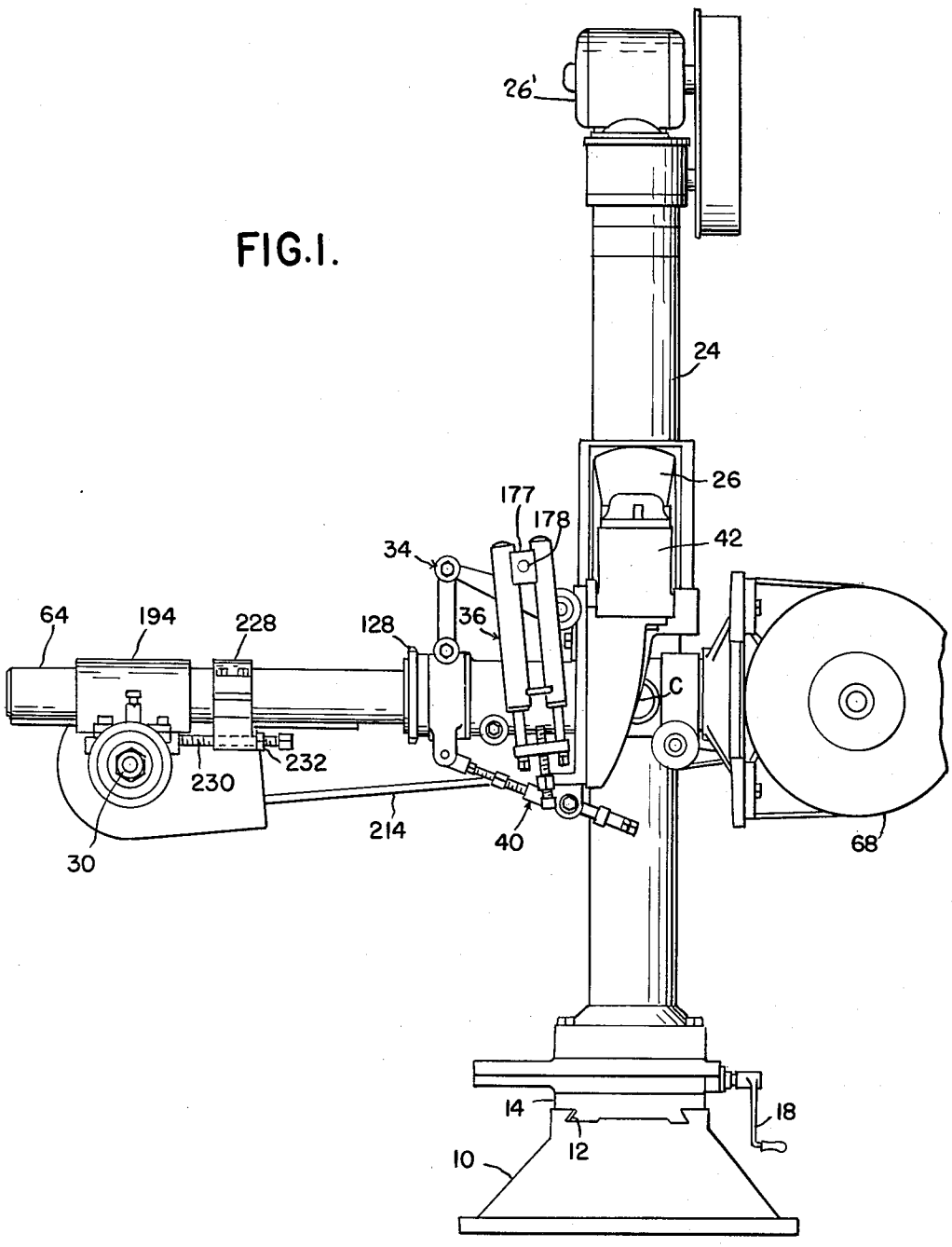
June 5, 1956 H. A. LANE 2,748,546

MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

Filed Feb. 23, 1954 7 Sheets-Sheet 1

FIG. 1.



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MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

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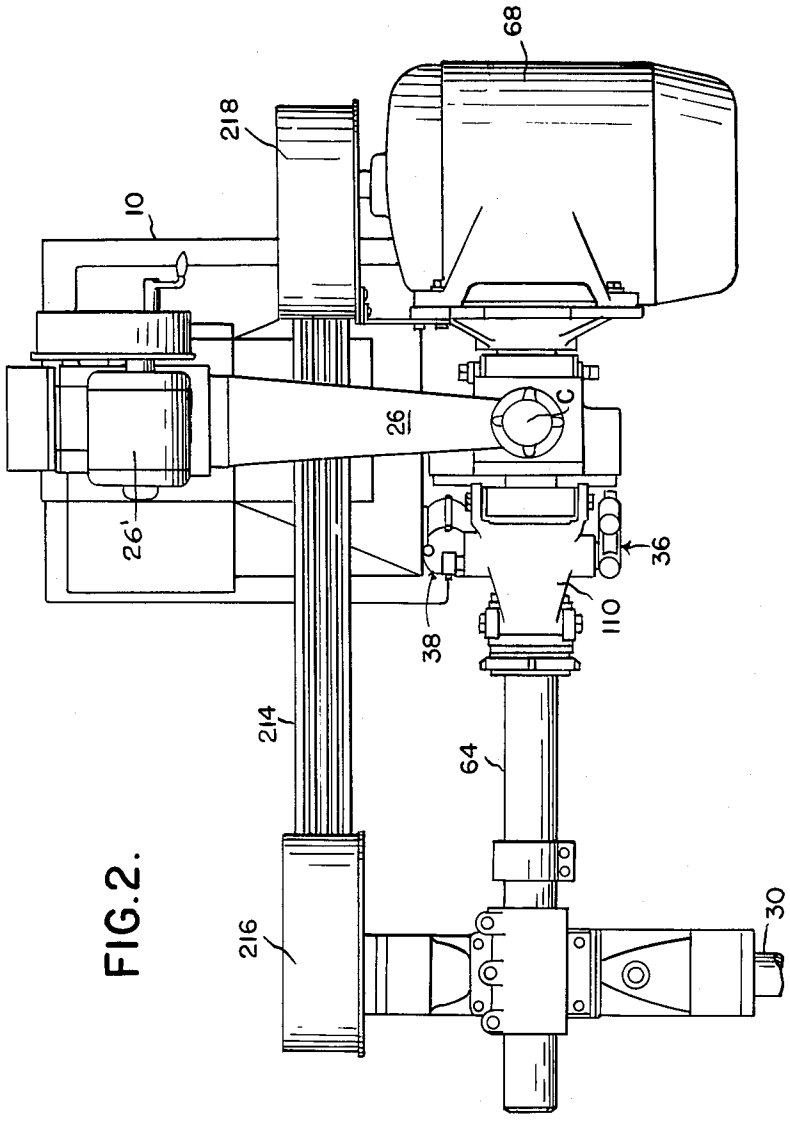

FIG. 2.

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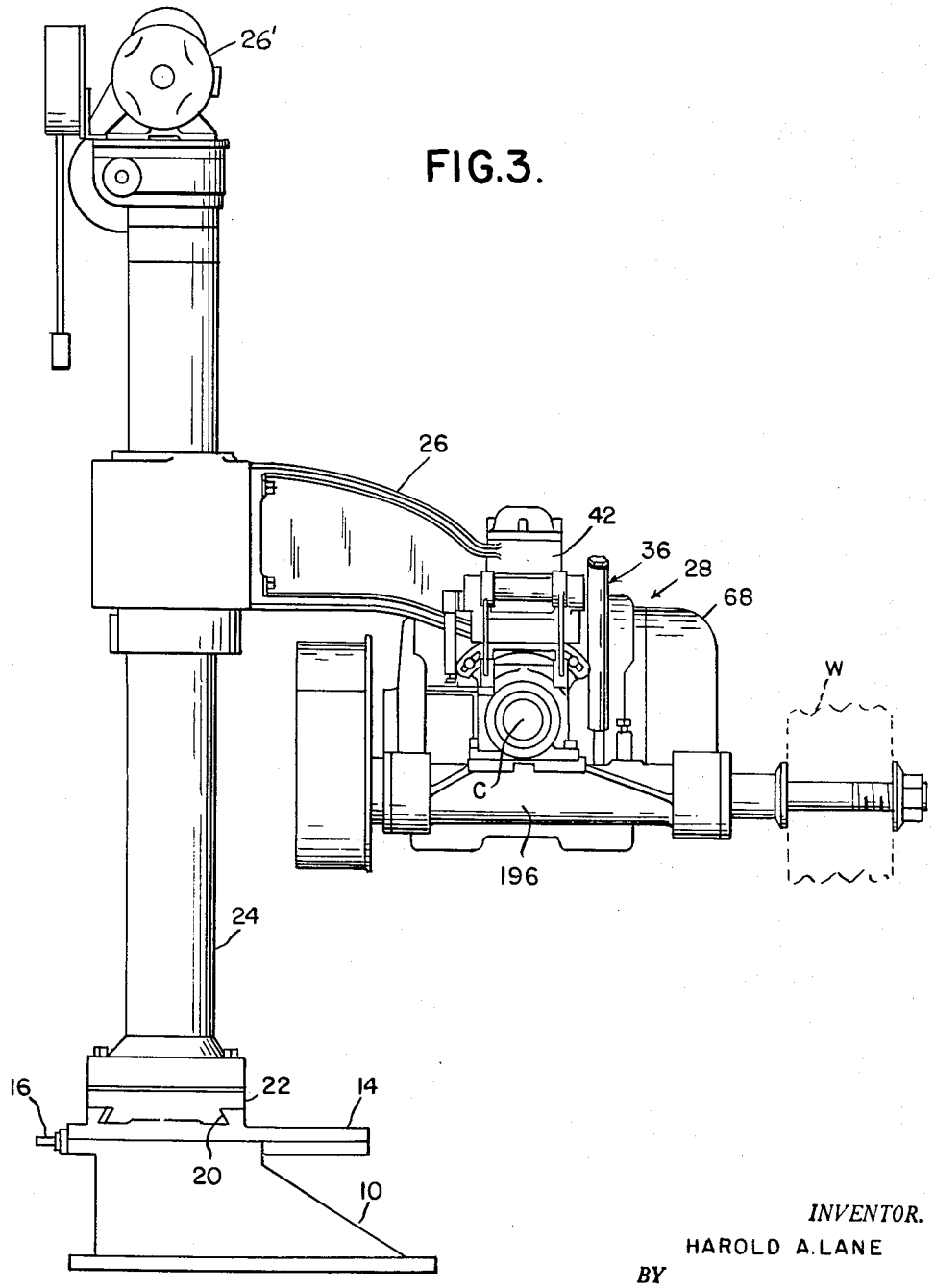
FIG.3.



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MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

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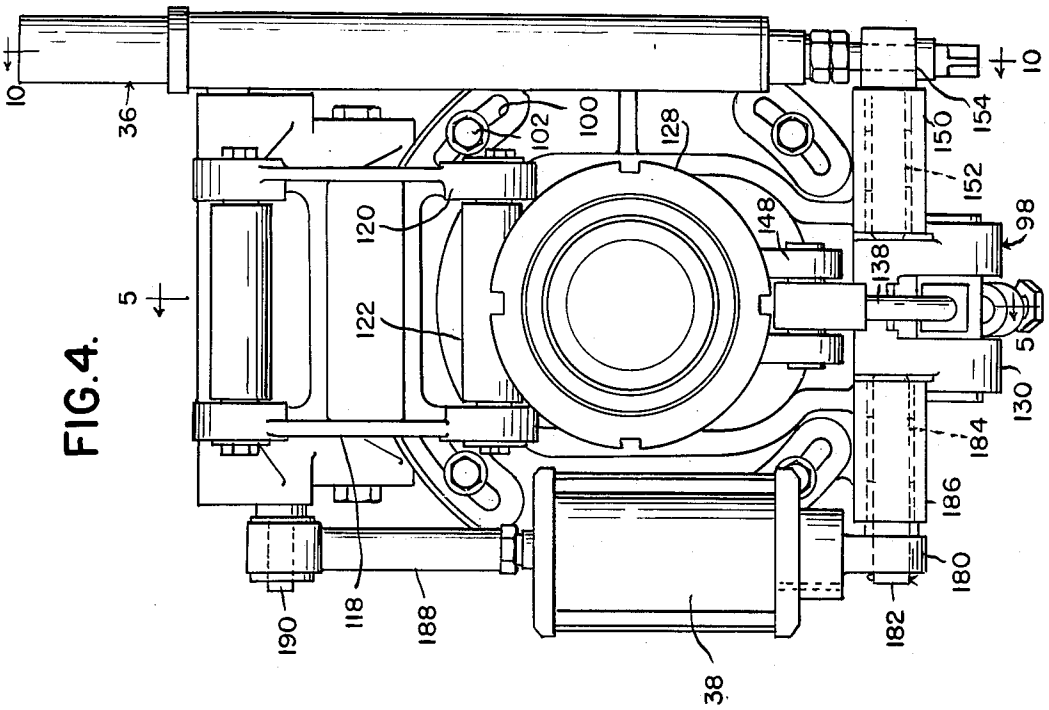

FIG.4.

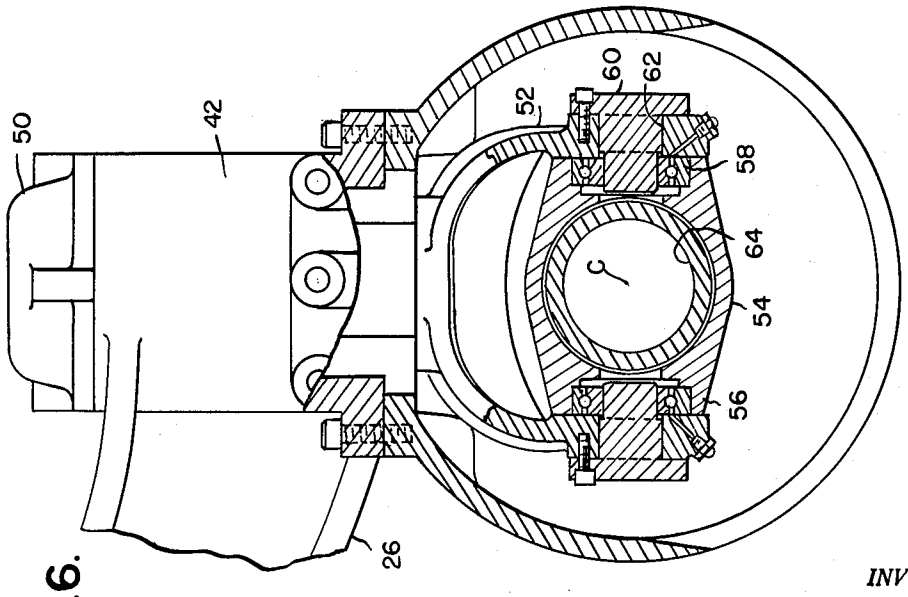

FIG.6.

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MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

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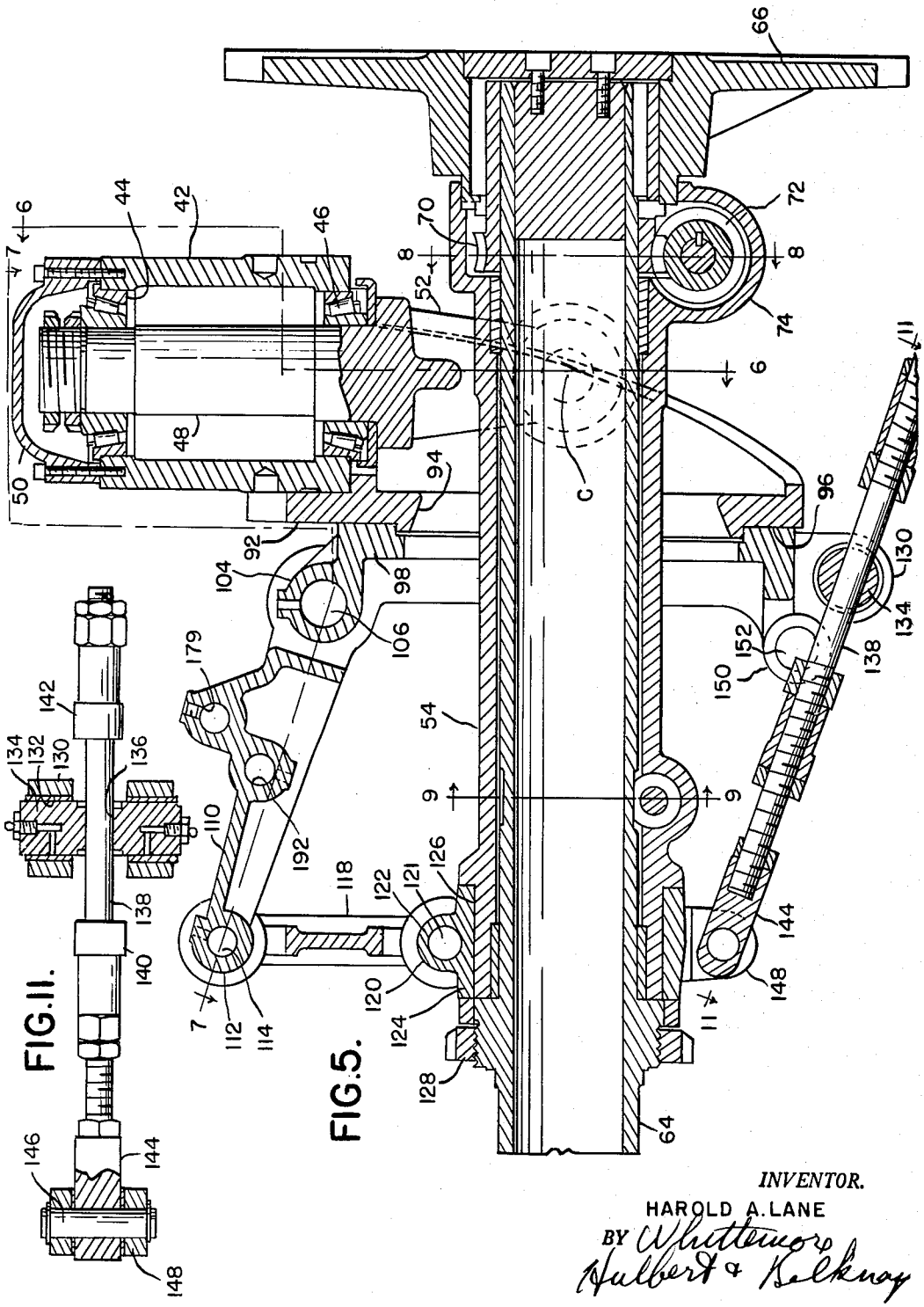

FIG. 11.

FIG. 5.

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MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

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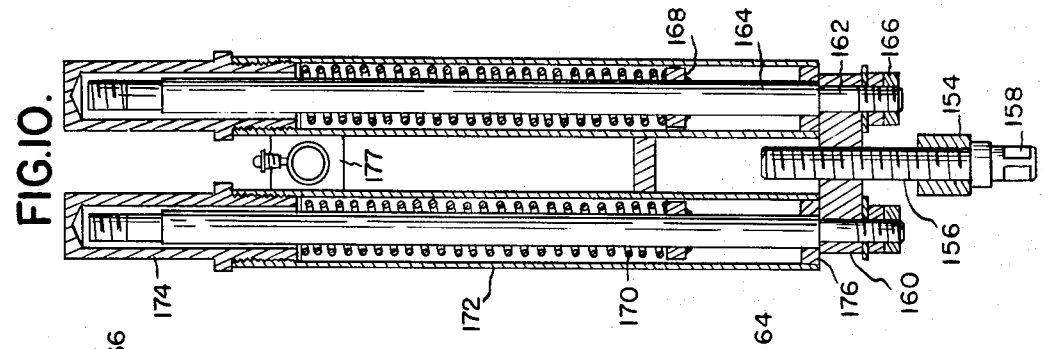

FIG.10.

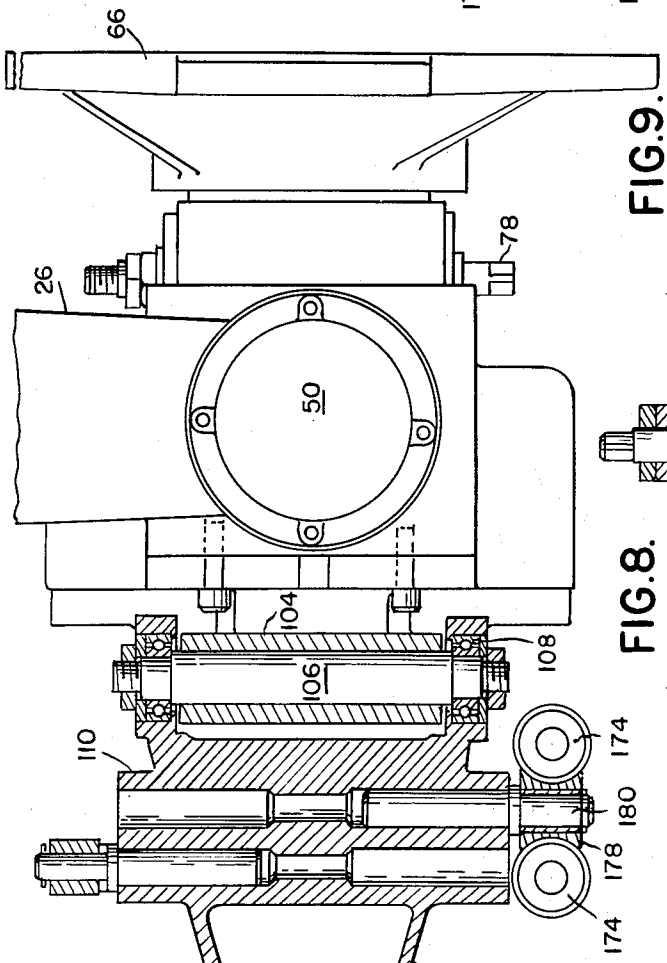

FIG.7.

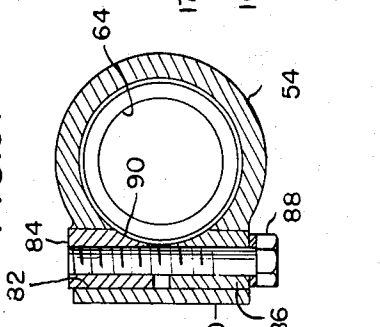

FIG.9.

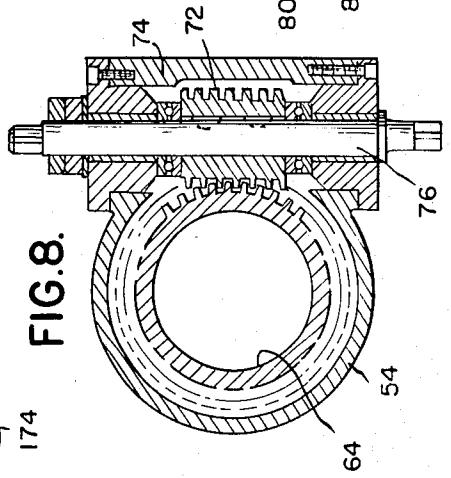

FIG.8.

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MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

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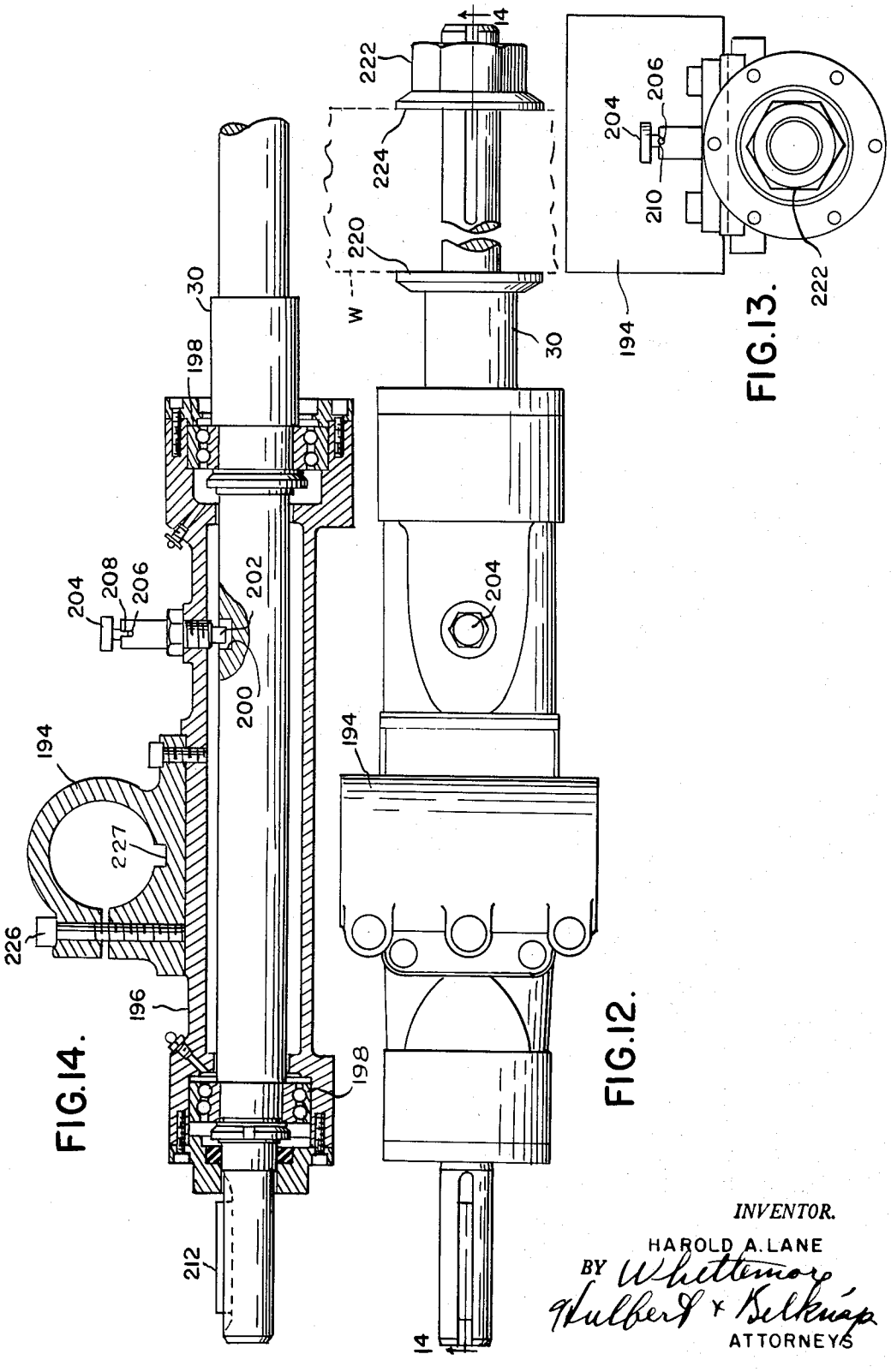

FIG.14.

FIG.12.

FIG.13.

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United States Patent Office 2,748,546 Patented June 5, 1956

2,748,546

MACHINE FOR GRINDING, POLISHING, BUFFING OR THE LIKE

Harold A. Lane, Birmingham, Mich., assignor to Midwest Supply and Manufacturing Company, Ferndale, Mich., a corporation of Michigan

Application February 23, 1954, Serial No. 411,640
16 Claims. (Cl. 51—166)

The present invention relates to a finishing machine such as a machine for grinding, polishing, buffing or the like.

In machines of this type it is necessary to provide a support for a rotary tool such for example as a grinder, polisher, buffer, or the like, with provision for yielding movement so that it may make efficient contact with the surface of a work piece during relative movement between the work piece and finishing tool. In a common application a work piece or a series of work pieces are advanced sequentially past the finishing machine. In many cases the work piece has an irregular contour so that the wheel is required to yield to maintain proper working contact with the surface of the work piece or work pieces. It is furthermore necessary in machines of this type to provide means controlling the direction of movement of the wheel as it is engaged by the work. In many cases the direction of movement of the wheel must be at an oblique angle to the axis or working surface of the wheel.

It is an object of the present invention to provide a machine having a tool supporting head provided with means for effecting angular adjustment of a work supporting arm about a stationary universal pivot axis in combination with means limiting movement of the support arm to a single plane.

It is a further object of the present invention to provide quickly adjustable motion limiting means effective to restrain movement of a universally mounted support arm to a single plane.

It is a further object of the present invention to provide a machine of the character described including support structure provided for universal angular movement of a wheel shaft, a motor for driving the wheel shaft, in combination with means for restricting the movement of the support structure to a single plane passing through the universal pivot axis.

It is a further object of the present invention to provide a machine as described in the preceding paragraph in combination with means for effecting angular adjustment of the support structure about an axis passing through the universal pivot axis.

It is a further object of the present invention to provide a machine comprising support structure, means mounting the support structure for universal movement about a fixed pivot axis, adjustable means for restricting motion of said support structure to a single plane passing through said pivot axis, and separate adjustable means carried by said support structure carrying a grinding wheel or the like for angular adjustment about an axis passing through the universal pivot axis.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a side elevation of a machine of the character described.

Figure 2 is a plan view of the machine shown in Figure 1.

Figure 3 is a front elevation of the machine shown in Figure 1.

Figure 4 is an enlarged elevational view of the support structure.

Figure 5 is a vertical section on the line 5—5, Figure 4.

Figure 6 is a vertical section on the line 6—6, Figure 5.

Figure 7 is a plan view of the structure shown in Figure 5, partly sectioned along the irregular line 7—7.

Figure 8 is a section on the line 8—8, Figure 5.

Figure 9 is a sectional view on the line 9—9, Figure 5.

Figure 10 is a sectional view on the line 10—10, Figure 4.

Figure 11 is a sectional view on the line 11—11, Figure 5.

Figure 12 is an elevational view of the spindle assembly employed in the machine.

Figure 13 is an end view of the spindle assembly shown in Figure 10.

Figure 14 is a section on the line 14—14, Figure 13.

Referring now to the drawings, and particularly Figures 1–3, the machine comprises a base 10 having ways 12 at its top receiving a slide 14 for horizontal adjustment. Suitable means are provided for effecting adjustment of the slide 14 including a feed nut and screw device having a non-circular extension 16 adapted to cooperate with a suitable hand tool such as the crank illustrated at 18 in Figure 1. Mounted in ways 20 provided on the slide 14 is a second horizontally adjustable slide 22, the direction of adjustment of the slide 22 being perpendicular to the direction of adjustment of the slide 14. Extending upwardly from the slide 22 is a vertical column 24 and vertically adjustable on the column is a rigid support arm 26. Suitable power means, including the motor 26' shown at the top of column 24, may be provided to adjust arm 26 vertically. Carried at the outer end of the support arm 26 for angular universal adjustment about a pivot center indicated at C is support structure designated generally at 28 adapted to support a spindle 30, which in turn carries a buffing, grinding, or polishing wheel, a fragment of which is indicated at W in Figure 3. The arrangement is such, as will appear from a description of the remaining figures, that the spindle 30 may be angularly adjusted into a predetermined position about the axis of a support arm, which axis passes through the pivot center C. In addition, the support arm is carried by support structure providing for universal angular adjustment of the support arm about the pivot center C. Associated with the support structure is adjustable motion limiting mechanism indicated generally at 34 effective to limit movement of the support structure to a single plane.

The mounting structure includes resilient means indicated generally at 36 effective to apply a predetermined substantially constant pressure between the wheel and the surface of the work piece. In addition, an air cylinder or the like, indicated at 38, is provided which may be controlled to move the wheel W away from the work piece during the cycle of the machine. Finally, adjustable abutment means indicated generally at 40 are provided effective to limit swinging of the support arm between predetermined limits.

Details of the mechanism thus briefly adverted to are best seen in Figures 4–11 to which reference is now made.

At the outer end of the rigid support arm 26 is a vertical cylindrical portion 42 including bearings 44 and 46 mounting a shaft 48 for rotation about a vertical axis. A removable cap 50 is provided for the cylindrical portion 42.

At its lower end the shaft 48 is bifurcated to provide depending laterally spaced legs 52 between which is mounted an elongated tubular sleeve member 54. For this purpose the sleeve member 54 in the vicinity of the depending legs 52 has laterally extending bosses 56 recessed to receive bearings 58. Pivot pins 60 extend through openings 62 in the legs 52 and into the bearings 58, thereby mounting the sleeve member 54 for rocking movement about a horizontal axis.

From the foregoing it will be observed that the sleeve

member 54 is mounted for universal angular adjustment about a pivot center C, this motion being provided by swinging movement about the vertical axis of the shaft 48 and swinging movement about the axes of the pivot pins 60 which axes are perpendicular to and intersect the vertical axis of the shaft 48.

Mounted within the tubular sleeve member 54 is a tubular support arm 64. At one end of the tubular arm 64 there is provided a motor mounting plate 66 on which the drive motor 68 (see Figures 1–3) is mounted. Fixedly secured to the support arm 64 is a worm gear 70 which meshes with a worm 72 housed within an enlargement 74 of the tubular sleeve member 54.

As best seen in Figure 8, the worm is carried by a shaft 76 opposite ends of which extend outwardly from the enlarged housing portion 74 and are squared or otherwise shaped as indicated at 78 for cooperation with a suitable hand tool. It will be apparent that by rotation of the worm 72, angular adjustment of the support arm 64 about its longitudinal axis may be effected.

In order to lock the support arm 64 in any desired position of angular adjustment the clamping structure best seen in Figure 9 is provided. The sleeve member 54 is enlarged as indicated at 80 and is provided with a transverse bore 82 adapted to receive two clamping members 84 and 86. The clamping member 84 is threaded to cooperate with a bolt 88 and the sides of the clamping members 84 and 86 are provided with transverse arcuate curvature as indicated at 90 for clamping engagement with the outside of the tubular support arm 64. Thus, in order to effect angular adjustment of the tubular support arm 64 about its longitudinal axis it is necessary to loosen the clamping screw or bolt 88, after which the appropriate adjustment is effected by turning the worm gear shaft 76, followed by reclamping the support arm by tightening the screw 88.

The structure as so far described provides for universal angular adjustment of the tubular sleeve member 54 with the support arm 64 adjustable therewith, and also for angular adjustment of the support arm 64 about its longitudinal axis relative to the sleeve member 54. However, in operation it is necessary to restrict swinging movement of the support structure generally to a single plane and the mechanism for accomplishing this will now be described.

Rigidly secured to the outer end of the rigid support arm 26 is a mounting plate 92 having an enlarged opening 94 through which the sleeve member 54 extends and in which the sleeve member 54 is permitted substantial lateral movement as it swings about its universal pivot center C. Surrounding the opening 94 in the plate 92 is a circular seat 96 on which is mounted an annular support member 98. The annular support member 98 is provided with arcuate slots 100 as best seen in Figure 4, and is clamped in position by clamp screws 102.

The support member 98 is provided with an elongated tubular sleeve portion 104 which receives a pin 106 reduced adjacent its ends to receive bearings 108. Mounted on the bearings 108 at opposite ends of the pins 106 is a link 110. At its opposite end the link 110 is formed to provided a tubular sleeve 112 which receives a pin 114 having reduced end portions shaped to receive bearings 116. A second link 118 is pivoted to the bearings 116 at one end and at its other end is provided with enlarged annular bosses 120 adapted to receive suitable bearings (not shown) carried on a pin 121 extending through an elongated sleeve portion 122 formed on a collar 124. The collar 124 is rotatable on a seat 126 formed in an enlarged portion of the sleeve member 54 and may be retained in position thereon by means of an enlarged nut 128 threaded on the sleeve member 64.

Due to the fact that the bearings 108 and 116 and the bearings received in the annular bosses 120 are spaced substantially apart, it will be apparent that the linkage comprising the links 110 and 118 is effective to restrict swinging movement of the sleeve member 54 to a plane perpendicular to the axes of pins 106, 114, and 121. Furthermore, it will be apparent that by loosening screws 102, the annular support member 98 and the linkage carried thereby may be angularly adjusted about the axis of the seat 96 so as to adjust the plane in which the sleeve member 54 may swing.

In order to restrict swinging movement of the sleeve member 54 between predetermined limits, the annular support member 98 adjacent its lower end is provided with ears 130 (see Figs. 10 and 11) having openings 132 within which is journaled a swivel pin 134 having a transverse opening 136 therethrough. Extending through the opening 136 is a rod 138 having adjustable threaded abutments 140 and 142 thereon. One end of the rod is threaded into a connector element 144 which is pivoted by a pivot pin 146 between ears 148 extending from the underside of the collar 124. Swinging movement of the sleeve member 54 about the pivot center C in the plane to which its motion is restricted by the linkage, will result in sliding movement of the rod 138 in the opening 136 of the pin 134 until abutments 140 and 142 engage the pin.

Means are also provided for establishing a force urging the sleeve member 54 in one direction or another, and this mechanism illustrated generally at 36 is best seen in detail by referring to Figures 4, 5 and 10. The lower end of the annular support member 98 is provided with a tubular portion 150 which receives a pivot pin 152 having an apertured block 154 at one end thereof. Extending through the block 154 is an adjusting screw 156 the lower end of which is squared as indicated at 158 for coaction with a suitable hand tool. Adjustably carried by the screw 156 is a transverse block 160 having a pair of openings therethrough in which are received reduced ends 162 of rods 164, the rods being retained in place by suitable lock nuts 166. Welded or otherwise secured to the rods 164 intermediate the ends thereof are spring abutment collars 168. Suitable compression springs 170 are provided within tubular housing members 172, the upper ends of which are closed by removable threaded cap members 174 against which the opposite ends of the springs 170 engage. The lower ends of the tubular housing members 172 are closed by annular members 176 welded or otherwise secured therein. It will be apparent from an inspection of Figure 10 that the force of the spring 170 is exerted between the rods 164 and the tubular housing members 172. Interconnecting the tubular housing members 172 is a block 177 which is secured by a pivot pin 178 (see Figure 1) received in opening 179 in the link 110.

It will be observed that the rods 164 are provided with identical reduced and threaded portions at opposite ends thereof so that by removing the caps 174 and reversing the rods and spring structure in the tubular housings 172, the direction of force applied by the spring mechanism to the sleeve member 54 may be reversed.

In order to provide for movement of the wheel away from the surface of the work piece at predetermined cycles during the operation the air cylinder 38 is provided. As best seen in Figure 4, this air cylinder at its lower end is provided with an apertured boss 180 by means of which it is pivotally connected to a pin 182 received within an opening 184 provided in an enlargement 186 formed on the annular support member 98. Within the cylinder 38 is a piston having a connecting rod 188 connected by a pivot pin 190 received within an opening 192 formed in the link 110.

As best seen in Figure 1, means are provided on the support arm 64 for carrying the spindle 30 of the wheel. The spindle 30 and supporting structure are best illustrated in Figures 12–14. As seen in these figures a split clamping member 194 is bolted or otherwise secured to a shaft housing 196 having bearings 198 therein adapted to receive the spindle 30 for rotation. The spindle 30,

as illustrated at 200, is provided with a recess adapted to receive a plunger 202 provided with springs (not shown) urging the plunger into engagement with the recess. The upper end of the plunger is headed as indicated at 204 and carries a laterally extending pin 206 receivable in a relatively deep slot 208 when turned to proper position to permit engagement between the pin and the recess 200. When the plunger is retracted and rotated 90 degrees, the pin 206 engages in a relatively shallow slot or recess 210 at which time the lower end of the plunger is withdrawn from the recess 200. This relation is illustrated in Figure 13. At one end the spindle 30 is provided with a key 212 by means of which it may be connected in driving relation to a sheave (not shown). The motor 68 is also provided with a sheave adapted to drive the spindle 30 through belting indicated at 214, suitable belt guards being provided as indicated at 216 and 218 in Figure 2.

At its opposite end the spindle 30 is provided with an annular shoulder 220 against which one side of the wheel W is caused to abut. The wheel is assembled in position by a nut 222 engaging the outer threaded end of the spindle 30 and bears against washer 224.

It will be appreciated that the split clamping member may be engaged over the outer end of the support arm 64 and clamped thereon by tightening clamp screws 226. Also of course, the clamping member 194 may be adjusted longitudinally of the support arm 64. Preferably it is held against rotation thereon by a key received in the key slot 227 (Figure 14).

Referring now to Figure 1, means may be provided for effecting predetermined tightening of the belt 214. This means comprises a collar 228 which may be rigidly clamped to the support arm 64 and which includes an elongated threaded abutment element 230 engageable with one side of the supporting clamp 194. A lock nut 232 is provided. By loosening the clamp screws 226 the member 230 may be rotated to shift clamp member 194 longitudinally of the support arm 64 to effect desired tightening of the belt 214. At this time lock nut 232 may be tightened as well as the clamping nuts 226.

From the foregoing it will be apparent that there is provided a structure in which the buffing, polishing or grinding wheel may be adjusted in a horizontal plane by appropriate adjustment of the slides 14 and 22. The wheel may be adjusted vertically by vertical adjustment of the support arm 26 on the column 24. Having effected general adjustment of the wheel to the desired location, the axis of the wheel may be adjusted to bring the working surface of the wheel into conformity with the surface of the work piece, this adjustment being accompanied by adjustment of the driving motor for the wheel. At all times the support arm 64, the motor, and the wheel spindle are mounted for universal angular adjustment about a pivot center C, but at any time this universal angular movement is restricted to a plane as determined by the angular setting of the annular support member 98 to which the linkage comprising the links 110 and 118 is connected. Accordingly, when it is desired to provide for swinging movement of the wheel in any desired plane, it is necessary only to loosen clamp screws 102, at which time the annular support member 98 and the linkage, spring balancing mechanism, abutment mechanism, and air cylinder mechanism, may be adjusted as a unit about the axis of the support arm 64. It will be observed that the means for adjusting the plane in which the support arm swings is entirely independent of the means for adjusting the angularity of the axis of the wheel spindle so that compensating adjustments of the two need not be made. There is thus provided for the first time an extremely simple device providing for substantially universal control of the orientation in space and the direction of movement of a buffing wheel or the like, in which the orientation of the wheel may be adjusted independently and without reference to the plane in which the buffing wheel swings, and conversely, adjustment of the plane in which the buffing wheel swings may be made independently of and without disturbing the orientation of the buffing wheel.

The drawings and the foregoing specification constitute a description of the improved machine for grinding, polishing, buffing or the like in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about the longitudinal axis of said arm passing through said pivot center, a tool spindle on said arm, said motion limiting device comprising a first link pivoted to said arm, a second link pivoted to said first link, and a support adjustably secured to said frame, said second link being connected to said support.

2. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about an axis passing through said pivot center, a tool spindle on said arm, said motion limiting device comprising a first link pivoted to said arm, a second link pivoted to said first link, and an annular support adjustably secured to said frame and surrounding said arm, said second link being connected to said support.

3. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about an axis passing through said pivot center, a tool spindle on said arm, said motion limiting device comprising a first link pivoted to said arm, a second link pivoted to said first link, an annular support adjustably secured to said frame and surrounding said arm, said second link being connected to said support, a stop link pivotally connected to said arm, an abutment member on said support having an opening in which said stop link is slidable, and adjustable stop elements on said stop link engageable with said abutment member to limit swinging of said arm.

4. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, a tool spindle on said arm, motor means on said arm for driving said tool spindle, spring means connecting said arm and said device to bias said arm for swinging movement in one direction, and means for independently adjusting said motion limiting device and said spindle about the longitudinal axis of said arm passing through said pivot center.

5. A machine as defined in claim 4 in which said spring means comprises reversible means effective to reverse the direction in which said arm is biased.

6. A machine of the class described comprising a frame, a tubular support sleeve pivotally mounted on said frame for universal angular adjustment about a pivot center, a motion limiting device on said frame and operatively connected to said sleeve and effective to limit angular movement of said sleeve to a plane passing through said pivot center, means mounting said device on said frame for angular adjustment about an axis passing through said pivot center, a support arm in said sleeve, a tool spindle

carried by said arm, motor means for driving said spindle, adjustable stop means interconnecting said device and sleeve to limit the amplitude of swinging movement thereof, and resilient means interconnecting said device and sleeve to bias said sleeve in a predetermined direction.

7. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about an axis passing through said pivot center, a tool spindle on said arm, and motor means on said arm for driving said tool spindle, said arm and the tool spindle and motor means carried thereby being angularly adjustable about the axis of said arm.

8. A machine of the class described comprising a frame, a support arm, a universal pivot connection between said arm and frame, a motion limiting device between said frame and arm effective to limit motion of said arm to a plane passing through the pivot center of said universal pivot connection, means for adjusting said device about an axis passing through said pivot center, a tool spindle on said arm, and motor means on said arm for driving said tool spindle, said arm and the tool spindle and motor means carried thereby being angularly adjustable about the axis of said arm, the adjustment of said device and the angular adjustment of said arm about its axis being entirely independent whereby either adjustment may be made without reference to the other.

9. A polishing or buffing machine comprising a frame, a tubular support sleeve pivotally mounted on said support for universal angular swinging movement about a pivot center, a support arm in said sleeve, means for effecting angular adjustment of said arm in said sleeve about its longitudinal axis, a shaft mounted for rotation on said arm, a buffing or polishing wheel on said shaft, means for rotating said shaft, and adjustable guide means carried by said frame operably connected to said sleeve to limit the direction of swinging movement of said sleeve to a plane containing the axis of said sleeve, and means for adjusting said guide means about the axis of said sleeve.

10. A polishing or buffing machine comprising a stationary support, an arm pivoted to said support for universal swinging movement about a fixed pivot point, a rotatable tool spindle carried on said arm, guide means on said support operatively connected to said arm for guiding said arm for swinging movement in a single plane, and means for adjusting said guide means and said tool spindle independently of one another about the longitudinal axis of said arm.

11. A polishing or buffing machine comprising a stationary support, an arm pivoted to said support for universal swinging movement about a fixed pivot point, a rotatable polishing or buffing head on said arm, guide means on said support operatively connected to said arm for guiding said arm for swinging movement in a single plane, means for adjusting said guide means about the longitudinal axis of said arm, said guide means comprising a pair of links pivotally connected together, an annular support member on said support to which one of said links is pivoted, and an annular member encircling said arm to which the other link is pivoted, said support member and annular member being angularly adjustable about the axis of said arm to adjust the plane in which said arm can swing.

12. A polishing or buffing machine comprising a stationary support, an arm pivoted to said support for universal swinging movement about a fixed pivot point, a rotatable polishing or buffing head on said arm, guide means on said support operatively connected to said arm for guiding said arm for swinging movement in a single plane, means for adjusting said guide means about the longitudinal axis of said arm, said guide means comprising a pair of links pivotally connected together, an annular support member on said support to which one of said links is pivoted, and an annular member encircling said arm to which the other link is pivoted, said support member and annular member being angularly adjustable about the axis of said arm to adjust the plane in which said arm can swing, the pivot connection at both ends of said links including laterally spaced bearings to impart lateral stability to the linkage.

13. A polishing or buffing machine comprising a stationary support, an arm pivoted to said support for universal swinging movement about a fixed pivot point, a rotatable tool spindle carried on said arm, guide means on said support operatively connected to said arm for guiding said arm for swinging movement in a single plane, means for adjusting said guide means and said tool spindle independently of one another about the longitudinal axis of said arm, a tool head on said spindle, and resilient means connected between said support and arm to bias said arm in one direction to apply pressure between the head and a work piece, said resilient means being connected to said guide means for angular adjustment therewith.

14. A polishing or buffing machine comprising a stationary support, an arm pivotally connected to said support for universal swinging movement about a pivot center, an annular support member on said support surrounding said arm and angularly adjustable on said support about the axis of said arm, an annular member encircling said arm and angularly adjustable about its axis, a pair of laterally stable links connecting said support member and annular member, and relatively slidable abutment members connected to said support member to limit the magnitude of swinging movement of said arm.

15. A polishing or buffing machine comprising a stationary support, an arm pivotally connected to said support for universal swinging movement about a pivot center, an annular support member on said support surrounding said arm and angularly adjustable on said support about the axis of said arm, an annular member encircling said arm and angularly adjustable about its axis, a pair of laterally stable links connecting said support member and annular member, and resilient means mounted on said support member and angularly adjustable therewith and operatively connected to said arm for biasing said arm for swinging movement in one direction in the plane in which it is swingable.

16. A polishing or buffing machine comprising a support, an arm pivotally mounted on said support for universal swinging movement about a stationary pivot point, a support member on said support angularly adjustable thereon about the axis of said arm, an annular member on said arm angularly adjustable thereon about its longitudinal axis, and guide linkage for restricting swinging movement of the arm to a single plane, said linkage comprising one link connected to said support member and another link connected to said annular member.

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