This invention relates to surface treating machines and is more particularly concerned with improvements in machines for abrading or polishing the surfaces of wood or similar materials by engaging the same with a traveling abrasive coated belt.

Surface abrading machines have heretofore been provided for finishing wood panels or like members having flat surfaces which employ an abrasive coated, traveling belt. In general, such machines have been employed for finishing work only when the depth of cut is relatively small and the scratch line pattern produced is generally not so prominent as to be objectionable. Rough surfacing to reduce the thickness or prepare the surface for a fine finishing or polishing operation has usually been accomplished with machines employing abrasive coated rolls or drums. In copending application Serial No. 830,004, filed July 28, 1959, drum and belt sanding are both employed, provision being made for first passing the work piece beneath a sanding drum unit so as to remove a substantial amount of material and reduce the work piece to a definite thickness and then passing the work piece immediately beneath one or more vertically disposed sanding belt units for obtaining a fine finish.

In the operation of this machine, it has been found that a more satisfactory surface polish can be obtained if lateral vibration or oscillation can be imparted to the traveling belt and it is a general object of this invention to provide a mechanism for satisfactorily accomplishing such belt movement in one or more of the sanding belt units.

It is a more specific object of the invention to provide in a roll supported traveling belt-type surface finishing machine a mechanism for vibrating in an axial path one of the rolls, which support the belt.

It is another object of the invention to provide a mechanism associated with one of the supporting rolls of a traveling belt-type surface finishing apparatus which is effective to impart a reciprocating movement of relatively small amplitude and comparatively high speed in the direction of the axis of the roll.

It is a further object of the invention to provide an improvement in belt-type sanding machines which comprises mounting on the bearing support at one end of a belt supporting roll an apparatus for vibrating the roll in an axial path which permits the bearing support to be oscillated in a path generally normal to the axis of the roll.

These and other objects and advantages of the invention will be understood from a consideration of the apparatus which is shown by way of illustration in the accompanying drawings wherein:

FIGURE 1 is an elevational view with portions broken away of a belt sander having a vibrator mechanism incorporated therein which embodies the principal features of the invention;

FIGURE 2 is a partial side elevation, at the bottom of the machine, to an enlarged scale;

FIGURE 3 is a fragmentary section taken on the line 3—3 of FIGURE 1, to an enlarged scale;

FIGURE 4 is a partial side elevation at the top of the machine, to a still larger scale;

FIGURE 5 is a sectional view taken on the line 5—5 of FIGURE 2; and

FIGURE 6 is a fragmentary section taken on the line 6—6 of FIGURE 4.

Referring to FIGURE 1 of the drawings, the invention is illustrated as incorporated in a belt sanding apparatus or unit of the vertically disposed type which is particularly adapted to be employed in the combination sander described in copending application Serial No. 830,004.

The illustrated unit is capable also of independent use when properly supported above a flat table and connected to a suitable motor or other power drive mechanism.

The illustrated unit comprises a frame 10 carrying upper and lower rollers or cylinders 11 and 12 on which a relatively wide abrasive coated belt 13 is adapted to be supported. The principal member of the frame 10 is a cross beam 14 which is supported primarily at one side of the machine by an upstanding portion 15 of a main supporting frame 16 so that the cross beam 14 extends with its major portion projecting in cantilever fashion across a work supporting traveling conveyor indicator at 17.

The front end of the cross beam 14 is supported and locked in position relative to the front portion of the main supporting frame 16 by means of a swinging frame or lock member 18 (FIGURES 1 and 2) which has the form, when in closed position, of an inverted V, which is mounted at its lower end on the main frame 16 by means of a pair of longitudinally spaced bearing brackets 19 and 19' which receive the ends of a pivot pin 20 carried in the ends of the legs of the member 18. At its upper or apex end the lock member 18 has a headed locking bolt 21 (FIGURES 1 and 2) which is rotatably mounted on the frame and adapted to engage its threaded inner end in a threaded socket 22 in a downwardly projecting end bracket 23 which is secured on the end of the cross beam 14. The locking arm 13 is adapted to be swung on the pivot pin 20 outwardly of the machine to an open position to permit the belt 13 to be removed endwise of the rolls 11 and 12 when belt replacement is desired.

The lower belt carrying roll 12 which constitutes the contact or pressure roll for holding the belt against the work has the ends of its supporting shaft 24 journaled in bearings 25 and 25' which are carried in swingingly mounted, transversely spaced support arms 26 and 26'. The support arms 26 and 26' are mounted at one end on pivots 27, 27' which are secured on the bottom of the cross beam 14. The pivots 27 and 27' have their axes aligned transversely of the machine so that the support arms 26 and 26' form a swing support frame for the roll 12. The support arms 26 and 26' extend in a generally horizontal direction and each arm, as shown in FIGURE 3, carries intermediate its ends an upstanding pin or bolt 28 which projects through an aperture 30 in the bottom of a socket 31 in the bracket 23 and through a compression spring 32. An adjustable end stop 33 is provided on the top end of the bolt 28 against which the spring 32 engages so as to normally urge the roll support arms in an upper direction away from the work supporting bed of the machine.

Mechanism for adjusting the elevation of the roll 12 is provided which engages with upwardly extending end portions 34 and 34' (FIGURES 1 to 3) on the roll support arms 26 and 26' and moves the arms downwardly against the force of the springs 32. The upper edges or faces of the arm extensions 34 and 34' engage the beveled surfaces of a pair of wedge-shaped lower members 35 and 35' which are carried on right and left hand threaded ends of an operating cross shaft 36, the latter being journaled at its opposite ends in portions of downwardly extending brackets 25 and 25' on the cross beam 14 and having one end extended and squared to receive an operating handle or wheel (not shown). The depending bracket formations 25 and 25' at the ends of the cross beam 14
are slotted at 37 and 37' in a direction transversely of the beam 14 to receive the arm extensions 34 and 34' which are rubber covered with spiral grooves or it may have any other surface suitable for receiving the belt 13 and applying pressure through the belt as the work is carried beneath the unit. The shift shaft 24 is extended at the rear side of the machine and is connected with a suitable power source (not shown).

The upper belt tensioning roll 11 has the opposite ends of its supporting shaft 40 mounted in bearing carrying bracket members 41 and 41' (FIGURES 1, 4 and 5) which are supported on the upper ends of vertically disposed pistons 42 and 42', the latter extending upwardly of the hydraulic cylinders 43 and 43' which are mounted in vertically extending recesses 44 and 44' in the ends of the cross beam 14. At the rear side of the machine the bearing bracket 41' is secured by a vertical pin 45 which extends upwardly of the end of the piston 43'. The bearing in the bracket 41' is self-aligning and will permit the roll 12 to swing a limited amount in a horizontal plane above the vertical axis of its support. It is also slidable in the axial direction in the bracket 41'.

At the front side of the machine the bearing bracket 41 (FIGURES 4 to 6) has a horizontally disposed base portion and end sections 46 and 46' which are of reduced width. Relatively small slide plates 47 and 47' are secured on the bottom faces of the end sections 46 and 46' which ride on a pair of support rollers 48 and 48'. The rollers 48 and 48' are mounted for free rotation on relatively small shafts 49 and 49' which extend between a pair of upstanding guide plates 50 and 50'. The guide plates 50 and 50' are disposed in parallel spaced relation on the top of the piston 42 so as to provide a guideway or chamber which is open at the top and at the ends. The cross shafts 49 and 49' and the rollers 48 and 48' which they support are at an elevation which supports the bearing member 41 and its associated apparatus above the top edges of the vertical guide plates 50 and 50'.

Pairs of guide blocks 51 and 51' are secured on the ends of the top edges of the plates 50 and 50' so as to engage in sliding relation with the side edges of the end sections 46 and 46' of the base of the bearing member 41. The guide blocks 51 and 51' extend across the tops of the two pairs of side guide blocks 51 and 51' with the ends of these bars and the guide blocks bolted down to the top edges of the plates 50 and 50'. The hold down bars 52 and 52' engage in sliding relation with the top surfaces of the end sections 46 and 46' of the bearing member 41 so that the swinging movement of the latter is confined to a predetermined path above the plates 50 and 50'. A center bearing roller 54 having a diameter slightly less than the distance between the inner opposed faces of the plates 50 and 50' is mounted on a stub shaft or pin 55 depending from the bottom of the bearing member 41. The movement of the bearing member 41 is controlled by means of a horizontally disposed pneumatic or hydraulic cylinder 56 which is mounted between the plates 50 and 50' with its piston 57 extending at opposite ends thereof so as to engage with the vertically disposed slings 58 and 58' of angle bracket 59 and 59'. The angle brackets 59 and 59' are secured by bolts or other fastening means to the bottom face of the bearing bracket 41 adjacent the slide plates 47 and 47' so that the depending slings 58 and 58' are confined within the housing formed between the guide plates 50 and 50'.

The movement of the bearing member 41 is relatively small and is limited in each direction by cushion and stop members 60 and 60' which are mounted in the hold down bars 52 and 52'. Each stop member comprises a cylindrical housing and a spring pressed stop pin 61 and 61' with the latter disposed horizontally for engagement with a vertically extending wall portion of the bearing member 41.

The cylindrical 56 is connected with an air or fluid line through an electromagnetic valve (not shown) which is under the control of a pair of air operated switches 62 and 62' (FIGURE 1). The switches 62 and 62' are supported in a housing forming bracket 63 which is slidable mounted for adjustment transversely of the machine on a bar support 64 having its ends secured on the cross beam 14. The bracket 63 and its associated switches 62 and 62' are mounted adjacent the front end of the cross beam 14 with the switches in transversely spaced, side-by-side relation so that their operating fingers are disposed opposite spaced apertures in a horizontally disposed air control tube 65. The air tube 65 extends in a transverse direction across the open face of the bracket 63 and in outwardly spaced relation to the same and is secured by the bracket 66 to the housing forming bracket 63 with a suitable connection to a compressed air supply (not shown). The housing forming bracket 63 is adjusted on the support bar 64 so that the edge of the sending belt 13, when the belt is tracking properly, moves in a path which is between the two switches 62 and 62' with the outer switch 62 being held closed by the unobstructed air stream from the tube 65 and the inner switch 62' being held open by the air from the tube 65 by the interposed margin of the belt 13. As long as the belt is tracking properly on the rolls 11 and 12, there is no swinging movement of the top roll 11. When the belt 13 moves too far to the right, as viewed in FIGURE 1, the innermost switch 62' is operated by the uncovered air stream from the tube 65 and the operating cylinder 56 is actuated to swing the roll 11 in the proper direction to cause the belt to move to the left on the roll 11. This movement is stopped when the belt moves sufficiently to bring the edge between the two switches 62 and 62' thereby cutting off the air stream to the switch 62' so that the belt moves too far to the left, as viewed in FIGURE 1, so as to cause margin of the belt to cover the air stream actuating the outer switch 62, the latter opens which operates the cylinder 56 to move the roll 11 in the opposite direction, thereby causing the belt 13 to move to the right until the edge reaches its proper path which uncovers the air stream operating switch 62 and stops the swinging movement of the roll 11. This arrangement automatically positions the belt in proper tracking relation on the supporting rolls 11 and 12 with corrections being made in its path of travel in response to transverse movement of the belt.

The vertically disposed cylinders 43 and 43' are connected to the pneumatic or hydraulic system to provide for vertical movement of the pistons 42 and 42' with the movement being equalized by a shaft 66 which is journaled in the supporting beam 14 and carries at its opposite ends pins 67 and 67' which extend through slots in the cylinders 43 and 43' and engages with rack formations 68 and 68' provided on the pistons 42 and 42'. The vertical movement of the pistons 42 and 42' is limited by stop members 70 and 70' (FIGURE 5) which engage in the slots 71 and 71' cut in the pistons 42 and 42'. The pistons 42 and 42', of course, are urged upwardly to provide tension in the belt 13 through the tensioning roll 11, while the units is in operation, the tension being relieved when it is necessary for the belt to be removed from the unit.

The shaft 40 has a reduced end portion 72 (FIGURE 4) on which axially spaced cylindrical bearing sleeves 73 are secured by means of an end lock screw 76 which is threaded onto the end of the shaft section 72. The bearing sleeves 73 cooperate with associated bearings 75 to support the shaft end 72 in axially slidable and rotatable relation in the bearing member 41. The shaft end 72 is provided with an axially extending end recess 76 in which a bearing 77 is seated and held therein by the end lock screw 76. The outer end of the cylindrical bearing
forming portion of the bearing bracket 41 is closed by a combination cover and bracket plate 79 which is bolted thereto and on which the roll vibrating or reciprocating mechanism 80 is mounted.

The roll vibrating mechanism 80 (FIGURES 4 and 5) comprises a fluid motor having its cylinder 81 secured by a frame structure 82 to support plate 83 which is in turn bolted to spaced axially extending bracket arms 84 and 84'. The cylinder 81 is mounted so that the piston 85 extends into the recess 76 in the end section 72 of the shaft 40 and has its axis aligned with the axis of the shaft 40. The piston 85 carries a bearing sleeve 86 which is secured therein and has a portion of reduced exterior diameter which extends through the bearing member 77 to receive a lock nut 87 on the threaded end so as to couple the piston to the shaft 46 for movement therewith in the axial direction while permitting relative rotational movement. A fluid control valve 88 is mounted on a support plate 89 extending between the bracket arms 84 and 84' while a fluid reversing poppet valve 90 is mounted in a bracket formation 91 provided therefor at the base of the plate member 79. A trip member 92 for the poppet valve, in the form of an elongate angle bar or plate, is secured to a collar or bracket plate 93 which is secured on the piston sleeve member 85.

In operation of the apparatus, the belt 13 is placed on the rolls 11 and 12 from the left side of the apparatus as viewed in FIGURE 1, with the locking frame 18 being pivoted about the pin 20 to an open position and the upper roll 11 being lowered by downward or retractive movement of the bearing supporting pistons 42 and 42'. With the belt 13 in position on the rolls 11 and 12 hydraulic fluid is supplied to the cylinders 43 and 43' through a suitable connection with the hydraulic system of the machine to tension the belt 13. The lowermost roll 12 is adjusted by rotation of the shaft 36 to bring the lowermost, work engaging portion of the belt to the proper elevation above the work supporting or carrying conveyor 17 for obtaining proper pressure between the belt and the work surface as the work pieces are conveyed beneath the roll 12. The belt 13 is driven by the roll 12 which has its shaft 24 connected to a power source and proper tracking of the belt 13 on the rolls 11 and 12 is obtained by operation of the cylinder 56 under the control of the air operated switches 62 anno 62'. The upper belt carrying roll 11 is vibrated or oscillated independently of the belt tracking movements thereof by the vibrator mechanism 80 since the latter is mounted on the bearing member 41. The belt 13 is being connected to the end of the roll 46 in such a manner that the roll 11 is free to rotate relative to the piston 85 and is moved in its axial direction by reciprocating movements of the piston 85, the latter being controlled automatically by the valve 90 which is actuated in response to movements of the piston 85. Since the vibrator mechanism 80 is carried on the bearing 41 it is not affected by any swinging movements of the roll 11 which are required for proper belt tracking.

While specific materials and particular details of construction have been referred to in describing the surface finishing apparatus as illustrated, it will be understood that other materials and equivalent details of construction may be resorted to within the spirit of the invention.

I claim:

1. In a surface finishing machine, an upright supporting frame, a pair of transversely extending rolls mounted in vertically spaced relation on said frame and an endless traveling abrasive belt carried on said rolls, the uppermost one of said pairs of rolls having a shaft, bearing forming bracket members at opposite ends of said frame which receive said shaft in rotatable sliding relation, a vertical pivot connecting the bearing bracket at one end of said uppermost roll with the supporting frame, means connecting the bearing bracket member at the other end of said uppermost roll for sliding movement on the supporting frame in a direction transversely of said shaft, means operable in response to sidewise shifting of the abrasive belt for moving said last mentioned bearing bracket member relative to said frame so as to swing said uppermost roll about said vertical pivot and thereby maintain said abrasive belt in predetermined position on said rolls, and means mounted on said last mentioned bearing bracket member and connected to said shaft for automatically oscillating said shaft in an axial direction in said bearing bracket members independently of sidewise movement of the belt so as to vibrate the belt.

2. In a surface finishing machine, an upright supporting frame, means on said supporting frame for mounting thereon a pair of vertically spaced rolls, means comprising bearing bracket members, a pair of vertically spaced rolls, an endless traveling abrasive belt supported on said pair of rolls, the uppermost one of said pair of rolls having a shaft, said shaft being mounted at its opposite ends in axially sliding relation in said bearing bracket members, pivot means connecting the bearing bracket member at one end of said uppermost roll with the supporting frame, means forming a sliding connection in a direction transversely of said shaft between the bearing bracket member at the other end of said uppermost roll and said supporting frame, means operable in response to sidewise shifting of the abrasive belt for moving said last mentioned bearing bracket member so as to swing said uppermost roll about said pivot means and thereby maintain said abrasive belt in predetermined position on said pair of rolls, and independently operating mechanism mounted on one of said bearing bracket members and connected to the adjacent end of said shaft for oscillating said shaft in an axially extending path so as to impart uniform back and forth movement to said uppermost roll and vibrate the abrasive belt without regard to sidewise shifting thereof.

3. In a surface finishing machine, an upright supporting frame, bearing forming end bracket members on said supporting frame, a pair of vertically spaced rolls journaled in said end bracket members, an endless traveling abrasive belt supported on said pair of rolls, the uppermost one of said pair of rolls having a shaft, which shaft is mounted at its opposite ends in axially sliding relation in said bearing forming end bracket members, one of said end bracket members at one end of said uppermost roll having a pivoted connection with the supporting frame, means for connecting the other one of said end bracket members to the supporting frame for sliding movement thereon so as to swing said uppermost roll about said pivoted connection, means operable in response to sidewise shifting of the abrasive belt for moving said last mentioned end bracket member relative to said supporting frame so as to cause said abrasive belt to travel in a predetermined path on said pair of rolls, and a belt vibrating mechanism at one end of said uppermost roll shaft comprising an hydraulic cylinder supported with its piston in axial alignment with said uppermost roll shaft and connected thereto so as to oscillate said uppermost roll shaft in the axial direction thereof without interfering with the rotation of said uppermost roll shaft and independently of swinging movement of said uppermost roll.

4. In a surface finishing machine, an upright frame, an endless traveling abrasive belt and vertically spaced end supports for said belt mounted on said upright frame, the lowermost one of said end supports comprising a roll, a shaft for said roll, bearing members in which opposite ends of said shaft are mounted in axially sliding relation, and means carried on one of said bearing members for imparting a reciprocating movement to said roll in the direction of its axis of rotation which means comprises a support bracket, a fluid motor mounted on the
bracket and having a piston extending in the direction of the axis of said shaft, means connecting the end of said shaft with the piston of the fluid motor so as to move therewith and to rotate relative thereto, and means responsive to movements of said piston to control the flow of fluid to said motor whereby to reciprocate said shaft.

5. A traveling belt type surface finishing machine comprising a vertically disposed supporting frame, a traveling abrasive belt, parallel, vertically spaced belt supporting rolls, said rolls having supporting shafts, upper and lower bearing members mounted on said frame which receive opposite ends of said supporting shafts, and means for imparting to the upper one of said rolls a reciprocating motion in the direction of the axis of its supporting shaft, which means includes a bracket plate secured on the end face of one of said upper bearing members, a pair of spaced, axially extending bracket arms on said bracket plate, a cross bar connecting said bracket arms, a fluid operated motor mounted on said cross bar and having a piston which extends in axial alignment with the shaft of said upper roll, said upper roll supporting shaft having a recess in one end thereof, a bearing confined in said recess, said piston having a sleeve member on the outer end thereof which sleeve extends into said recess and through said bearing and a nut on the end of said sleeve member for connecting said sleeve to said bearing so that said upper roll supporting shaft moves in the direction of its axis with said piston while it is free to rotate relative to said piston.

6. A traveling belt type surface finishing machine as recited in claim 5, and means controlling the flow of fluid to said motor so as to automatically reciprocate said upper roll supporting shaft and cause said belt to oscillate.

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