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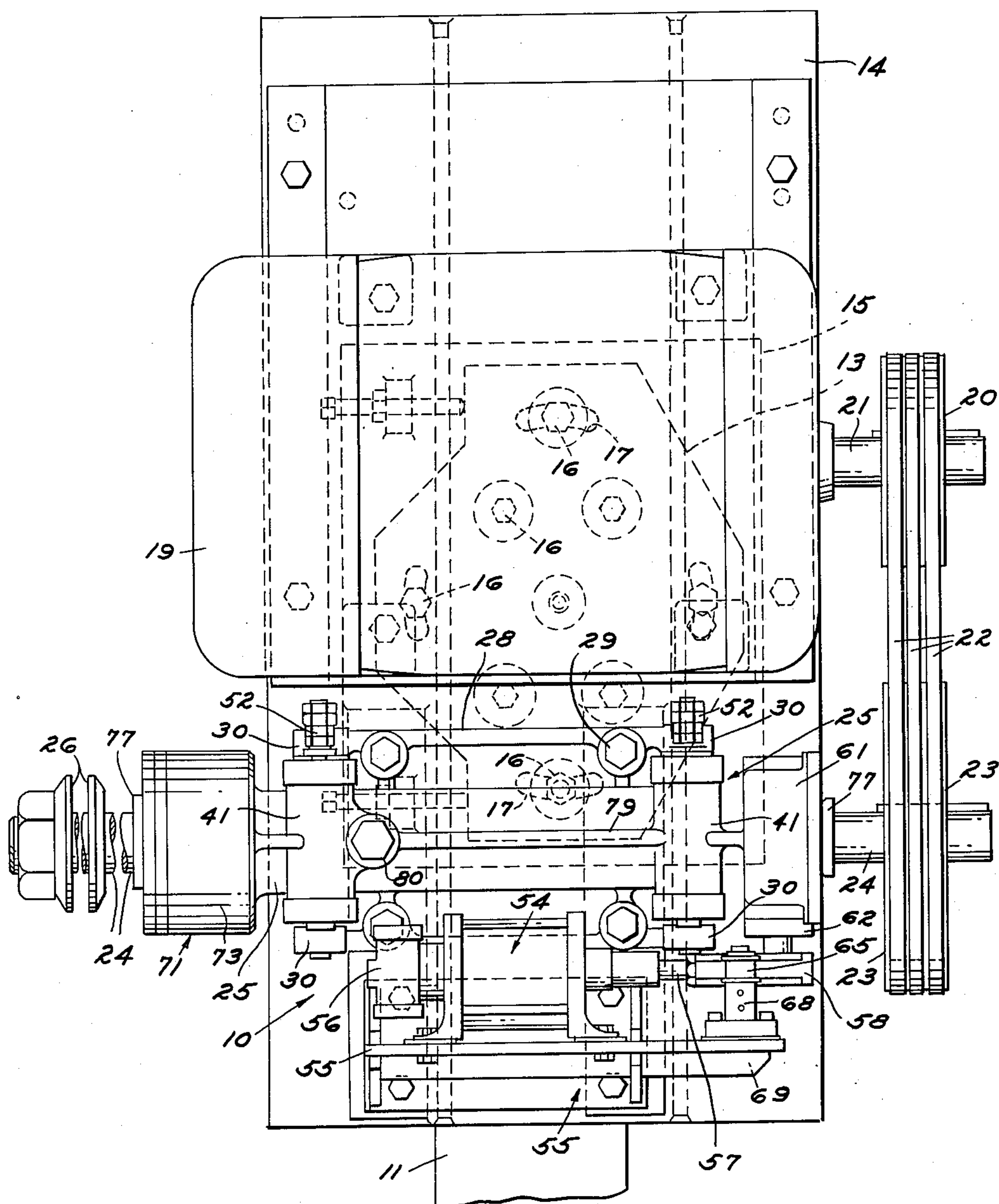
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RECIPROCATORY BUFFING SPINDLE STRUCTURE

Filed June 17, 1960

4 Sheets-Sheet 1

FIG. 1



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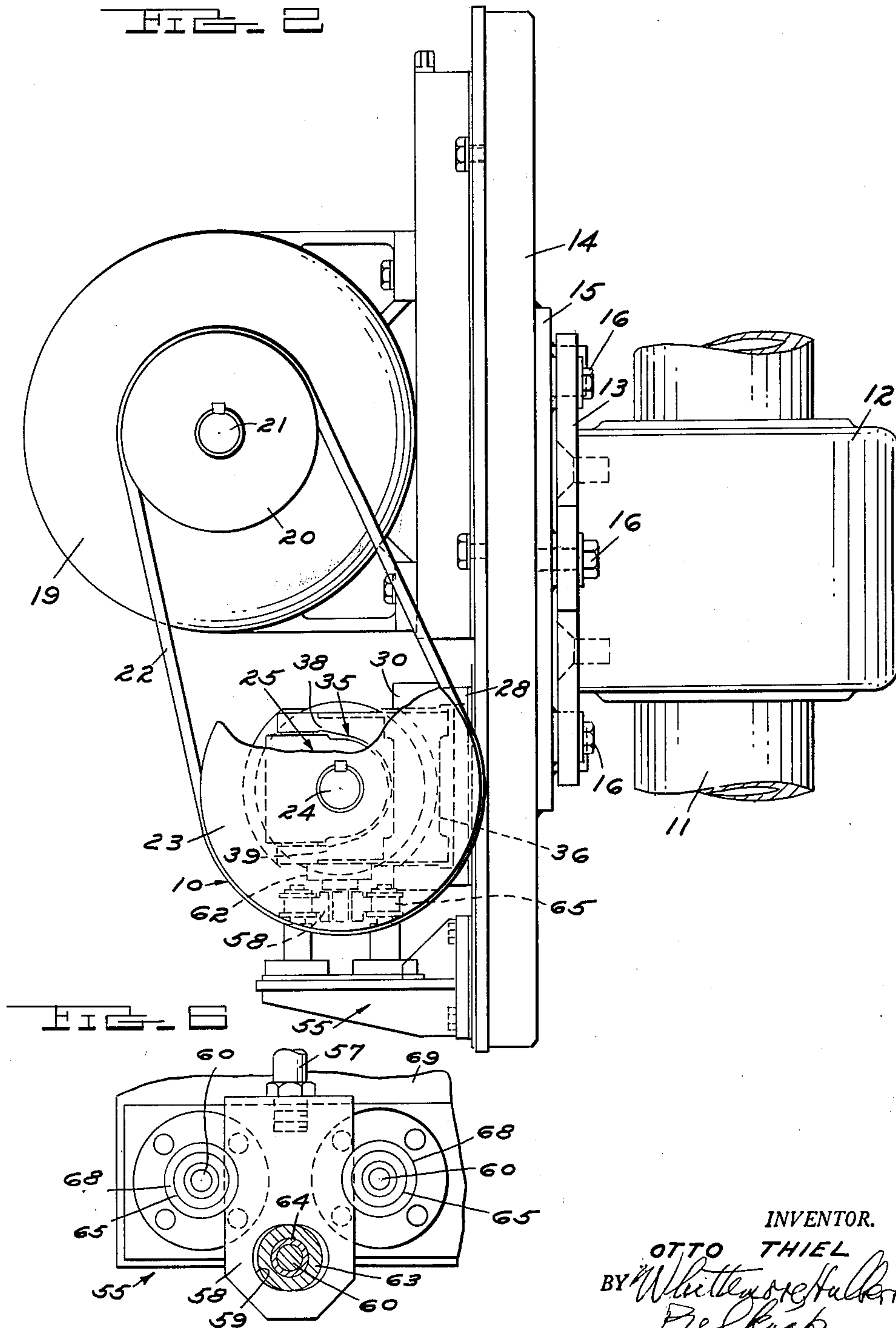
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4 Sheets-Sheet 2



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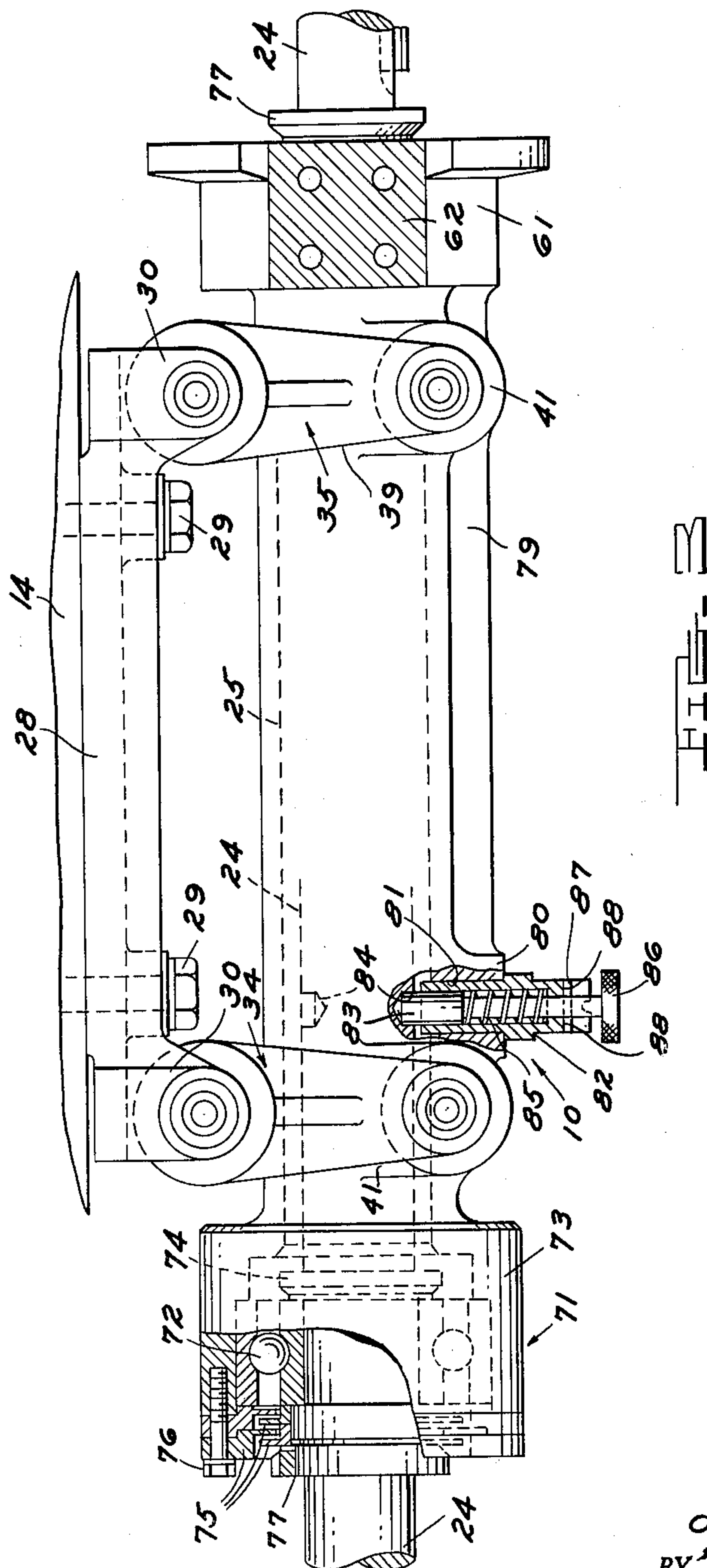
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RECIPROCATORY BUFFING SPINDLE STRUCTURE

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4 Sheets-Sheet 3



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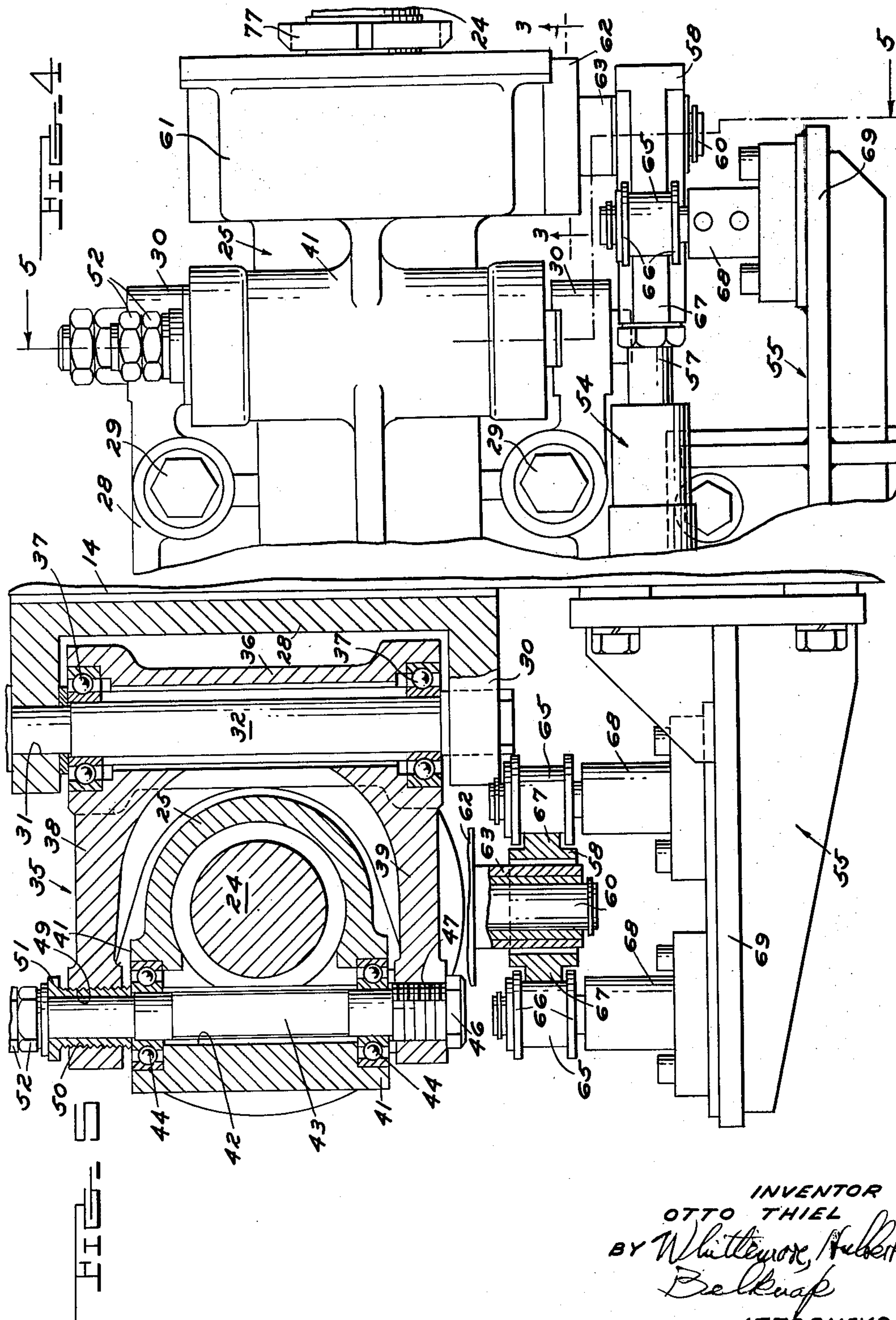
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4 Sheets-Sheet 4



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RECIPROCATORY BUFFING SPINDLE STRUCTURE

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12 Claims. (Cl. 51—34)

The present invention relates to improvements in a reciprocatory spindle structure, for example, associated with a buffing or polishing machine, whereby a buffing or polishing wheel may be given a rapid reciprocatory stroke in the direction of its axis as work to be polished is advanced thereacross. It is in the contemplation of the invention that a fast reciprocatory spindle stroke of small amplitude shall be produced, at a rate of reciprocation up to 200 strokes per minute.

It is an object of the invention to provide reciprocatory spindle structure as described, wherein a buffing tool spindle is mounted upon a suitable support, such as an upright column or the like, through the agency of improved oscillatory arm or bracket means which carries a housing in which the buffing wheel spindle is mounted for rotation. In accordance with the invention, such mounting provisions include longitudinally spaced pivoting arms which are of substantial length, thereby giving a more linear reciprocatory stroke in the buffing action, hence less transverse component than if a shorter swing radius were employed.

A further object is to provide reciprocatory spindle structure as described, in which the reciprocatory stroke may be imparted variously, i.e., from a mechanical or fluid pressure prime mover.

A still further object is to provide a structure in which the reciprocating spindle housing is mounted in an improved anti-friction fashion, and in a way to best sustain its weight in action. To this end, the housing is journaled on upright axes in longitudinally spaced pairs of vertically aligned swing arms or brackets, themselves journaled by anti-friction means at their inner radial ends in a pair of longitudinally spaced, upright pivot devices.

It is a further and more specific object to provide a structure in which the spindle housing is carried at the outer ends of the swing arms in an improved manner enabling the weight of the housing to be equally borne by the upper and lower swing arm or bracket of each pair.

It is a further object to provide such structure, in which the swing arms are integral parts of longitudinally spaced, laterally projecting, U-shaped yokes, each pivotally mounted by anti-friction means on an inner upright axis; and in which the means for mounting the spindle housing in the yoke arms comprises an adjustable adapter threaded into the upper arm of each yoke and manipulable to transfer to that upper arm its proper share of the weight of the housing.

In accordance with the last mentioned objective, the top and bottom arms of each swing yoke may be of the same cross sectional contour, since they bear equal portions of the housing weight. Accordingly, if insufficient space is present at the bottom or top of the yoke structure to accommodate further actuating provisions, the yokes may be turned 180° and the unit operated with unimpaired efficiency, in exactly the same manner as in the other disposition of the yokes. Such actuating provisions, for example, may comprise a pneumatic cylinder or mechanical prime mover and linkage means, as indicated above.

A further object of the invention is to provide a reciprocatory spindle device of the character described, adapted to be driven from a suitable prime mover through the agency of a longitudinal connector rod, for example, in which said rod is guided in an improved manner in its

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linear stroke and has improved anti-friction means for operatively connecting the same to the spindle housing to impart reciprocatory motion to the latter as it is carried pivotally by the swing yokes, arms or brackets.

The foregoing as well as other objects will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings illustrating the invention, wherein:

FIG. 1 is a fragmentary side elevational view of the improved reciprocatory spindle structure;

FIG. 2 is an end elevational view of the structure, partially broken away, as viewed from the right of FIG. 1;

FIG. 3 is a fragmentary bottom plan view, in part sectioned along line 3—3 of FIG. 4, of the swing yoke and spindle housing components of the structure, being also partially broken away and in horizontal section axially of the spindle;

FIG. 4 is a fragmentary side elevational view in enlarged scale as compared with FIG. 1, more clearly showing swing yoke, spindle housing and prime mover connecting rod and guide provisions;

FIG. 5 is a fragmentary view in transverse vertical section along broken line 5—5 of FIG. 4; and

FIG. 6 is a fragmentary plan view showing the connecting rod and guide means, by which the housing swing structure is operatively connected to a prime mover.

Referring first to FIGS. 1 and 2, the improved structure of the invention, generally designated 10, is appropriately mounted rigidly by a suitably fixed support, for example, an upright column 11 receiving a massive clamping collar 12 by which the structure 10 may be positioned vertically on the column as desired, and then rigidly fixed to the latter as a support. The collar 12 carries at one side thereof an appropriate bracket 13, upon which an upright mounting plate 14 may be adjustably mounted. To this end, the plate 14 may have an adapter 15 welded thereon, and with securing bolts or studs 16 connecting the plate unit 14—15 to the bracket 13, one of these being provided with arcuate holes 17 enabling a degree of angular adjustment of the mounting plate 14 and reciprocatory structure 10 in relation to bracket 13 and column 12.

An electrical spindle driving motor 19 is appropriately mounted on the outer face of plate 14, having a plural sheave pulley 20 secured on its shaft 21 and connected by drive belts 22 to a further multiple sheave pulley 23 secured on the spindle 24 of a buffing wheel. Although such wheel is not shown, it will be understood that the spindle 24 extends longitudinally through a spindle housing 25 (with which the improved reciprocatory structure 10 is associated), the buffing wheel being clamped up on spindle 24, at its outer end and externally of housing 25, between end discs 26. The belts 22 accommodate readily the very small-amplitude reciprocatory stroke imparted to housing 25 and spindle 24 by the improvements of the invention.

Now referring to FIGS. 3, 4, 5 and 6 in conjunction with FIGS. 1 and 2, the structure 10 is mounted by means of a special adapter plate 28 to the outer face of the main mounting plate 14. Plate 28 is of rectangular outline, being secured to plate 14 by four bolts or studs 29, and is at its corners provided with outwardly projecting pairs of bosses 30 which are, respectively, in vertical alignment with one another at opposite sides of plate 28. These bosses are provided with aligned trunnion openings 31 receiving the upper and lower ends of upright yoke pivoting pins 32, as best shown in FIG. 5.

The reference numerals 34, 35 designate a pair of like swing yokes of laterally opening, U-shaped outline, each of which includes an upright tubular mounting sleeve 36 surrounding a pivot pin 32 and having an antifriction pivot on the latter through the agency of ball bearings 37. Upper and lower yoke arms 38, 39, respectively, are

formed integral with the sleeve 36, being identical as to cross sectional outline. As indicated above, the yokes 34 are themselves symmetrical about a horizontal plane through the axis of spindle 24. Suitable washer and cap members are applied to pivot pins 32 to mount the same in fixed relation to the bosses 30 of the adapter mounting plate 28.

As shown in FIGS. 3 and 5, the spindle housing 25 is provided at longitudinally spaced points, not too far from its respective ends, with vertically aligned pairs of upper and lower enlarged bosses 41, at which the housing 25 is formed to provide an upright bore 42. Upright pins 43 extend through this bore, being journaled in the upper and lower bosses 41 by ball bearings 44; and externally of the housing the pins 43 are each secured in an improved fashion to the upper and lower swing arms 38, 39 of the respective yokes 34, 35 to sustain the weight of the housing, spindle and associated components as the latter are reciprocated axially of the spindle 24 in the operation of the improved structure.

To this end, a bottom thrust journal member or cap 46 is threadedly mounted in a bore or opening 47 in each of the lower swing arms 39, and the lower end of each pin is axially sustained in this cap. The invention, as indicated above, contemplates that the weight of the housing and associated parts shall be equally borne by the upper arms 38 of the respective swing yokes 34, 35, so that the latter may be manufactured uniform and be capable of being reversed, should this be desired.

Further, each upper swing yoke arm 38 is formed to provide a threaded opening 49 threadedly receiving a tubular adjusting sleeve 50, in which the upper end of the pivot pin 43 is received. The sleeve 50 has an enlarged top flange 51, and take-up nuts 52 are threaded on the upper end of pin 43, these nuts, with associated washers, resting on the top of the sleeve flange 51.

It is thus seen that, with the sleeve properly adjusted in the threaded opening 49 to bear against the inner race of ball bearing 44, the nuts 52 may be taken up adequately and, as supported by the sleeve 50 on the upper arm 38, transfer to the upper arm a share of the weight of the spindle housing, spindle and associated components equal to that borne by the lower arm 39. Thus neither need be designed stronger nor more massive than the other, and the yokes 34, 35 are reversible 180° on the adapter mounting plate 28 or, indeed, the plate 28 need only be reversed on the main mounting plate 14, if more space is needed than available to accommodate various operating components of the reciprocatory structure 10 to be described.

It is also to be seen that, with the spindle housing 25 mounted at the outer ends of the pairs of yoke arms 38, 39 of yokes 34, 35, the housing has a reciprocatory motion which is, to all intents and purposes, rectilinear, considering its very small amplitude of stroke. Undesirable transverse action of the spindle and buffing wheel is thus eliminated; and the arrangement thus has a further advantage over one in which the housing is sustained on a pivot more inward in relation to the center of oscillation.

In the embodiment of the invention illustrated, the prime mover for the reciprocatory stroke, as best shown in FIGS. 1, 4 and 5, is a pneumatic cylinder 54 suitably mounted by an outwardly projecting bracket structure 55 bolted or otherwise secured to the main upright mounting plate 14. It is disposed directly beneath the spindle housing 25, and is of entirely conventional nature. It is activated for reversing stroke operation of its piston (not shown) under the control of any suitable valve arrangement well known for the purpose, and constituting no part of the present invention. The reference numeral 56 (FIG. 1) designates such a valve unit mounted on the bracket 55 at one end of pneumatic cylinder 54. As indicated above, a mechanical prime mover capable of imparting a suitable small amplitude, rapid stroke may be substituted for the pneumatic device.

The piston of the cylinder 54 actuates a connecting rod 57 extending outwardly of cylinder 54. At its outer end, as shown in FIGS. 1, 4, 5 and 6, the connecting rod has secured thereon a yoke or coupling 58 through which the reciprocatory action of the connecting rod is transmitted to one of the spindle housings 25 as the latter is pivotally sustained by the swing yokes.

Coupling 58 is provided with an opening extending vertically therethrough, this opening being non-circular and slightly elongated transversely of the direction of stroke of rod 57. Opening 59 receives from above a connecting stem 60 which is upwardly secured to an enlarged bell-like bearing member 61 of the spindle housing 25, as through the agency of a connector block or head 62 carried by stem 60 and suitably secured upwardly to the bearing member 61. Anti-friction sleeve bearing elements 63, 64 surround the stem and act within the transversely elongated opening 59 of rod coupling 58. Accordingly, it is seen that the reciprocating action of cylinder connecting rod 57 is transmitted (upon reverse energization of pneumatic cylinder 54) to the spindle housing 25 and associated parts in the form of a motion which is in effect rectilinear. The transverse enlargement of opening 59 accommodates any extremely small transverse component of motion attendant upon the motion of housing 25 as carried by the oscillatory yokes 34, 35.

In order to render the stroke of the coupling 58 strictly linear, it is guided and laterally restrained by a pair of anti-friction rollers 65 on either side of the rod coupling 58 (see FIGS. 4 and 5). These have spaced upper and lower flanges 66 between which parallel side shoulders 67 of coupling 58 are rollingly received. The result is that noise and chatter in operation is greatly reduced. The guide rollers 65 are suitably mounted in upright posts 68 mounted on a horizontal end extension 69 of the bracket 55.

FIG. 3 illustrates structural features of a bearing device, similar to the bearing member 61, at the opposite end of spindle housing 25, and generally designated 71. The spindle is radially journaled by a ball bearing 72 within the outer tubular bearing member 73 of the device 71, and annular shoulder means 74 abut the inner spindle race of bearing 72. The opposite side of this race is engaged by dust protective rings 75 secured by bolts 76 to the open end of bearing member or housing 73, and a lock ring 77 is threaded on the spindle to clamp these ring provisions in place against the inner bearing race. Thus the spindle 24 is constrained for axial reciprocating motion with its housing 25.

As further shown in FIGS. 1 and 3, provision is made to releasably restrain the spindle 24 against movement in the housing 25. To this end, and to rigidify the same also, the housing is provided with an integral horizontally and laterally projecting rib 79 between its bosses 41 with an enlarged boss 80 at one end of the rib, at which the housing is provided with a radial bore 81 to its interior. A sleeve 82 is fixedly seated in this bore to receive a detent or holding pin 83, the inner end of which is enlarged and adapted to be received in one of two radial openings 84 in spindle 24. A coil spring acts between this enlarged pin end and sleeve 82 to hold the detent radially inwardly. It may be withdrawn from this position by pulling an external knob 86 thereof and then turning the latter 90°, thus to position a cross pin 87 on pin 83 athwart the end of sleeve 82 and hold the last named pin out of the radial opening 84. Otherwise, the cross pin 87 is received in opposed slots 88 in sleeve 82, its inner end projecting into the opening 84 to lock spindle 24 against rotation. This is desirable in the mounting and removal of the buffing tool when the spindle is in rotative and reciprocatory operation.

It is seen that the invention affords a rapid, small amplitude stroke reciprocatory device for buffing, polishing and like finishing wheels which is inexpensive in structure yet reliable in operation. The reciprocatory stroke is, to all intents and purposes, rectilinear and devoid of lateral os-

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cillatory component. The spindle and housing parts are effectively sustained in an improved manner, equalized as to distribution of load to supporting components.

What I claim as my invention is:

1. Reciprocatory spindle structure for a rotary spindle type tool, comprising a housing having means to journal the spindle of said tool, a fixed support, a yoke journaled on said support on an upright axis, said yoke providing spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of the axis of said spindle, means journaling said housing between said arms for reciprocatory motion therewith, a prime mover device including a reciprocatory connecting member, a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation, and way means guiding said connecting member for rectilinear motion adjacent said pin and slot connection.

2. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced axes, said yokes each providing spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes for reciprocatory motion therewith, a prime mover device including a reciprocatory connecting member, a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation, and way means guiding said connecting member for rectilinear motion adjacent said pin and slot connection.

3. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, including means adjustably pivoting said housing between the arms of the respective yokes to transfer the weight of the housing at spaced points therealong to both arms of each yoke, and a prime mover device including a reciprocatory connecting member and an operating connection between said connecting member and said spindle housing.

4. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, including means adjustably pivoting said housing between the arms of the respective yokes to transfer the weight of the housing at spaced points therealong to both arms of each yoke, a prime mover device including a reciprocatory connecting member, and a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight

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movement of said housing transversely of the direction of reciprocation.

5. Reciprocatory spindle structure for a rotary spindle type tool, comprising a housing having means to journal the spindle of said tool, a fixed support, a yoke journaled on said support on an upright axis, said yoke providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of the axis of said spindle, means journaling said housing between said arms and adjacent the outer arm ends for reciprocatory motion therewith, comprising a pivot pin and means pivotally receiving opposite ends of said pin in said respective arms, said last named means including means to adjust the pin relative to the upper arm and thereby adjust the weight of said housing borne by said upper arm, and a prime mover device including a reciprocatory connecting member and an operating connection between said connecting member and said spindle housing.

6. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, comprising a pivot pin and means pivotally receiving opposite ends of said pin in said respective arms, said last named means including means to adjust the pin relative to the upper arm and thereby adjust the weight of said housing borne by said upper arm, and a prime mover device including a reciprocatory connecting member and an operating connection between said connecting member and said spindle housing.

7. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, comprising a pivot pin and means pivotally receiving opposite ends of said pin in said respective arms, said last named means including means to adjust the pin relative to the upper arm and thereby adjust the weight of said housing borne by said upper arm, a prime mover device including a reciprocatory connecting member and a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation.

8. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced axes, said yokes each providing spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes for reciprocatory motion therewith, a prime mover device including a reciprocatory connecting member, a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation, and anti-

friction roller means engaging and linearly guiding opposite sides of said connector member in reciprocation adjacent said pin and slot connection.

9. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, a prime mover device including a reciprocatory connecting member, a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation, and anti-friction roller means engaging and linearly guiding opposite sides of said connector member in reciprocation adjacent said pin and slot connection.

10. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, comprising a pivot pin and means pivotally receiving opposite ends of said pin in said respective arms, said last named means including means to adjust the pin relative to the upper arm and thereby adjust the weight of said housing borne by said upper arm, a prime mover device including a reciprocatory connecting member, a pin and slot connection between said connecting member and said spindle housing to operatively connect the latter to said device for reciprocation thereby, while accommodating slight movement of said housing transversely of the direction of reciprocation, and anti-friction roller means engaging and linearly guiding opposite sides of said connector member in reciprocation.

11. Reciprocatory spindle structure for a rotary spindle

type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, and a prime mover device including a reciprocatory connecting member and an operating connection between said connecting member and said spindle housing, said operating connection including means accommodating slight movement of said housing transversely of the direction of reciprocation.

12. Reciprocatory spindle structure for a rotary spindle type tool, comprising an elongated tubular housing having means to journal the spindle of said tool adjacent opposite ends of the housing, a fixed support, a pair of yokes, journaled on said support on longitudinally spaced, upright axes, said yokes each providing vertically spaced, laterally extending arms between which said spindle housing is disposed for reciprocation in the direction of its length and the axis of said spindle, means journaling said housing between said arms of each of said yokes and adjacent the outer arm ends for reciprocatory motion therewith, a prime mover device including a reciprocatory connecting member and an operating connection between said connecting member and said spindle housing, said operating connection including means accommodating slight movement of said housing transversely of the direction of reciprocation, and way means guiding said connecting member for rectilinear motion adjacent said operating connection.

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