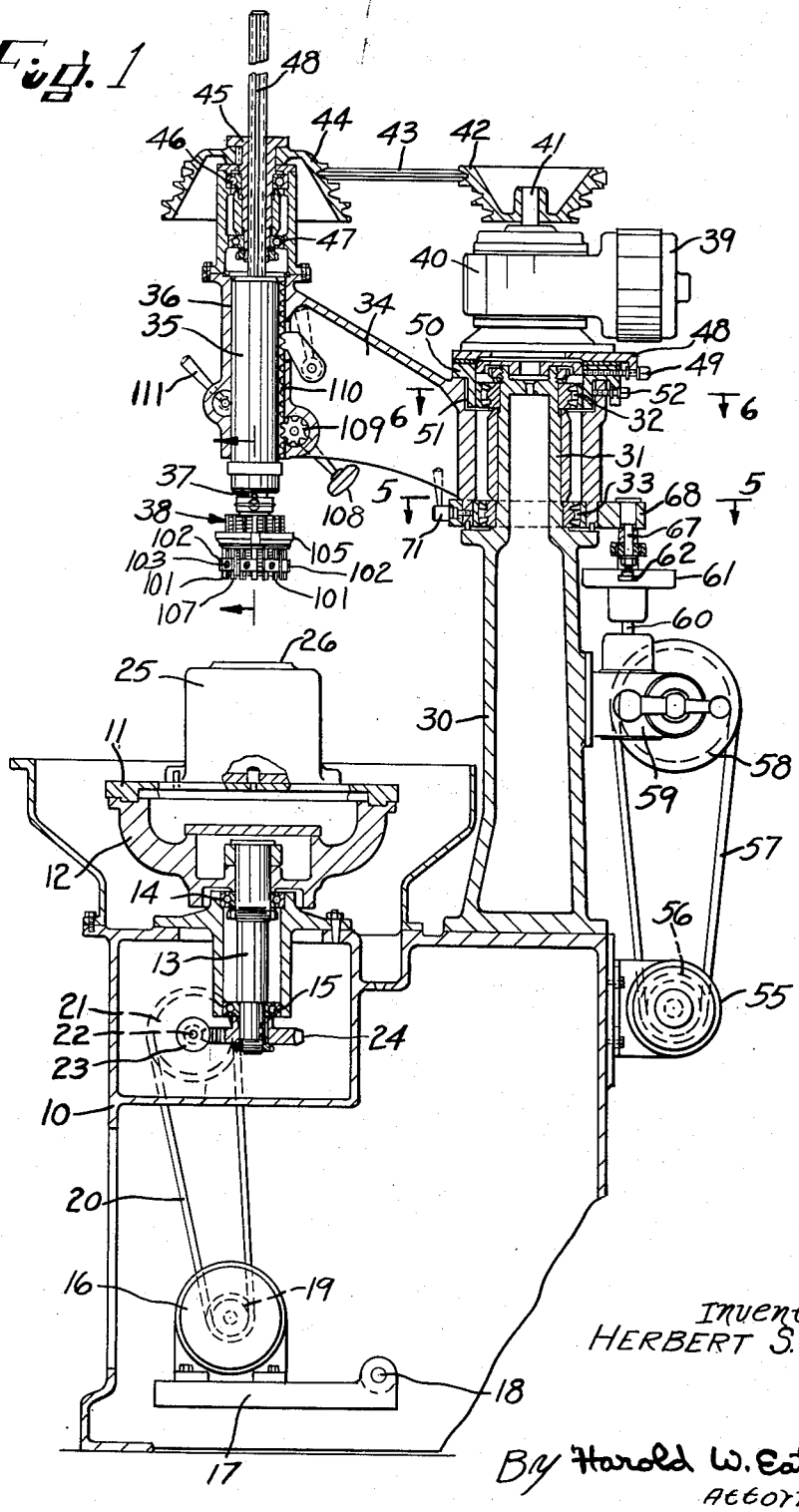
Nov. 17, 1953 H. S. INDGE 2,659,185

HONING MACHINE

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Fig. 1



Inventor
HERBERT S. INDGE

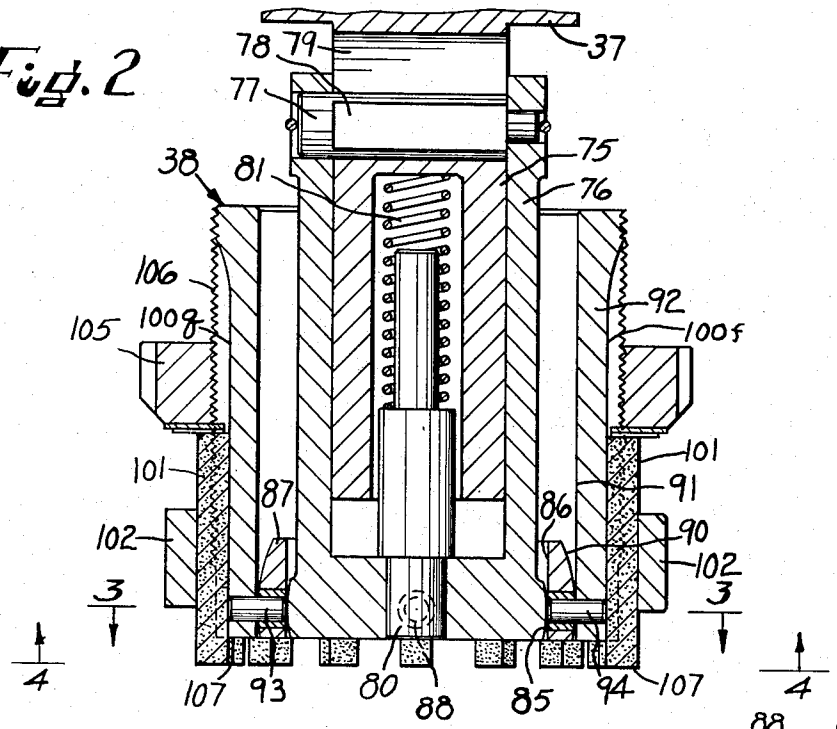
By Harold W. Eaton
Attorney

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Fig. 2



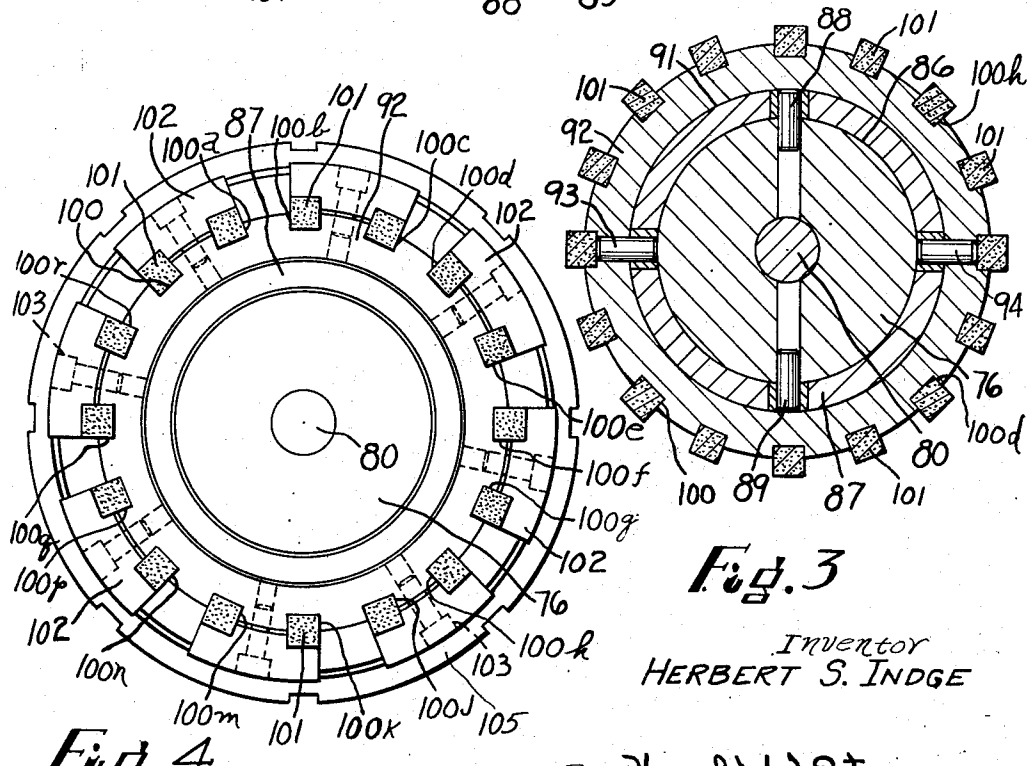


Fig. 4

Fig. 3

Inventor
HERBERT S. INDGE

By Harold W. Eaton
Attorney

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Fig. 5

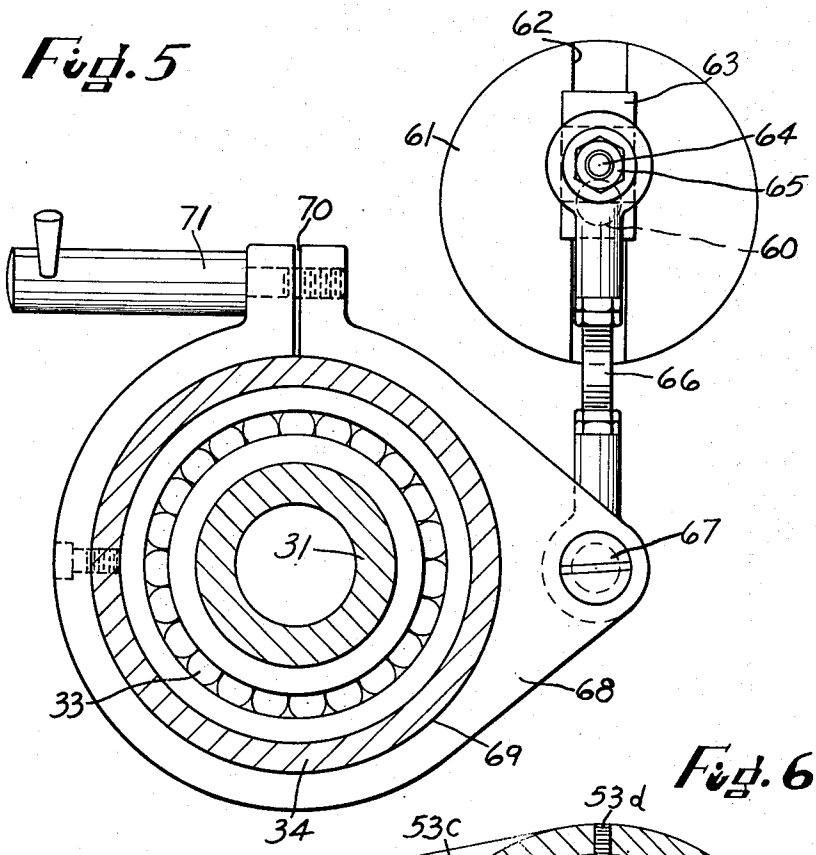
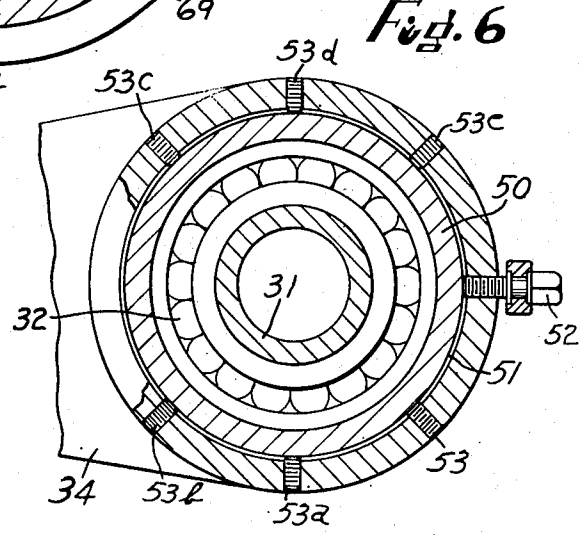


Fig. 6



Inventor
HERBERT S. INDGE

By Harold W. Eaton
Attorney

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UNITED STATES PATENT OFFICE

2,659,185

HONING MACHINE

Herbert S. Indge, Westboro, Mass., assignor to Norton Company, Worcester, Mass., a corporation of Massachusetts

Application June 29, 1951, Serial No. 234,285

3 Claims. (Cl. 51—55)

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The invention relates to honing machines and more particularly to a honing head for honing plane surfaces on a work piece.

One object of the invention is to provide a simple and thoroughly practical honing apparatus for precisely honing plane surfaces. Another object is to provide a yieldably mounted freely floating honing head. Another object is to provide a honing head which is provided with a universal driving connection having its pivotal axes lying in a plane located adjacent to the operative face of the hone so that pressure applied for the honing operation is uniformly distributed to the honing members. A further object is to provide a honing head having a plurality of spaced honing elements which are adjustably mounted on the head to facilitate compensation for wear so as to maintain the operative face of the hone in a predetermined relationship with respect to the axes of the universal driving connection. Other objects will be in part obvious or in part pointed out hereinafter.

One embodiment of the invention has been illustrated in the accompanying drawings, in which like reference numerals indicate like parts and wherein:

Fig. 1 is a vertical sectional view of a honing machine illustrating the improved floating honing head;

Fig. 2 is a vertical sectional view, on an enlarged scale, through the honing head;

Fig. 3 is a cross-sectional view, taken approximately on the line 3—3 of Fig. 2, through the honing head;

Fig. 4 is a bottom plan view, taken approximately on the line 4—4 of Fig. 2, of the honing head;

Fig. 5 is a fragmentary cross-sectional view, on an enlarged scale, taken approximately on the line 5—5 of Fig. 1, showing the mechanism for oscillating the honing head; and

Fig. 6 is a fragmentary cross-sectional view, on an enlarged scale, taken approximately on the line 6—6 of Fig. 1, through the adjusting mechanism for aligning the arm which supports the honing head.

A honing machine has been illustrated in the drawings comprising a base 10 which serves as a support for a rotatable work supporting platen 11. The platen 11 is supported by a spider 12 mounted on the upper end of a rotatable shaft 13. The shaft 13 is supported in anti-friction bearings 14 and 15 which are in turn supported in fixed relationship with the base 10.

A motor 16 is provided for imparting a rotary

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motion to the platen 11. The motor 16 is mounted on a motor supporting platen 17 which is pivotally mounted on a rock shaft 18 carried by the base 10. The motor 16 is provided with V-groove pulley 19 which is connected by a V-belt 20 with a V-groove pulley 21 which is mounted on the end of a rotatable shaft 22. The shaft 22 is provided with a worm 23 which meshes with a worm gear 24 mounted on the lower end of the shaft 13. It will be readily apparent from the foregoing disclosure that rotary motion of the pulley 19 will be imparted through the mechanism above described to impart a rotary motion to the platen 11 and to a work piece 25 mounted thereon, having a plane surface 26 to be honed.

The base 10 also serves as a support for a vertically arranged column 30 having a cylindrical portion 31 formed at its upper end. The cylindrical portion 31 serves as a support for a pair of spaced anti-friction bearings 32 and 33 which in turn support a horizontally extending arm 34.

The arm 34 supports a vertically arranged sleeve 35 which is slidably supported within a cylindrical aperture 36 formed in the arm 34. The sleeve 35 serves as a support for a rotatable spindle 37. The spindle 37 is preferably arranged with its axis of rotation parallel to the axis of rotation of the platen 11 and the work piece 25. A honing head 38, to be hereinafter described, is mounted on the lower end of the spindle 37.

A suitable driving mechanism is provided for the spindle 37 comprising an electric motor 39 which drives a conventional gear reducer unit 40. The gear reducer unit 40 is provided with a driven shaft 41 which supports a multiple V-groove pulley 42. The pulley 42 is connected by a V-belt 43 with a multiple V-groove pulley 44 mounted on a rotatable sleeve 45. The sleeve 45 is journalled in spaced anti-friction bearings 46 and 47. The bearings 46 and 47 are supported within a housing which is fixedly mounted on the arm 34. In order to facilitate tensioning the V-belt 43, the gear reducer unit 40 is mounted on a transversely arranged slide 48 which may be adjusted transversely relative to the column 30 by means of an adjusting screw 49. As illustrated in Fig. 1, the slide 48 is preferably supported on a flanged plate 50 carried by the bearing 32. In order to facilitate adjustment of the arm 34, a clearance is provided between the flanged plate and an internal cylindrical aperture 51 formed within the arm 34. An adjusting screw 52 is provided on the flanged plate 50 which serves to adjust the upper portion of the

arm 34 which is fulcrumed about the lower antifriction bearing 33 so that the honing supporting spindle 37 may be axially aligned with the axis of rotation of the work supporting platen 11. A plurality of clamping screws 53, 53a, 53b, 53c, 53d, 53e are provided to lock the arm 34 in the desired adjusted position.

In honing a plane surface such as surface 26 on a work piece 25, it is desirable to provide not only a rotary motion of the hone 38 and the work platen 11 but also to provide an oscillation of the honing head 38 during the lapping operation. A suitable mechanism may be provided for oscillating the arm 34 which may comprise an electric motor 55 mounted on the base 10. The motor 55 is provided with a V-groove pulley 56 which is connected by a V-belt 57 with a V-groove pulley 58 mounted on the drive shaft of a conventional gear reducer 59. The gear reducer 59 is provided with a driven shaft 60 which supports a crank plate 61 having a diametrically arranged T-slot 62. A slide block 63 is arranged to be adjusted transversely within the T-slot 62. A clamping bolt 64 is provided to facilitate locking the slide block 63 in adjusted position by means of a nut 65. The clamping bold 64 serves as a crankpin which is rotatably connected to one end of a connecting rod 66. The other end of the connecting rod 66 is connected by a stud 67 with an arm 68. The arm 68 is provided with an aperture 69 which mates with a correspondingly shaped surface on the arm 34. The arm 68 is provided with a slot 70 and a binder screw 71 by means of which the arm 68 may be adjustably clamped to the arm 34. It will be readily apparent from the foregoing disclosure that rotation of the pulley 56 caused by the motor 55 will be imparted to revolve the clamping bolt 64 to impart an oscillating motion to the arm 34. The extent of oscillation may be varied by adjustment of the slide block 34 within the T-slot 62 of the crank plate 61. If no oscillating motion of the arm 34 is desired, the slide block 63 may be adjusted so that the axis of the clamping bolt 64 is aligned with the axis of the shaft 60. It will be readily apparent that the extent of oscillation of the arm 34 may be adjusted by shifting the slide block within the T-slot 62 to vary the eccentricity of the axis of the clamping bolt 64 relative to the shaft 60.

The honing head 38 is preferably formed with a plurality of spaced honing elements in order to produce a highly efficient honing action upon the work surface 26 to be honed. The lower end of the spindle 37 is provided with a cylindrical portion 75 which slidably supports a cup-shaped sleeve 76. A stud 77 having parallel slabbed off surfaces 78 is supported by the sleeve 76 and passes through an elongated slot 79 formed in the cylindrical portion 75 of the spindle 37. The elongated slot 79 serves to facilitate motion of the honing head in an axial direction relative to the spindle 37. The cup-shaped sleeve 76 is provided with a centrally located vertical stud 80 which supports the lower end of a compression spring 81. The compression spring 81 serves to facilitate applying a predetermined honing pressure as will be hereinafter described.

It is desirable to provide a universal driving connection between the spindle 37 and the honing elements to be hereinafter described and to locate the universal driving connection as close to the operative face of the hone as practicable in order that the hone may be freely floating and that pressure applied thereto may be uniformly distributed to the entire operative honing face. The cup-shaped sleeve 76 is provided with a partial spherical surface 85 which fits within an internal cylindrical surface 86 formed in an annular ring 87. The annular ring 87 is pivotally connected to the cup-shaped sleeve 76 by a pair of diametrically opposed studs 88 and 89 (Fig. 3). Similarly the annular ring 87 is provided with a partial spherical surface 90 which fits within an internal cylindrical surface 91 formed within a sleeve 92 which is concentric with but spaced from the sleeve 76. The sleeve 92 is pivotally connected with the annular ring 87 by means of a pair of diametrically opposed pivot studs 93 and 94 which are arranged at 90° to the pivot studs 88 and 89. It will be readily apparent that the pivot studs 88—89 and 93—94 are located in close proximity to the operative face of the honing elements to be hereinafter described and serve as a universal connection to allow the sleeve 92 to freely float relative to the spindle 37.

The sleeve 92 is provided with a plurality of grooves 100, 100a, 100b, 100c, 100d, 100e, 100f, 100g, 100h, 100j, 100k, 100m, 100n, 100p, 100q and 100r formed in the outer periphery thereof and arranged parallel to the axis of rotation of the spindle 37. A plurality of elongated honing sticks 101 are mounted within the grooves 100. Adjacent pairs of honing sticks 101 are clamped to the sleeve 92 by means of a clamping block 102 and a clamping screw 103 which is screw threaded into the sleeve 92.

It is desirable to provide a suitable longitudinal adjustment for the honing sticks 101 to compensate for wear thereof during honing so as to maintain the operative honing face in close proximity to the pivotal axes of the universal driving connection. This mechanism may comprise a collar 105 which is threaded onto a threaded portion 106 formed on the outer periphery of the sleeve 92. The collar 105 serves as an end thrust member for all of the honing sticks 101. When it is desired to adjust the honing sticks 101, the clamping screws 103 may be loosened and the collar 105 rotated to cause an endwise motion of the honing sticks 101 after which the clamping screws 103 may be tightened to clamp the honing sticks 101 in adjusted position. The lower faces 107 of the honing sticks 101 are arranged to lie in the same plane to form an operative honing surface.

The operation of this improved honing apparatus will be readily apparent from the foregoing disclosure. A work piece 25 having a surface 26 to be honed is mounted on the platen 11, the electric motors 16, 39 and 55 are then started, the sleeve 35 may then be lowered by means of a manually operable lever 108 which rotates a gear 109 meshing with a rack bar 110 to cause a downward motion of the sleeve 35 to move the honing surface 107 into operative engagement with the surface 26 to be honed. The work piece is rotated, the hone 38 rotated and the arm 34 oscillating through a stroke determined by the position of the clamping bolt 64 as above described. The downward movement of the sleeve 35 is continued until the spring 81 is compressed to give the desired honing pressure after which the sleeve 35 is locked in adjusted position by a binder bolt 111. Due to the universal driving connection located adjacent to the honing faces 107, a uniform honing pressure will be applied to the entire operative face of the hone 38.

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 honing machine having a rotatable spindle and a honing head thereon including a slidably mounted sleeve on said spindle, driving connections between the spindle and sleeve including an elongated slot in said spindle and a drive pin on said sleeve passing through said slot, an outer sleeve surrounding said first sleeve which is concentric with and spaced therefrom, a plurality of spaced grooves formed in the outer periphery of the outer sleeve, a honing element adjustably clamped in each of said grooves, the ends of said elements forming a plane honing face, yieldable means interposed between the spindle and inner sleeve to facilitate an axial yielding movement of the sleeve and honing head, and a universal driving connection between the lower ends of said sleeves to facilitate equalizing the pressure applied to said honing face.

2. In a honing machine having a rotatable spindle and a honing head thereon comprising a slidably mounted sleeve on said spindle, an outer sleeve surrounding said first sleeve which is concentric with and spaced therefrom, a plurality of spaced honing elements adjustably clamped on the outer periphery of said outer sleeve, the ends of said elements forming a plane honing face, a universal driving connection between the lower ends of said sleeves to facilitate equalizing pressure applied to said honing face, and an adjustable collar threaded onto the outer periphery of said outer sleeve which serves as an end thrust member for said honing elements and also to facilitate endwise adjustment thereof to compensate for wear so as to maintain the honing elements in a predetermined relationship with the pivots of said universal driving connections.

3. In a honing machine having a rotatable spindle and a honing head thereon including a slidably mounted sleeve on said spindle, yieldable connections between said spindle and sleeve to facilitate an axial yielding movement of said sleeve an outer sleeve surrounding said first sleeve which is concentric with and spaced therefrom, a plurality of spaced honing elements adjustably clamped on the outer periphery of the outer sleeve, the ends of the said elements form a plane honing surface and universal driving connections between the lower ends of the said sleeves comprising an annular ring interposed between the lower ends of the said sleeves, a partial spherical surface formed on the lower end of the inner sleeve which fits within an internal cylindrical surface within said ring, a pair of diametrically opposed aligned studs interposed between the lower ends of the said inner sleeve and said ring, a partial spherical surface on the outer periphery of said ring which mates with an internal cylindrical surface formed within said member, and a pair of diametrically opposed aligned studs arranged at right angles to said first studs and interposed between said ring and the lower end of said outer sleeve to facilitate self-alignment of the honing face.

HERBERT S. INDGE.

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