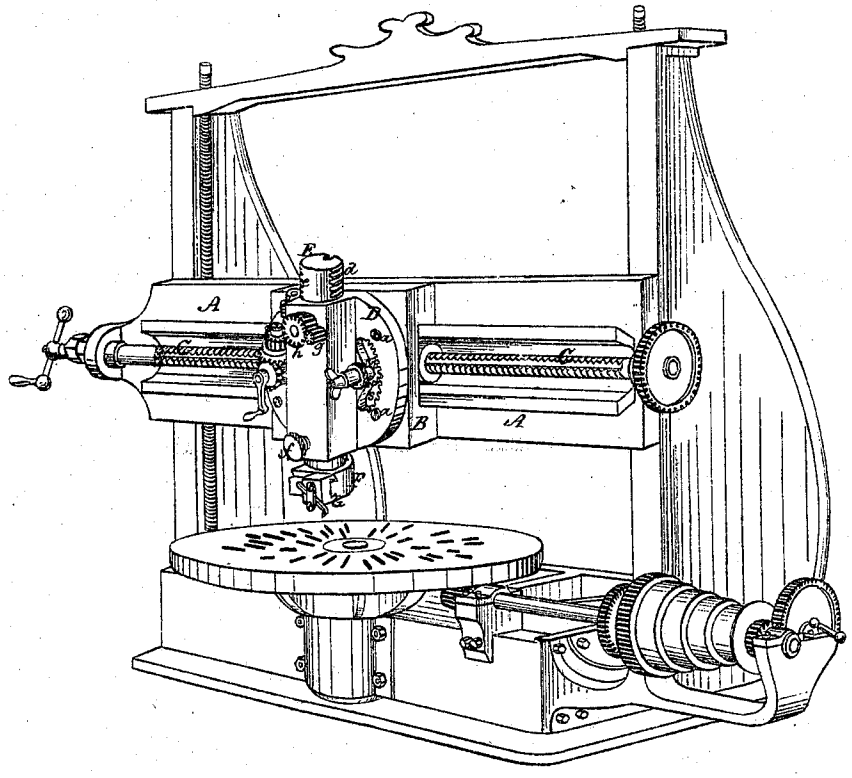


Fig. 2.

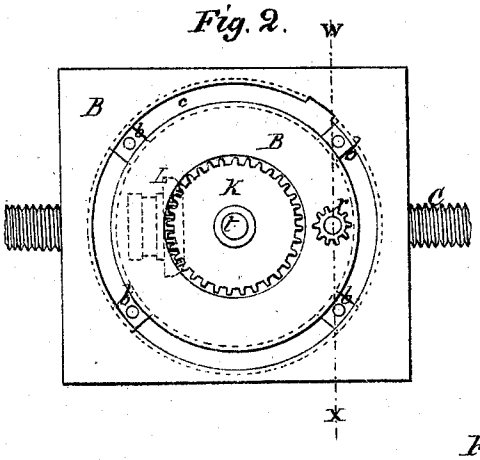


Fig. 3

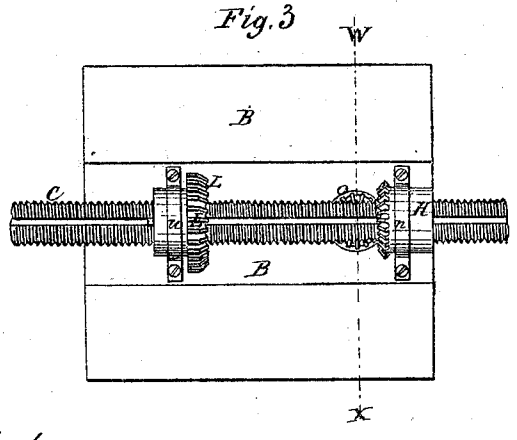
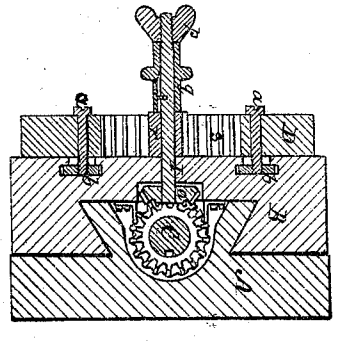


Fig. 4.



Witnesses
Phil. T. Sarner
Geo. F. Stenz,

Inventor
Jerome Wheelock
By Wm. C. Wood & Co.
Attorneys

2 Sheets--Sheet 2.

J. WHEELOCK.

Improvement in Boring Mills.

No. 124,647. Patented March 12, 1872.

Fig. 5.

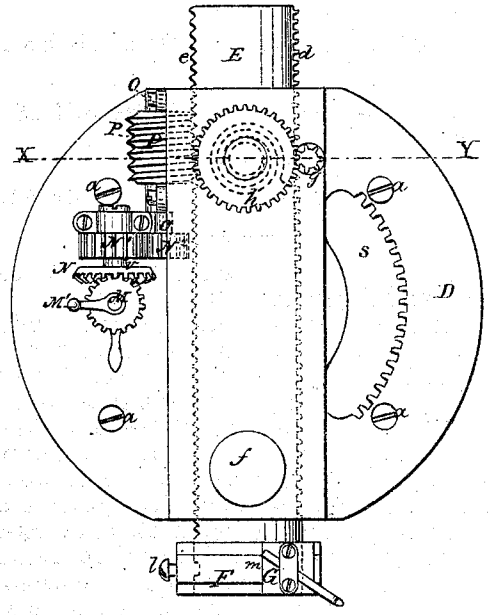


Fig. 6

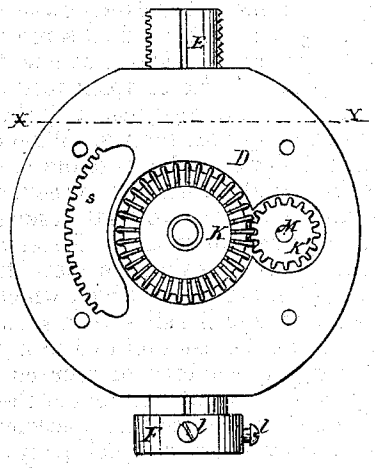


Fig. 7

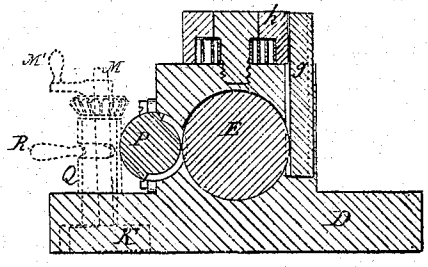
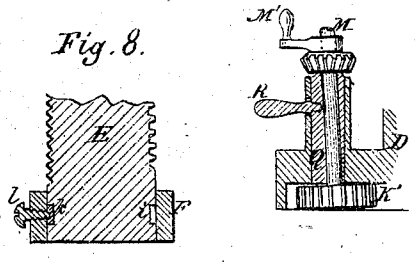


Fig. 8.



Witnesses
Phil. F. Garner
Geo. T. Stetz,

Inventor.
Jerome Wheelock.
By Munn & Co
Attorneys.

124,647

UNITED STATES PATENT OFFICE.

JEROME WHEELOCK, OF WORCESTER, MASSACHUSETTS.

IMPROVEMENT IN BORING-MILLS.

Specification forming part of Letters Patent No. 124,647, dated March 12, 1872.

To all whom it may concern:

Be it known that I, JEROME WHEELOCK, of the city and county of Worcester, in the State of Massachusetts, have invented certain new and useful Improvements in Boring-Mills.

My improvements relate generally to that portion of the mill to which the cutting-tool is attached, and by which its feed movements are effected, controlled, and adjusted for the proper performance of the great variety of service for which such mills are generally intended. My invention consists, first, in a novel combination of the horizontal cross-head screw, gearing, and slide, by which the slide, with its swivel and tool-spindle, may be moved to and fro on the cross-head without the rotation of the cross-head screw; secondly, in a novel method of adjusting the swivel on the slide, and in controlling or actuating its movement, by which the tool-spindle may be set at any desired angle in a plane parallel with the vertical face of the cross-head; thirdly, in a novel method of mounting the "tool-boot" on the spindle, by means of which the tool may be set at any desired horizontal angle radiating from the central axial line of the tool-spindle; fourthly, in a novel method of sustaining the weight of the tool-spindle, by means of which all loose longitudinal play of the spindle in its housing is effectually prevented; and also in certain other less important features, hereafter more fully described; and I do hereby declare that the following specification, taken in connection with the drawing furnished and forming a part of the same, is a clear and true description of an apparatus involving the several and combined features of my invention.

Two sheets of drawings are presented and properly numbered. Figure 1, Sheet 1, represents, in perspective, the standards, table, and main cross-head of a boring-mill to which my improvements are attached. Fig. 2 represents the slide detached from the cross-head in front view. Fig. 3 represents the slide in rear view. Fig. 4 represents a vertical section of cross-head, slide, swivel, and thumb-screw on the line W X, Figs. 1, 2, 3, 5, and 6. Fig. 5, Sheet 2, represents the swivel detached and enlarged in front view. Fig. 6 represents the swivel in rear view. Fig. 7 represents a cross-vertical sectional view of the swivel, tool-spindle, &c., on the line X Y, Figs. 1, 5, and 6. Fig. 8 represents the "tool boot-holder" in vertical section.

A denotes the cross-head. It extends from standard to standard, and is fitted to vertical slides thereon in a manner well known. B denotes the slide, which is fitted to move to and fro on the cross-head. C denotes the feed-screw, by means of which the traverse motion is communicated to the slide B. As heretofore constructed, this feed-screw has possessed but one function, exercised in moving the slide to and fro on the cross-head. When constructed and applied as herein described this screw-rod performs the double service of actuating not only the cross-feed on the cross-head, but the vertical feed on the tool-spindle, and, by extending the principle involved to the connections joining the main vertical screws, which control the general vertical movement of the cross-head, the several complex feed motions can, if desired, be accomplished by the simple rotation of the upright screws. With such an arrangement it would be possible to operate the feed in one, all, or none of the several lines of direction, while the vertical screws might continue regularly in motion. These particular features will hereafter be more fully described. D denotes the swivel, which is secured to the face of the slide B in such a manner that it can be semi-rotated in a vertical plane and rigidly confined or secured in any desired position. The attachment of the swivel to the slide is, in this instance, accomplished by several screw-bolts, *a*, which pass through holes in the swivel and engage with nuts *b*, which are fitted to an inverted T-shaped annular groove, *c*, cut in the face of the slide B. E denotes the tool-spindle or boring-bar. It is fitted to slide longitudinally in a vertical housing, which is attached to or forms a part of the swivel. One side of the spindle is provided with teeth *d*, after the manner of a rack-gear. Its opposite side is provided with similar teeth *e*, cut spirally, after the manner of a segmental section of an interior screw. A set-screw, *f*, passes through the housing and engages with a smooth side of the spindle for preventing, on certain occasions, any longitudinal movement of the spindle within the housing. The teeth *d* on the spindle engage with a geared shaft, *g*, which, in turn, engages with a gear, *h*, which is mounted on a stud

projecting from the face of the tool-spindle housing. Within the gear *h* is a coil-spring, so set with relation to the stud and the gear that it will resist with its spring-force the movement of the gear, which would be actuated by the downward movement of the tool-spindle; in other words, the spring acts as a counterpoise to the weight of the spindle, and, therefore, at all times holds it firmly against the downward-bearing surfaces of the adjacent mechanism which actuates the movement of the tool-spindle. At its lower end the tool-spindle is provided with a peripherical annular groove or channel, *i*, to which a shoe, *k*, is fitted, so as to fill the groove for a portion of its length. This shoe is capable of being freely moved around the spindle in the groove. F denotes a swiveled tool-boot holder. It has a circular eye, through which the lower end of the tool-spindle projects, and it is fastened thereto by means of set-screws *l*, which engage with the shoe *k* in the channel *i* in such a manner that by turning the screw down hard upon the shoe the tool-boot holder will be held rigidly on the spindle at any angle radiating from the axial line of the spindle. When the screws are but lightly turned they will admit of a rotary movement on the spindle without detachment therefrom. When the screws are entirely disengaged from the shoe *k* the boot-holder can be readily detached from the spindle, leaving the shoe in its groove. G denotes the tool-boot. It is mounted on its holder F by a dovetailed slide, *m*, and is capable of longitudinal horizontal movement on the slide, when such is desirable, but can be secured in any position thereon by means of a set-screw.

Having thus designated and described these several parts of my apparatus, the uses of which are readily apparent, I will now proceed to explain the mechanism by which the slide is connected to the feed-screw C and made to travel to and fro on the cross-head, or to remain stationary, when desired, even though the screw continues to revolve. H denotes a beveled nut-gear, which is connected to the rear side of the slide B by means of a collar or strap, *n*, within the embrace of which it can freely revolve. This nut-gear is loosely tapped to the feed-screw C in such a manner that when the nut-gear is free to revolve in its collar *n* the screw will not move the slide, for the obvious reason that the nut-gear will revolve as the screw turns. I denotes a horizontal shaft, which projects outward from the face of the slide, and is fitted to revolve in bearings extending through the slide. Its inner end is keyed to a small beveled pinion, *o*, which engages with the beveled nut-gear H. The outer end of the shaft I is provided with a thumb-screw nut, *p*, and also with a burred sleeve, *q*, which is notched so as to engage with a short stud which projects from the shaft, and thereby operatively connects the sleeve and shaft. Between the burred sleeve *q* and the face of the slide, loosely mounted on the shaft I, is a small gear, *r*, which is free to turn on the shaft, except when compressed between the end of the sleeve and the face of the slide by the thumb-screw *p*, in which case both the shaft and the gear must move together or not at all. The swivel D is provided, on one side of the spindle-housing, with a semi-crescent shaped slot, *s*, cut entirely through it. This slot has horizontal gear-teeth cut on its outer or concave side, making it, in fact, a segmental section of an internal gear, with which the gear *r* on the shaft I meshes.

The mechanism embraced between the nut-gear H and the thumb-screw *p* on the outer end of shaft I is, although comparatively simple to the eye, very complex in its combined functions; but it can readily be comprehended by closely observing the following methods of operation, by which certain specific and desirable results are obtained, viz.: First, to cause the slide to automatically traverse the cross-head while the feed-screw C is revolving, tighten the thumb-screw *p*, which pinches the gear *r* between the end of the sleeve *q* and the face of the slide. This will of course prevent any movement of the shaft I, by reason of the contact of the gear *r* with the teeth in the slot *s*. The shaft I being stationary, it will prevent the nut-gear H from revolving when the screw C is turned, and therefore the slide will be moved to and fro on the cross-head, according to the rotary movement of the screw. Second, to cause the slide to traverse the cross-head without any movement of the feed-screw, turn loose the thumb-screw *p*, and then revolve the shaft I by turning the burred sleeve *q*, which will, in turn, revolve the nut-gear H on the feed-screw, and thus carry the slide in either direction on the cross-head, while the feed-screw is stationary. Third, to cause the slide to remain stationary while the feed-screw continues to revolve, loosen the thumb-screw *p*, which will obviously permit the shaft I to freely revolve with the nut-gear H, which will, in turn, revolve with the feed-screw, and therefore result in no movement of the slide. Fourth, to turn the swivel on its axis and change thereby the vertical angle of the tool-bar or spindle, loosen the screw-bolts *a*, tighten the thumb-screw *p*, and then turn the shaft; the gear *r*, which then turns with the shaft, engages with the teeth in the slot *s* and moves the swivel on its axis. With no other boring-mill with which I am acquainted can these adjustments of the tool be effected by a workman while standing closely adjacent to the cutting-tool itself. The advantages of my arrangement are readily obvious, for the workman controls every movement of which the tool is capable while he is standing in one position and in close proximity to the work which is being performed by the mill.

Having thus far described my invention, it is only necessary now to describe the method by which the complex feed is actuated by a single feed-rod or screw. On observing the front view of the slide B, Fig. 2, and the rear view of swivel D, Fig. 6, it will be seen that

an annular chamber is located at their center, with half its space in each end; that there is a central axial bearing in each half. K represents a gear, having a straight and a beveled face, and which is, in this instance, cast solid with its axis *t*. This gear occupies the annular chamber, with its axis in the central bearings before referred to. The axis *t* serves not only for a center on which its gear revolves, but also as a pivot on which the swivel D can semi-rotate. L denotes a beveled gear, which is mounted loosely on the feed-screw C, but at the same time is sustained in a collar or strap, *u*, which projects from the rear of the slide B. The screw C has a straight longitudinal slot cut therein throughout its length, and the eye of the gear L is provided with a spline or key, which projects into and loosely occupies the slot in such a manner that the screw, when revolving, will rotate the gear. In this connection the screw exercises merely the function of a driving-shaft, to give motion to this gear. The beveled face of the gear K meshes with the gear L, and therefore the rotary movement of the screw causes a corresponding movement in both gears. M denotes a second horizontal shaft, which projects outward through the swivel D, and has a bearing therein. On its inner end is keyed a pinion, K′, which meshes with the straight face of the gear K. Near its outer end there is keyed to it a beveled pinion, which engages with a horizontal beveled gear, N, which is keyed to the lower end of the short vertical counter-shaft *v*, mounted in hangers projecting from the face of the swivel. To the outer end of the shaft M a crank, M′, is keyed, for the purpose of affording a means for revolving the shaft independent of the gear K. O denotes a second vertical shaft, parallel with the tool-bar or spindle, and sustained in bearings attached to the housing. To the lower end of this shaft a pinion, N^2, is keyed, which meshes with the gear N^1. There is also mounted on and keyed to this shaft, between its bearings, a cylinder, P, on the outer periphery of which there is cut a short length of screw, which projects through an opening in the side of the casing and engages with the spiral teeth *e*, which are cut in the side of the tool-spindle. It will readily be seen that the rotary movement of the feed-screw C will cause a corresponding movement of the screw P, which will, in turn, cause the spindle E to move longitudinally in its housing on the swivel.

In order that the workman may have absolute control over the tool-bar or spindle, I have devised a means by which the spindle may be held stationary while the feed-screw C continues to revolve, and I will now explain that portion of the apparatus by which this result is accomplished. Q denotes a cylindrical sleeve, which surrounds the shaft M and extends throughout its length between the two gears at the ends. At its outer end it is truly cylindrical; but at its inner end it is eccentric, so that the sleeve when turned one way will permit the shaft M to stand truly horizontal with its pinion K′, in proper working relation to the gear K. When, on the contrary, the sleeve is turned in the opposite direction, the shaft is thrown out of line at its inner end, thus disengaging the pinion from the gear K. The sleeve Q is turned by means of a lever, R, projecting therefrom through a slot in the tubular bearing within which the shaft M and the sleeve are located. To give a means for longitudinally operating the tool-bar or spindle independently of the main feed-screw, I have attached the crank M′ to the outer end of shaft M, and am able thereby, after throwing the pinion K′ out of gear, to readily move the spindle up or down in its housing.

With my improvements it becomes practicable to mount two slides with boring-bars on the same cross-head, and to operate one or both at the same time, as may be desired. In such case the cutting-tools—during the operation of turning a pulley, for instance—would be engaged with the work at opposite points on the periphery of the pulley, and thus not only enable the mill to work rapidly, but, at the same time, serve well in balancing the friction of the revolving table in its bearings. It would also even be practicable to mount three of my slides upon the same cross-head, and while the two outer ones are engaged with the periphery of a pulley the third could be employed in turning or boring out the central eye. In all of the various ways in which my mill can be employed it is observable that the main cross-head may at all times be brought down close to the upper side or edge of the piece of work to be turned or bored, on account of the peculiar arrangement of the tool boot-holder on the boring-bar or spindle, and the facility with which the tool-spindle may be elevated into its housing.

For so connecting the cross-head and its screw to the main vertical side screws that the cross-head may, while the main screws revolve, be moved up or down, or permitted to remain in a fixed position, and, at the same time, to enable the main vertical side screws to communicate a rotary movement to the horizontal cross-head screw, I propose to cut a longitudinal straight groove in the main screws, and make them to correspond, in that particular, with the cross-head horizontal screw, as shown, to fit thereto a nut-gear corresponding in essential character with the nut-gear H, which is to be attached to the cross-head in the same manner as it is shown attached to the slide B. In both positions it will operate the same. When held stationary with the cross-head, the vertical screws will raise or lower the cross-head; when loose to revolve with the screws, the cross-head will remain stationary. To rotate the horizontal screw C by the rotation of the main vertical screws, I propose to fit loosely to the vertical screws a splined gear corresponding to the splined gear L, described, which will, in turn, engage, by intermediate gearing, with a gear keyed or

splined to the screw-rod C; the immediate operative result of such a connection of the vertical screw with the cross-head screw being precisely the same as between the cross-head screw C and the tool-spindle screw P.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, with the slide and swivel of the slotted feed-rod C, the splined gear L, the spiral-toothed tool-bar or spindle, and the intermediate connecting mechanism by which the tool-bar or spindle is automatically longitudinally operated by the revolution of the feed-rod, substantially as described.

2. The combination of the horizontal shaft I, projecting outward at right angles to the face of the slide, with the slide, the feed-screw, nut-gear, and pinion, by which the slide may be moved to and fro while the feed-screw remains stationary substantially as described.

3. For the purpose of connecting and disconnecting the slide and screw C, and also to rotate the swivel, the shaft I, gear *r*, and toothed slot in the swivel, combined substantially as described.

4. The tool-boot and its holder F, connected to the end of the boring-bar or tool-spindle, capable of being semi-rotated thereon, and provided with means for its rigid or fixed adjustment at any angle radial from the axial line of the tool-bar or spindle, substantially as described.

5. The combination of the toothed spindle or boring-bar with a spring counterpoise, the two being so connected that the weight of the spindle will be sustained by the spring, substantially as described.

6. The eccentric sleeve, in combination with the shaft and its adjacent connecting-gearing, by which the tool-spindle and the feed-rod are operatively connected or disconnected, substantially as described.

7. The combination of the slide or cross-head with the feeding-screw, and the nut-gear mounted upon and arranged to revolve freely with the screw or to be held stationary, for the purpose of operatively connecting and disconnecting the slide or cross-head from the feeding-screw, substantially as described.

JEROME WHEELOCK.

Witnesses:

A. GEORGE BULLOCK,

C. B. WHITING.