July 5, 1955 E. R. RUSNOK 2,712,273

MILL HEAD

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Fig. 2.

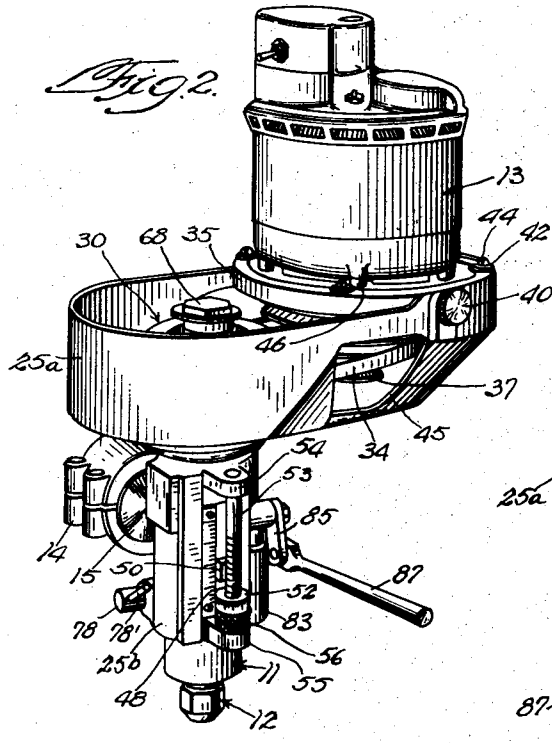


Fig. 1.

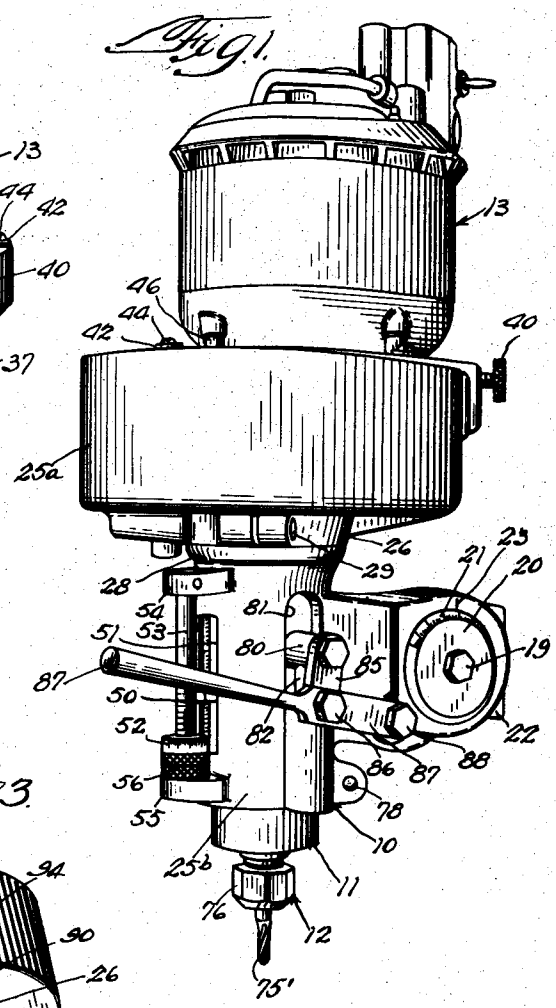
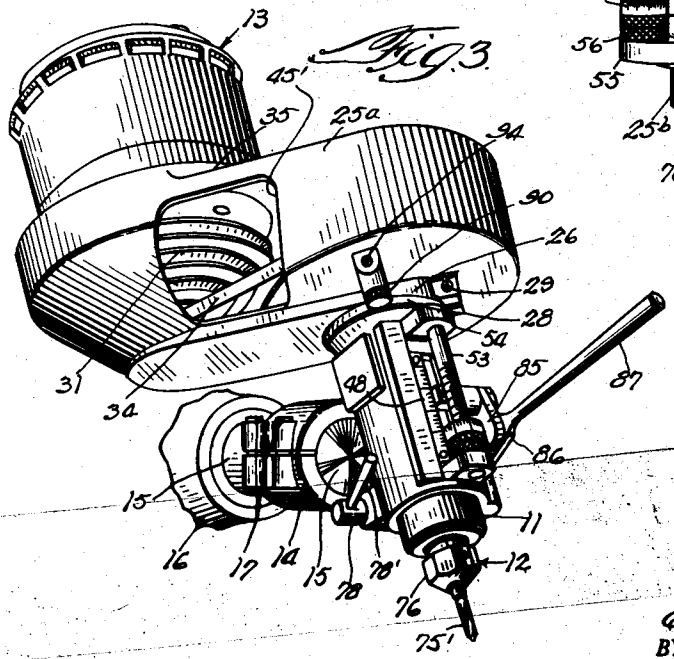


Fig. 3.



INVENTOR.
Edward Rusnok.
BY.
Phleger, Olson & Mecklenburger
Patty's

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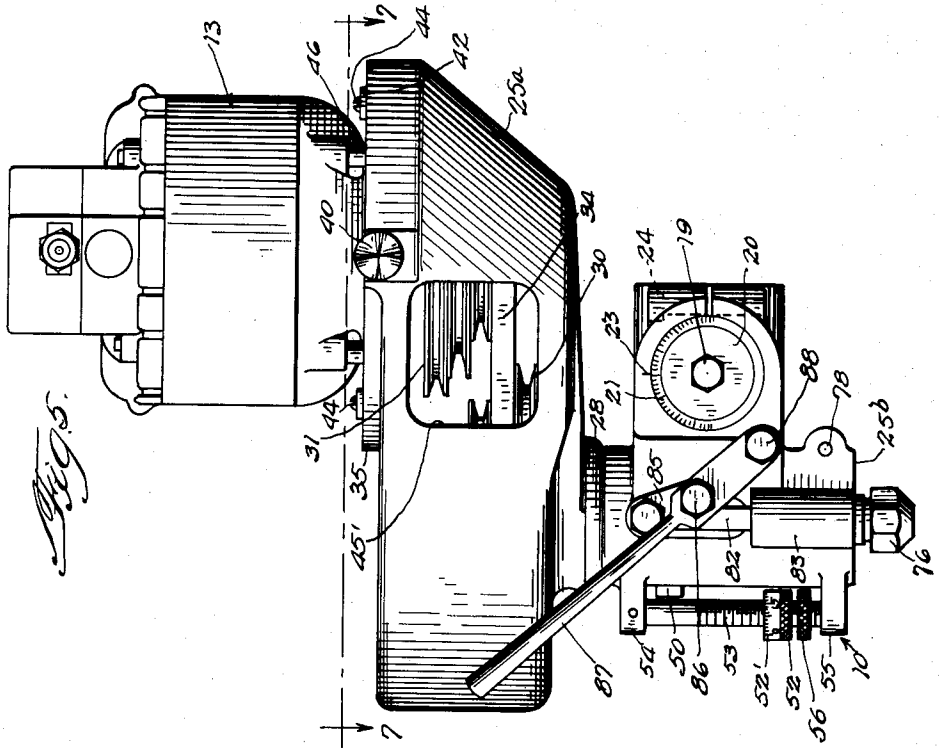


Fig. 5.

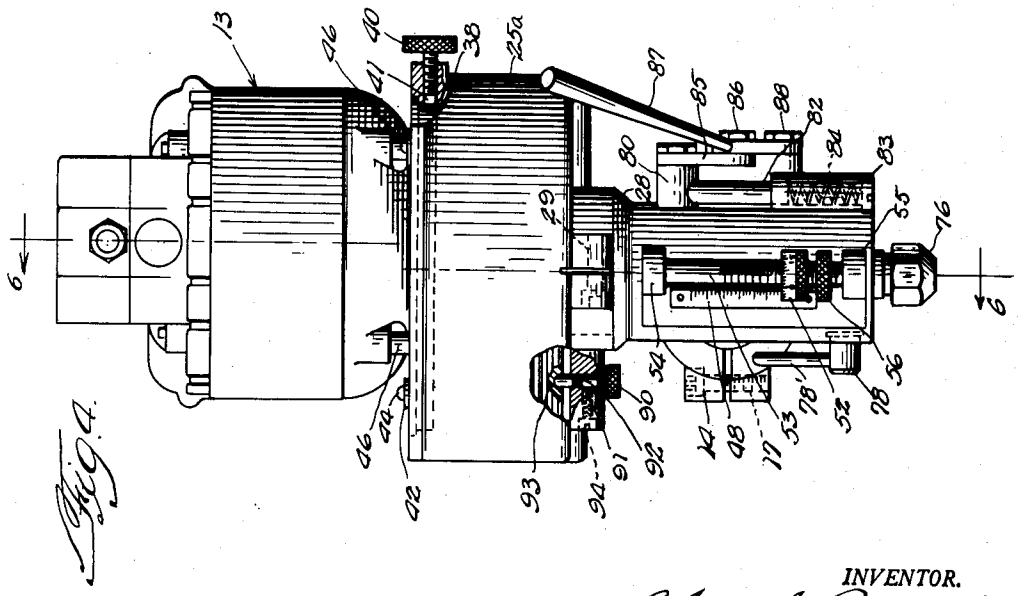


Fig. 4.

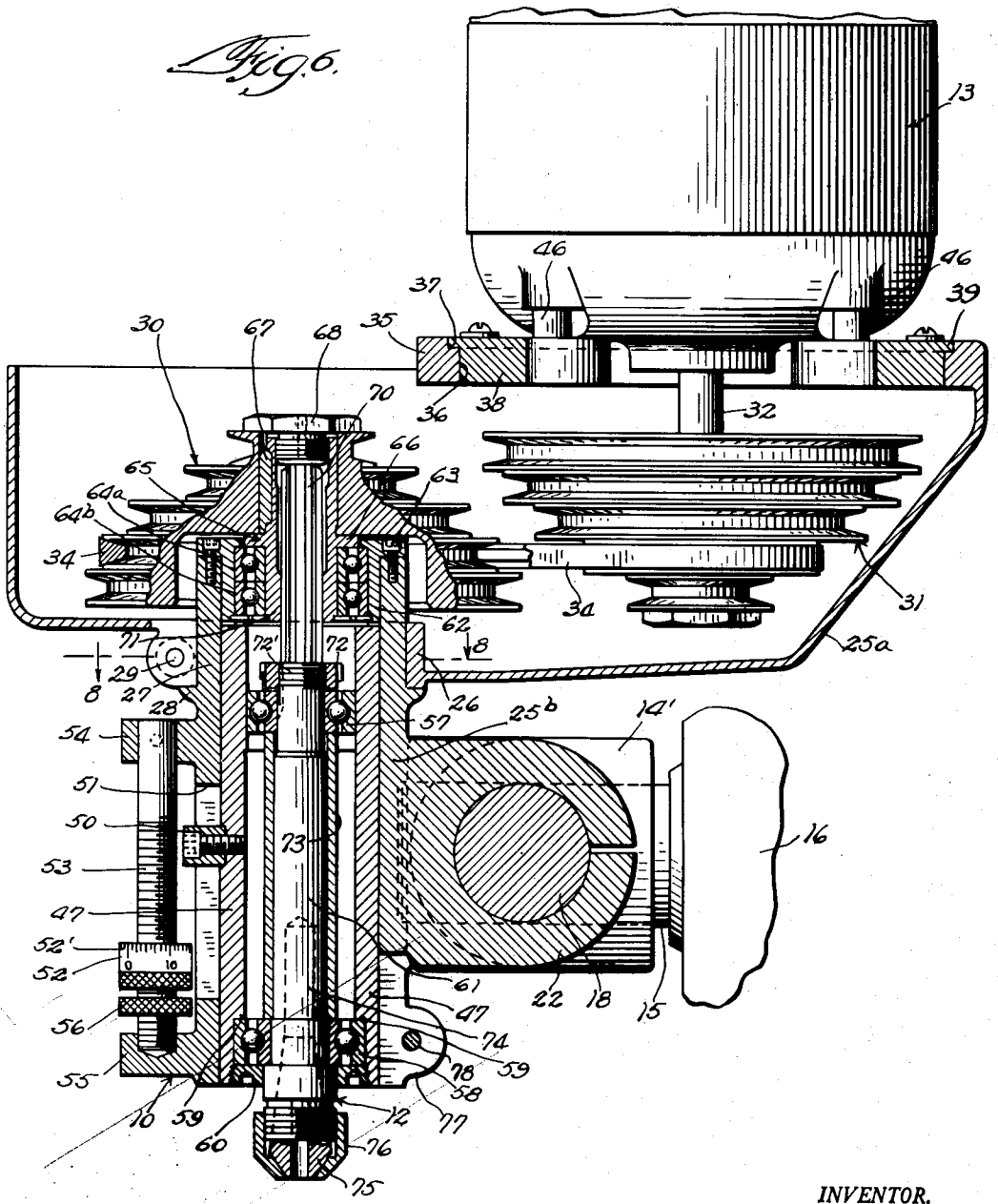
INVENTOR.
Edward Rusnok.
BY.
Theiss, Olson & Mecklenburger.
Patty

July 5, 1955 E. R. RUSNOK 2,712,273

MILL HEAD

Filed April 3, 1951 4 Sheets-Sheet 3

Fig. 6.



INVENTOR.
Edward Rusnok.
BY.
Theiss, Olson & Merkenburger.
Attys.

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MILL HEAD

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Fig. 7.

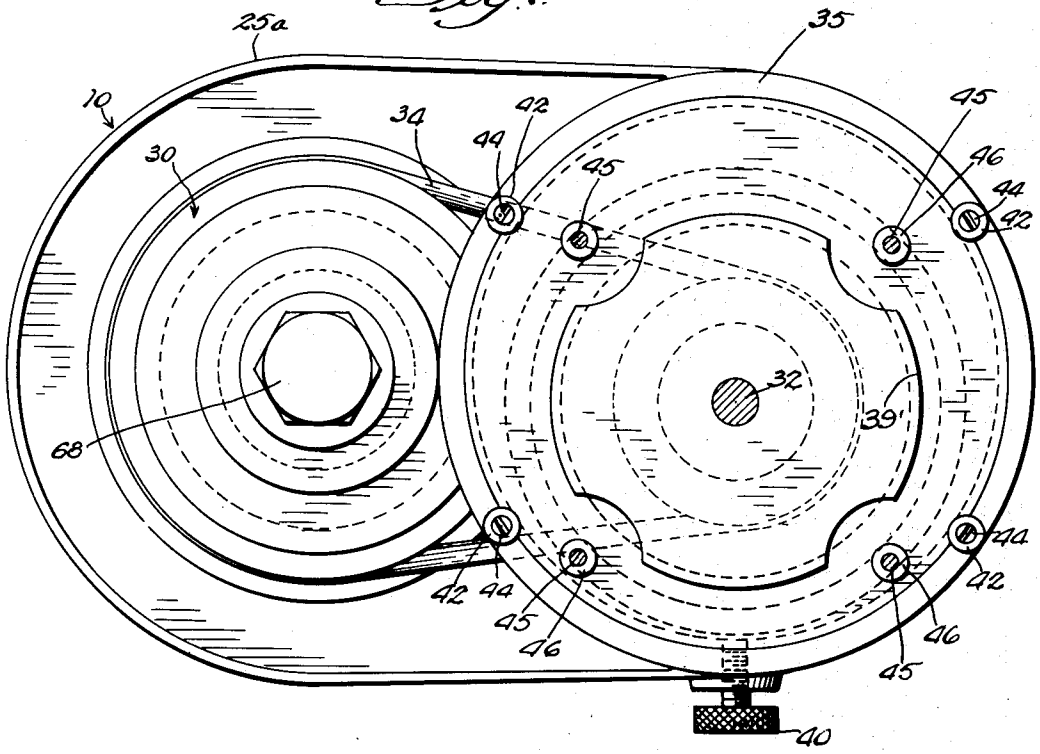
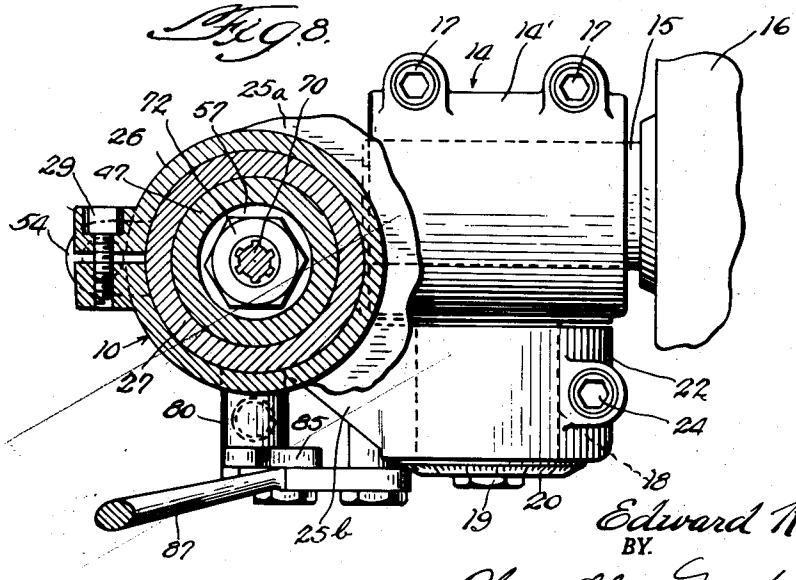


Fig. 8.



INVENTOR.
Edward Rusnok.
BY.
Thiess, Olson & Mecklenburger.
Attys.

United States Patent Office

2,712,273

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MILL HEAD

Edward R. Rusnok, Chicago, Ill.

Application April 3, 1951, Serial No. 219,083

9 Claims. (Cl. 90—14)

This invention relates to milling machines and the like and more particularly to a mill head for use on such machines.

Various mill heads have heretofore been proposed which are of such costly, weighty, and bulky design as to greatly restrict their utility for various machining operations. Furthermore with these prior mill heads, replacement of parts or varying the setting of the head relative to the work table is oftentimes an awkward and time-consuming step. A further disadvantage of these prior mill heads is that the feed of the tool towards the work piece is relatively slow and the sensitivity or feel of the tool during feeding is poor.

Thus it is one of the objects of this invention to provide a mill head which possesses great utility and is adapted to accommodate machines of various sizes and shapes.

It is a further object of this invention to provide a mill head which enables the operator to attain greater sensitivity of the tool and more rapid feeding thereof, thus resulting in improved quality of the finished work piece and a decrease in the machining time as well.

It is a further object of this invention to provide a mill head which may be readily adjusted to various angular positions relative to the work table.

It is a still further object of this invention to provide a mill head which enables various parts thereof to be readily disassembled without the necessity of removing the head from the machine.

It is a still further object of this invention to provide a mill head having means for accurately adjusting and measuring the length of the feed stroke of the tool.

It is a still further object of this invention to provide a mill head whereby the rotational speed of the tool may be easily and conveniently varied.

It is a still further object of this invention to provide a mill head which is simple, compact, and lightweight in construction, inexpensive to manufacture, and effective in operation.

Further and additional objects will appear from the description, accompanying drawings, and appended claims.

In accordance with one embodiment of this invention a mill head is provided comprising a housing adjustably mountable on the overarm extension of a milling machine and adapted to assume various angular positions relative to the work table of the machine. Reciprocally mounted within the housing is a quill in which is rotatably mounted a tool spindle. Spaced from the quill and swivelly mounted on the housing is a spindle-driving unit which is adapted to effectively drive the spindle only when in certain positions of swivel adjustment.

For a more complete understanding of this invention reference should be made to the drawings, wherein

Figs. 1 and 2 are perspective views of the mill head;

Fig. 3 is a perspective view of the mill head shown angularly disposed with respect to the overarm extension of the machine;

Fig. 4 is a front elevational view of the mill head shown in a vertical position;

Fig. 5 is a right-side elevational view of the mill head shown in Fig. 4;

Fig. 6 is a vertical sectional view of the mill head taken along line 6—6 of Fig. 4;

Fig. 7 is a horizontal sectional view of the mill head taken along line 7—7 of Fig. 5; and

Fig. 8 is a fragmentary sectional view of the mill head taken along line 8—8 of Fig. 6.

Referring now to the drawings and more particularly to Figs. 1 through 5, a mill head is shown comprising a housing **10**, a quill **11** reciprocally mounted within the housing, and a tool spindle **12** rotatably mounted within the quill. Mounted on the upper portion of the housing **10** is a spindle-driving motor **13**.

The housing **10** is secured by means of a bracket **14** to the overarm extension or shaft **15** of a conventional type milling machine **16**. While the bracket **14**, shown in this instance, is of suitable type for engaging the shaft **15**, it is to be understood, of course, that the bracket may be of any other type depending on the shape or style of the overarm extension. The bracket **14**, as shown, has a split-collar **14'** which is adapted to be brought into hugging or gripping engagement with shaft **15** by tightening bolts **17**. As seen in Fig. 8, a stud 18 extends transversely from one side of the split-collar **14'**. Secured to the end of stud **18** by means of a holding screw **19** is a disc **20** having the outer perimeter thereof inscribed with a scale **21** calibrated into degrees. The stud **18** is embraced by a split-collar **22** forming a portion of housing **10**. Inscribed on the surface of collar **22**, adjacent disc **20**, is an index mark **23** which cooperates with the calibrated scale **21** so as to indicate the angular disposition of the housing with respect to the stud **18**. The housing **10** may be held in any fixed angular position relative to stud **18** by means of a tightening bolt **24** which is threadably mounted on the split-collar **22** of the housing.

Housing **10** comprises upper and lower sections **25***a* and **25***b*, respectively. The upper section **25***a* is in the form of a casing or guard and is mounted for swivel adjustment on the lower section **25***b*. As seen in Fig. 6, the upper section **25***a* of the housing is provided with a split-collar portion **26** which embraces a sleeve portion **27** formed in the lower section **25***b*. A ledge or shoulder **28** is formed in portion **27** against which the collar portion **26** of upper section **25***a* abuts. The upper housing section **25***a* is held in various fixed positions of swivel adjustment by means of a tightening bolt **29** which is threadably mounted into collar portion **26**.

Disposed within the upper housing section **25***a* are a pair of cooperating cone pulleys **30** and **31**. Pulley **30** is connected to tool spindle **12** and rotates therewith. Pulley **31**, on the other hand, is keyed to the drive shaft **32** of the motor **13**. An endless belt **34** provides the operative connection between the pulleys **30** and **31**. The relative speeds of the pulleys may be varied by movement of the belt axially along the periphery of the pulleys.

Motor **13** is of a conventional reversible type and is mounted eccentrically on a bearing plate **38**. The plate **38** is swivelly mounted on a rim portion **35** formed on upper housing section **25***a*. The rim portion **35** is provided with a countersunk opening **36** in which is swivelly mounted bearing plate **38**. The outer peripheral surface of plate **38** is provided with a flange **39** which rests on shoulder **37** formed within opening **36**, as seen in Fig. 6. The center portion **39'** of plate **38** is cut out so as to enable the motor drive shaft **32** to extend therethrough. The cutout center portion **39'** is oversized thereby reducing the weight of the plate. The plate **38** is held in various positions of swivel adjustment relative to rim portion **35** by means of a holding screw **40**. The screw is disposed perpendicular with respect to the axis of the motor **13** and is threadably mounted into a tapped hole

formed in the rim portion 35 of the upper housing section 25*a*, see Fig. 4. A plug 41 is disposed within the tapped hole between the end of screw 40 and the outer peripheral surface of plate 38. A plurality of plate holding washers 42 are disposed uniformly about the upper side of the rim portion 35 and are secured thereto by means of screws 44.

Motor 13 is mounted on plate 38 by means of bolts 45. A spacer sleeve 46 embraces the shank of each bolt 45 and is disposed between plate 38 and the underside of the motor 13. The length of the sleeves is dependent upon the length of the motor shaft 32, so that the cone pulley 31 may be properly aligned with respect to pulley 30. The motor 13, as heretofore mentioned, is positioned on the plate 38 so that the axis of the motor shaft 32 is disposed eccentrically with respect to the axis of rotation of plate 38, as seen in Fig. 7. Thus, due to the eccentric positioning of the motor shaft 32, the belt 34 may be readily slackened by the bolt 40 being unthreaded and the plate 38 rotated in a clockwise direction with respect to rim portion 35. While the belt is in a slackened condition, it may be adjusted axially along the pulleys until the belt is positioned within the proper peripheral grooves of the pulleys. When the belt is so positioned, the plate 38 is rotated in a counterclockwise direction until the belt is taut, whereupon the bolt is tightened and the plate remains in its counterclockwise position. In what groove the belt is to be positioned depends upon the speed of the tool spindle desired. Sufficient clearance is provided between the pulleys 30 and 31, and the portion of the upper housing section 25*a* above pulley 30 is open so as to enable the belt 34 to be readily removed from the pulleys when desired. Also, windows 45' are provided in the sides of upper housing section 25*a*, so that the operator may readily determine in what pulley grooves the belt is positioned.

The quill 11 comprises an elongated sleeve 47 which is disposed within a suitable opening formed in the lower section 25*b* of housing 10, as seen in Fig. 6. Projecting transversely from one side of sleeve 47 is a gauge stud 50 which extends through an elongated slot 51 formed in housing section 25*b*. The stud 50 is adapted, upon movement downwardly of the quill 11 relative to the housing, to abut a gauge nut 52 which is threadably mounted on shaft 53. The shaft 53 is in parallel relation with respect to the tool spindle and is held between two lugs 54 and 55 formed on housing section 25*b*, see Fig. 6. An elongated scale 48 is mounted on the lower housing section 25*b* adjacent slot 51 and in parallel relation with respect to shaft 53. The scale 48 is calibrated in inches and indicates the length of travel of the quill relative to the housing. The gauge nut 52 has a micrometer scale 52' inscribed on the outer peripheral surface thereof. Thus the length of the feed stroke of the quill can accurately be determined by adjusting the gauge nut 52 relative to the scale 48. A lock nut 56 is threaded on shaft 53 beneath gauge nut 52 and holds the latter in its adjusted position. Projecting transversely from sleeve 47 and positioned approximately ninety degrees from gauge stud 50 is a pin 80. The pin 80 is disposed within an elongated slot 81 formed in lower housing section 25*b*. The pin 80 and slot 81 will be described more fully hereinafter.

The quill sleeve 47 has mounted therein upper and lower ball bearings 57 and 58, respectively. The end of quill sleeve 47 is countersunk a slight amount and is adapted to receive bearing 58. A retaining washer 60 is threadably mounted into the lower end of quill sleeve 47 and holds the bearing 58 against the shoulder 59 formed by reason of the countersinking. The inner ball race of each of the bearings 57 and 58 is in snug engagement with the tool spindle shaft 61.

The upper end of quill sleeve 47 engages a second sleeve 62 which is secured to the end of sleeve portion 27 of the lower housing section 25*b* by means of screws

63, as seen in Fig. 6. Disposed within second sleeve 62 are a pair of ball bearings 64*a* and 64*b*. The inner ball race of each of these bearings is in snug engagement with a drive bushing 65. Bushing 65 is provided with an outwardly extending flange 66 which engages the upper side of ball bearing 64*a*. The bushing 65 is adapted to rotate with cone pulley 30 by reason of a key 67 disposed within a key way formed within the bushing 65 and the hub of pulley 30. The pulley 30 is held in place on bushing 65 by means of a tightening screw 68 which is threaded endwise into the upper end of the bushing, see Fig. 6.

The tool spindle shaft 61 is rotatably mounted within quill sleeve 47 and has the upper end 70 thereof splined, and in meshing engagement with corresponding internal grooves formed in the lower end portion 71 of the bushing 65. Thus the rotation of pulley 30 is transmitted through bushing 65 to the splined end 70 of the spindle shaft 61. The axial length of the splined end 70 of the spindle shaft 61 is sufficient so as to enable the end 70 to remain in meshing relation with the lower portion 71 of the bushing 65 when the quill is in its fully extended position relative to the lower housing section 25*b*.

The upper ball bearing 57 which is disposed within quill sleeve 47 is held in a longitudinally spaced relation with respect to bearing 58 by reason of a spacer piece 73. Bearing 57 is held against the spacer piece 73 by a lock nut 72 which is threaded onto a portion 72' of the spindle. The lower or exposed end of the spindle shaft 61 is provided with an axial bore 74 in which is positioned a conventional type tool collet 75. The collet 75 is actuated into gripping relation with respect to the tool 75' by means of a threaded adjusting nut 76. The locking of the tool 75' within the collet 75 is facilitated by a lock pin 90 which is mounted on the underside of the upper housing section 25*a*, see Fig. 4. The pin registers with a suitable opening 93 formed on the underside of pulley 30, when the pulley is in proper rotational adjustment with respect to the pin. Upon registration of pin 90 and opening 93, the pin 90 may be pushed into the opening the full amount, as shown. When the pin is in this position the pulley 30 cannot be rotated. A circumferential groove 92 is formed in the shank of pin 90 which is adapted to receive a spring ball 91 when the pin is in its retracted position. The spring ball 91 retains the pin in its retracted position. The spring ball 91 is mounted within a suitable opening 94 formed in the upper housing section 25*a*.

The lower end portion of the lower housing section 25*b* is split and provided with a pair of lugs 77 through which is transversely threaded a locking screw 78. The screw 78 is provided with a convenient handle 78' so that it may be readily manipulated by the operator. Upon tightening of screw 78, the quill can be locked in any extended position relative to the housing.

Pin 80, as heretofore mentioned, projects transversely from the quill sleeve 47 through an elongated slot 81 formed in the lower housing section 25*b*. Pivotally mounted on the end of pin 80 is a link 85, which in turn is pivotally connected at 86 to a handle lever 87. One end of lever 87 is pivotally mounted on the housing 10 at point 88.

Mounted on and extending transversely from pin 80 and disposed intermediate the housing section 25*b* and link 85 is an elongated stud 82. The free end of the stud 82 is disposed within a socket 83 formed in housing section 25*b*. Positioned within socket 83 is a coil spring 84 having one end thereof engaging the free end of the stud 82 and causing the quill 11 to normally assume a retracted position with respect to the housing 10.

When required, the quill 11 and tool spindle 12 may be readily disassembled from the lower housing section 25*b* without the housing section 25*b* being disengaged from the overarm extension 15 of the machine 16. To effect removal of the tool spindle 12 from the quill sleeve 47, the retaining ring 60 is removed from the lower end

of the quill sleeve 47 whereupon the tool spindle 12, including bearings 57 and 58 may be withdrawn endwise from the sleeve.

Thus it will be seen that a lightweight mill head of simple construction has been provided which is readily adjustable to assume various angular positions with respect to the overarm extension of the machine thereby increasing the utility of the machine. Furthermore the mill head enables the operator to obtain greater sensitivity of the tool and more rapid feeding thereof, thereby improving the quality of the finished work piece and decreasing the time for finishing the work piece as well.

While a particular embodiment of this invention is shown above, it is to be understood, of course, that the invention is not to be limited thereto, since many modifications may be made, and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. A mill head comprising a housing, a quill mounted on said housing for linear movement relative thereto, resilient means normally maintaining said quill in a retracted position, a tool spindle rotatably mounted within said quill, a quill-actuating element pivotally mounted on said housing, means operatively connected to said quill and to a point on said element spaced from the pivotal axis thereof for transmitting the movement of said element to said quill, a supporting member rotatably mounted on said housing, a spindle-driving unit mounted eccentrically on said member, and an operative connection between said unit and said spindle being effected by the relative position of rotational adjustment of said member.

2. A mill head comprising a housing, a quill telescopically mounted on said housing, resilient means urging said quill to normally assume a retracted position, a tool spindle rotatably mounted within said quill, a quill-actuating element pivotally mounted on said housing, means operatively connected to said quill and to a point on said element spaced from the pivotal axis thereof for transmitting movement of said element to said quill, a spindle-driving unit swivelly mounted on said housing, means for locking said unit in various positions of swivel adjustment, and an operative connection between said unit and said spindle, said connection being effected by the relative position of swivel adjustment of said unit.

3. A tool-supporting device for use with a machine having a work-supporting surface and a supporting arm spaced from said surface, comprising a housing disengageably mountable on said arm and adapted to assume various angular positions relative to said surface, a quill mounted within said housing for movement towards or away from said surface, resilient means urging said quill to normally assume a position away from said surface, a handle pivotally mounted on said housing for actuating said quill from its normal position to a fully extended position, means operatively connected to said quill and to a point on said handle spaced from the pivotal axis thereof for transmitting movement of said handle to said quill, means mounted on said housing for adjusting the fully extended position of said quill relative to said surface, a tool-spindle rotatably mounted within said quill and movable therewith, an apertured plate swivelly mounted on said housing and spaced from said quill, and a spindle-driving unit mounted eccentrically on said plate and operatively connected to said spindle for actuating said spindle only upon movement of said plate to various positions of swivel adjustment.

4. A mill head comprising a housing, a quill mounted on said housing for linear relative movement, a spindle rotatably mounted in said quill and axially fixed relative thereto, a quill-actuating element mounted on said housing for pivotal movement about an axis disposed transversely with respect to the direction of linear movement of said quill, resilient means maintaining said quill in a retracted position, spindle rotating means fixed in said housing and in driving engagement with said spindle, and means operatively connected to said quill and to a point on said element spaced from the pivotal axis thereof to effect linear movement of said quill upon pivoting of said element.

5. A mill head comprising a housing, a quill telescopically mounted on said housing and normally assuming a retracted position relative to said housing, a spindle rotatably mounted in said quill and axially fixed relative thereto, a quill-actuating element pivotally mounted on said housing, resilient means maintaining said quill in a retracted position, spindle rotating means fixed in said housing and in driving engagement with said spindle, and means operatively connected to said quill and to a point on said element spaced from the pivotal axis thereof to effect telescopic movement of said quill upon pivoting of said element.

6. A mill head comprising a housing provided with an elongated slot, an elongated quill telescopically mounted within said housing, the direction of movement of said quill being substantially parallel to said slot, an elongated shaft fixed in spaced relation on said housing and in substantially parallel relation with respect to said slot, an adjustable stop mounted on said shaft and adjustable with respect to said housing for limiting the extent to which the quill can project from the housing, a stud mounted on and extending transversely from said quill, said stud projecting through said elongated slot and abutting said stop when said quill assumes an extended position relative to said housing, and means operatively connected to said quill and housing for effecting movement of said quill.

7. A mill head comprising a housing provided with an elongated slot, an elongated quill telescopically mounted within said housing, the direction of movement of said quill being substantially parallel to said slot, a calibrated scale mounted on said housing adjacent to said slot and in substantially parallel relation with respect to said slot, an elongated stationary shaft mounted in fixed spaced relation on said housing and in substantially parallel relation with said scale, a stop threadably mounted on said shaft, the relative position of said stop on said shaft determining the extent to which said quill can move relative to the housing, a second scale mounted on the periphery of said stop and calibrated in fractions of the graduations of said elongated scale, a stud mounted on and extending transversely from said quill, said stud projecting through said elongated slot and abutting said stop when said quill assumes an extended position relative to said housing, and means operatively connected to said quill and housing for effecting movement of said quill.

8. A mill head comprising a housing provided with an elongated slot, an elongated quill telescopically mounted within said housing, the direction of movement of said quill being substantially parallel to said slot, a calibrated scale mounted on said housing adjacent to said slot and in substantially parallel relation with respect to said slot, an elongated stationary shaft mounted in fixed spaced relation on said housing and in substantially parallel relation with said scale, a stop threadably mounted on said shaft, the relative position of said stop on said shaft determining the extent to which said quill can move relative to the housing, a second scale mounted on the periphery of said stop and calibrated in fractions of the graduations of said elongated scale, a stud mounted on and extending transversely from said quill, said stud projecting through said elongated slot and abutting said stop when said quill assumes an extended position relative to said housing, and means operatively connected to said quill and housing for effecting movement of said quill, said means comprising a quill-actuating element pivotally mounted on said housing, means operatively connected to said quill and to a point on said element spaced

from the pivotal axis thereof for transmitting the movement of said element to said quill.

9. A mill head comprising a housing having an elongated slot therein, a quill mounted on said housing for linear relative movement, a spindle rotatably mounted in said quill and axially fixed relative thereto, a quill-actuating element mounted on said housing for pivotal movement about an axis disposed transversely with respect to the direction of linear movement of said quill, a pin extending transversely from said quill, resilient means maintaining said quill in a retracted position and means operatively connected to said pin and to a point on said element

spaced from the pivotal axis thereof to effect linear movement of said quill upon pivoting of said element.

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