

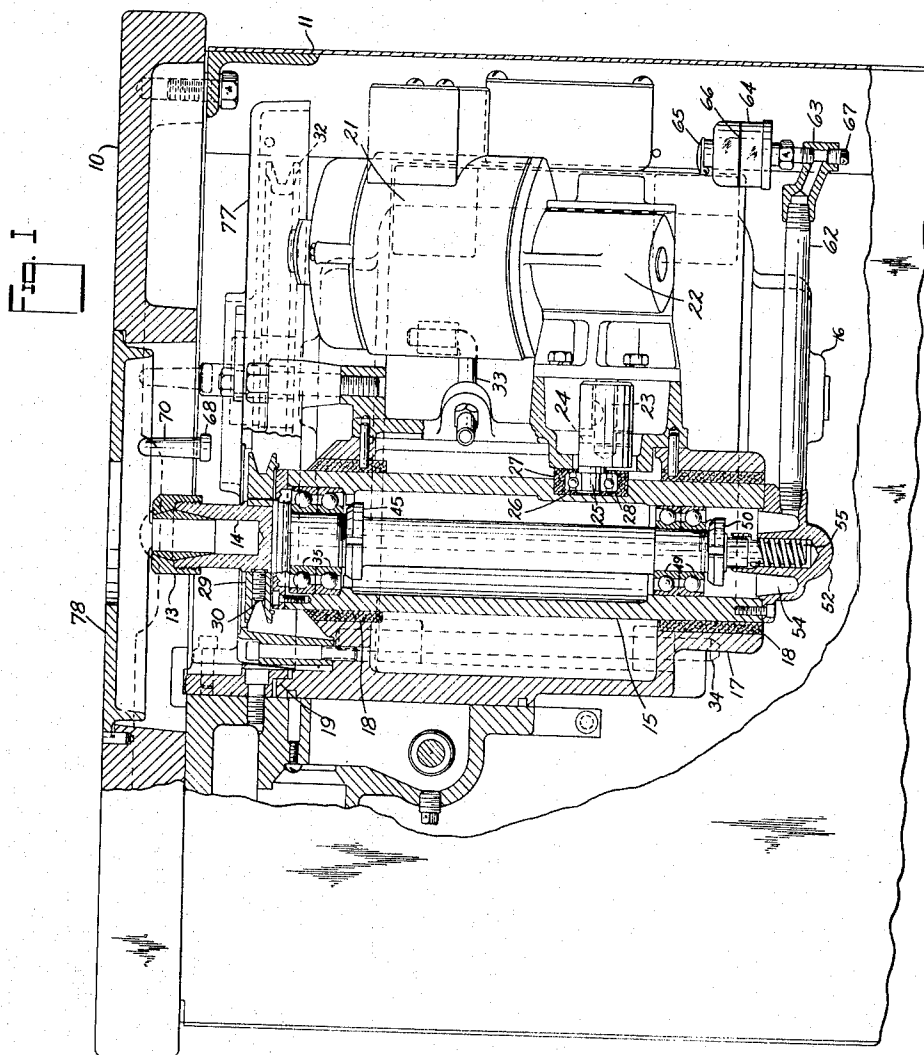
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E. T. KINDT ET AL
COMBINATION SPINDLE MACHINE

2,686,992

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3 Sheets-Sheet 1



INVENTORS
ERNEST T. KINDT &
IRA A. RIMMEL
BY
Richy & Watts
ATTORNEYS

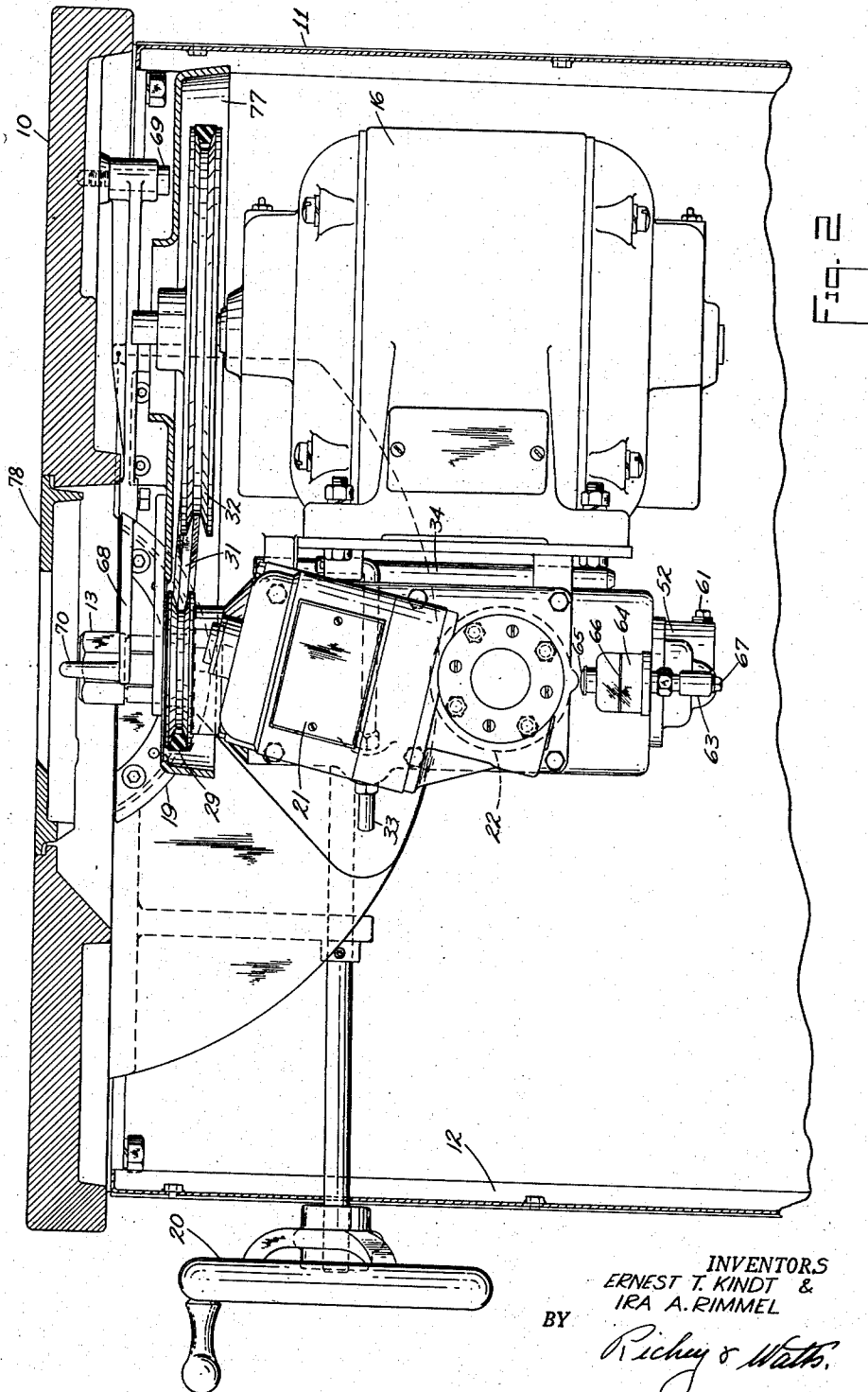
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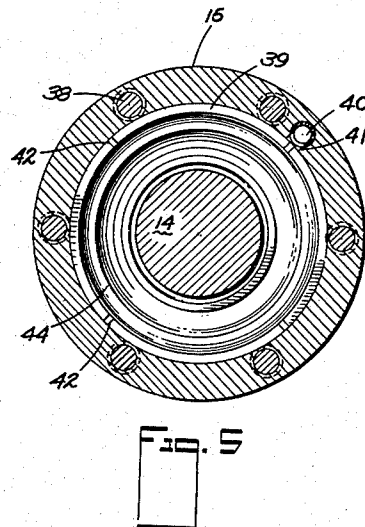
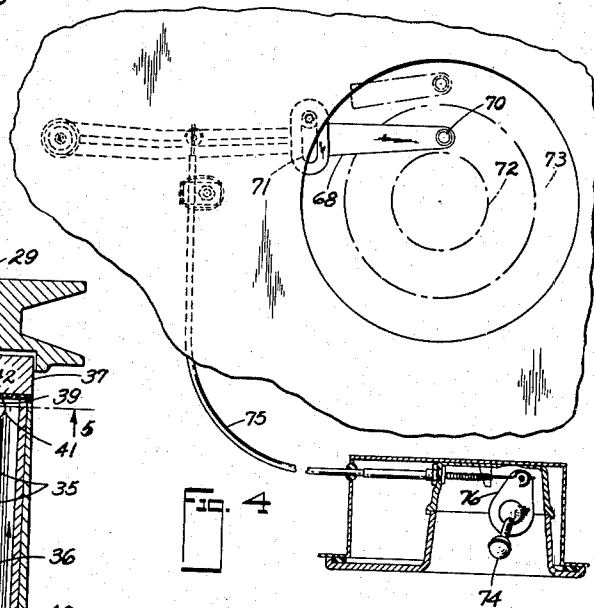
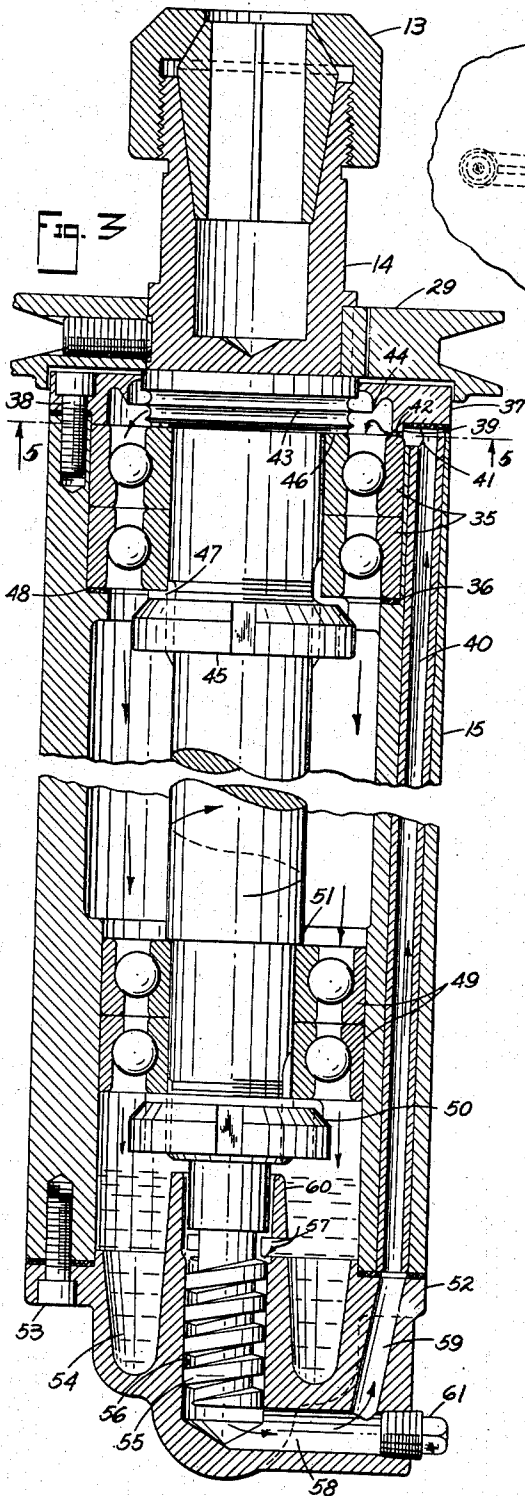
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ERNEST T. KINDT &
IRA A. RIMMEL
BY *Richy & Watto.*
ATTORNEYS

UNITED STATES PATENT OFFICE

2,686,992

COMBINATION SPINDLE MACHINE

Ernest T. Kindt and Ira A. Rimmel, Lakewood,
Ohio, assignors to The Kindt-Collins Company,
Cleveland, Ohio, a corporation of Ohio

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1 Claim. (Cl. 51—72)

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This invention relates to abrading machines and more particularly to sanding machines known commonly as spindle-type machines which employ an abrading element in the general form of a shaft or drum. The preferred form of the machine comprises a horizontal work table from which the abrading element projects. The abrading spindle and driving motor are mounted on a carriage which may be swung about an axis in the plane of the table to vary the inclination of the spindle to the table. The machine according to the invention involves new combinations of structural elements which have improved operating characteristics and constitutes an improvement upon the structure in the copending application of Ernest T. Kindt and Ira A. Rimmel, Serial No. 123,432, filed October 25, 1949.

One of the objects of this invention is to provide a spindle-type abrading machine wherein the spindle is mounted in a housing which is reciprocated by a separate prime mover.

Another object of the invention is to provide a spindle-type abrading machine with an oiling system which functions as the spindle rotates and supplies the necessary lubricant therefor.

A still further object of the invention is to provide the spindle of the abrading machine with a housing containing the bearings and the oiling system therefor, the housing being reciprocated, thus providing a unitary and dust-tight structure.

Another object of the invention is to provide a protective system for controlling the spindle speed as determined by the size of the abrading shaft or drum installed for operation.

Other objects of this invention will appear as the description of the preferred embodiment of this invention progresses.

In the drawings:

Fig. 1 is a front elevational view of the sanding machine with parts cut away to show details of construction;

Fig. 2 is a side elevational view with the side of the cabinet cut away to show the driving motors in their operable positions;

Fig. 3 is a sectional detailed view of the spindle housing or quill;

Fig. 4 is a detail of the protective system for limiting the rotative speed of the spindle as required by large diameter abrading elements; and

Fig. 5 is a sectional view of the upper end of the quill taken along line 5—5 in Fig. 3.

Referring first to Fig. 1, the sanding machine comprises a preferably cast table 10 supported on a generally rectangular casing 11 of sheet

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metal reinforced by angle iron stiffeners 12 at the corners. The casing 11 provides a shield for the working parts of the machine and an enclosed chamber into which dust from the sanding operation is drawn when the machine is in operation. The sanding operation is affected by cylindrical abrasive elements (not shown) which may be of various diameters and lengths and which may be held in a chuck 13 at the upper end of a motor driven spindle 14. The spindle is supported in a quill 15 and is driven by an electric motor 16. The quill 15 is mounted for vertical reciprocation in a supporting frame 17, bearings 18 being provided therebetween for wear and ease of operation. The frame 17 is mounted for arcuate movement in slides 19. The center of rotation as a result of movement in slides 19 is at the point of intersection of the centerline of spindle 14, and the top surface of table 10. The angular position of spindle 14 is determined and varied by rotation of hand wheel 20 located outside of casing 11.

A second electric motor is mounted on frame 17 and has a conventional gear reduction 22 affixed thereto. A drive shaft 23, extending from gear reduction 22, rotates at a speed considerably less than the normal speed of motor 21. A coupling 24 is keyed to shaft 23 and has an eccentrically located stub shaft 25 mounted on the end thereof. Shaft 25 travels in a circle about the centerline of shaft 23. A lateral channel 26 is formed in the outer wall of quill 15 and has its upper and lower walls in parallel relationship. A bearing block 27 is disposed for lateral sliding movement in channel 26 when coupling 24 is rotated and stub shaft 25 which engages block 27 follows the predetermined circular path. A ball bearing 28 intermediate stub shaft 25 and bearing block 27 reduces the friction between these two members during operation. It can be seen therefore that as motor 21 rotates, stub shaft 25 will be driven in a circular path thus producing vertical reciprocation of quill 15. The provision of bearing block 27 is desirable in the conversion of rotative movement to reciprocative movement. Spindle 14 has a belt pulley 29 mounted thereon immediately above quill 15 and is releasably affixed thereto by set screw 30. A belt 31 is trained over pulley 29 and a drive pulley 32 mounted on the drive shaft of motor 16. Adjusting bolt 33 moves motor 16 toward and away from spindle 14 thereby tightening the belt 31 as required. Freedom of movement of motor 16 is provided by the hinge-type support resulting from the use of pin 34 in shiftable engagement with the frame 17 and the base of motor 16.

The details of construction of quill 15 are illustrated in Fig. 3. The spindle 14 is carried for rotative movement along the medial axis of quill 15 by a pair of ball bearings located near the upper end of quill 15. A shoulder 36 formed in the inner wall of quill 15 holds bearings 35 against movement in a downward direction. A cap 37, having an opening formed therein for spindle 14, is affixed to the upper end of quill 15 by a plurality of cap screws 38. The cap 37 has a down-turned flange 39 which abuts against the uppermost bearing 35 and holds the assembly in rigid engagement with shoulder 36.

Lubrication for the top bearings 35 is provided by oil forcibly pumped through a passage 40 formed in the wall of quill 15 extending the full length thereof. At the uppermost end of the passage 40, an aperture 41 is formed in the inner wall of quill 15 between the passage 40 and the space surrounding the uppermost portion of bearing 35 and defined by the normally curved form provided on the end portions of the outer race. A plurality of notches 42 are formed in the flange 39 and operate as leakage ports and distributing means for allowing the lubricant to pass into the bearings uniformly distributed around the periphery thereof.

A plurality of slingers 43 are formed on spindle 14 immediately above bearing 35 and throw the lubricant therefrom, thus preventing the flow of oil along spindle 14 and outside quill 15. A down-turned ring 44 located on cap 37 in the cavity immediately above the bearing 35 receives the oil thrown from slingers 43 and causes it to drop on the moving elements of bearing 35.

A lock nut 45 is threadably engaged on spindle 14 for holding the inner races of bearings 35 in a fixed relationship with spindle 14 by clamping said inner races against the shoulder 46 formed immediately below the slingers 43. A washer 47 is provided between lock nut 45 and the inner race of the lowermost bearing 35 to facilitate the tightening of nut 45 to hold the bearings fixed to the spindle 14. A shim 48 is located between the outer race of bearings 35 and a shoulder 36. The thickness of shim 48 may be adjusted, thus obtaining the proper dimension for bringing the flange 39 of cap 37 into tight engagement with the outer race of the uppermost bearing 35 as screws 38 tighten cap 37 into closing engagement with the upper end of quill 15. Thus, the rigid mounting of the outer races to the quill and the inner races to the spindle provides a means of restraining the spindle 14 against movement longitudinally of the quill while rotating freely in the bearings.

A second pair of bearings is disposed intermediate quill 15 and the lower end of spindle 14 and have the inner races thereof rigidly mounted to spindle 14 by the action of lock nut 50, applying compressive stress to the inner races of bearings 49 and forcing them against shoulder 15 on spindle 14.

The lower end of quill 15 is closed by a cap 52 which is held in position by a plurality of cap screws 53. Cap 52 serves the purpose of providing a closure means for the quill and a reservoir for lubricating oil. An annular well 54 is formed in the cap 52 for receiving a quantity of oil and to act as a settling basin for sediment which may accumulate. A pump rotor 55 on the lowermost end of spindle 14 consists of a helical thread on a cylindrical projecting portion of spindle 14. The pump rotor

55 rotates in a cylinder 56 formed centrally in cap 52 having an inlet 57 adjacent the uppermost end of the rotor 55. An outlet passage 58 extends horizontally from the lowermost end of cylinder 56 and connects the pump through the connecting passage 59 to oil passage 40 extending to the upper end of quill 15. Rotation of spindle 14 and rotor 55 causes oil to be drawn from the reservoir in the quill 15 and forces it through passages 58, 59, and 40 to the uppermost end of quill 15 whereupon it returns by gravity through the bearings to the reservoir. A shroud 60 surrounds the portion of the spindle immediately above the pump rotor 55 and has clear space therebetween. The shroud 60 prevents the centrifugal pumping action of the shaft on the pool of oil in the reservoir, thus improving the efficiency of pump 55. In the absence of such a member, the oil would be thrown away from the inlet location and starving of the pump would result. A drain for cylinder 56 and passages 58, 59, and 40 is closed by a conventional pipe plug 61.

A filler for access in replenishing the supply of oil in the reservoir is connected to the cap 52 at the lowermost portion of the well 54. A length of pipe extending laterally therefrom has a T-connection 63 on the end thereof which carries a sight glass 64 having a hinged cover 65 thereon. A fill line 66 on sight glass 64 indicates the proper quantity of lubricant required to bring the level thereof to the operating point within quill 15. A drain for well 54 is provided by the removal of plug 67 from the lowermost connection on T 63. It may be noted that the filling arrangement moves along a path of travel as the quill 15 is reciprocated by the motor 21.

A protective device which functions with the machine to provide safety of operation when using abrasives of different diameters is provided in the form of an automatic switch control which governs the speed of motor 16 as a function of the size of the abrading elements installed on spindle 14. A lever 68 is pivotally mounted to table top 10 by a bolt 69. A finger 70 projecting vertically from lever 68 is in position for engagement with an abrading fixture to be mounted on the spindle 14. A slot 71 limits the angular motion of lever 68 to two positions one of which being the position which will allow the average small size fixture as designated by broken line 72 to be mounted on the spindle. When lever 68 is moved to the opposite end of its path of travel, an abrading fixture designated by the broken line 73 may be placed in operating position. The motion of lever 68 between these two positions is transmitted to a switch control 74 by a flexible wire cable 75 which is joined to the lever 68 intermediate shoulder 69 and slot 71. The opposite end of cable 75 is joined to an arm 76 which is operably connected to switch control 74 thereby obtaining an inter-connection between switch control 74 and the finger 70. The switch control 74 operates a two-position electrical switch which functions in the electrical circuit of motor 16 to provide two speeds of operation. The position of the lever shown in solid lines in Fig. 4 will therefore allow high speed operation of the spindle. Movement of lever 68 to the broken line position in Fig. 4 which would be required by the installation of a large size abrading element will cause switch control 74 to be moved into the low speed position. Damage to the machine and injury to the operators is prevented by the functioning of this assembly.

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A belt guard 77 affixed to the table top 10 is disposed to protect pulleys 29 and 32 and belt 31 from direct impingement of dust which results from the operation of the machine. A plurality of filler plates 78 having various sized openings may be disposed in table top 10 for use with abrasive elements of different diameters. A plate 78 may be selected which will clear the abrasive and also support the material brought into contact therewith.

With a suitable abrasive element mounted in chuck 13 on spindle 14 and the proper plate 78 in position, energization of motor 16 will cause the spindle 14 to rotate. The speed of rotation of spindle 14 will be determined by the position of switch control 74. If the abrasive element is of relatively large diameter, it is necessary to move lever 68 to a position which will allow the assembly thereof in chuck 13. The corresponding position of control 74 will limit the spindle speed to make the operation of the machine safe for the operators.

It is usually desirable in machines of this type to oscillate the abrasive element while it is rotating to obtain a smooth and even cut. In this device, it is accomplished by reciprocating the quill assembly as a unit. This feature allows the spindle bearings and seals to be dust free and to have a complete pressure lubricating system integral therewith.

Reciprocation of quill 15 is accomplished by energization of motor 21 which drives the eccentrically disposed stub shaft 25 which cooperates with block 27 slidably disposed in quill 15 to provide the desired motion. Individual control of the rotation of the spindle and the reciprocation thereof is achieved by the use of separate prime movers with selective energization. The pressure lubrication system for the bearings which supports the spindle functions immediately upon beginning the operation of the machine. The pump rotor 55 is directly connected to the spindle 14 and develops a pressure in the oiling system during the total operating time of the machine. Oil is taken from the reservoir in the lower portion of quill 15 and forced through the passages 58, 59, and 40 to the distributing ports at the upper end of the quill 15 whereupon the oil flows by gravity downwardly over the bearings 35 and 49 and returns to the reservoir. Adequate lubrication is thereby achieved at all times and contamination of lubricant supply is prevented.

It is to be understood that the specific nature of the present disclosure is not intended to be

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restrictive or confining and that various rearrangements of parts and modifications of design may be resorted to without departing from the scope or spirit of the invention as herein claimed.

What is claimed is:

A sanding machine comprising a horizontal table formed with a central opening, a spindle rotatably mounted in bearings below said opening, mounting means for affixing cylindrical abrasives of varying sizes to the spindle, said abrasives extending through the opening during operation, power means for rotating said spindle, an electrical circuit for said power means, a control device in said circuit having at least two positions for regulating the speed of said power means, a lever mounted on said table having one end adjacent said opening, a finger on said end of the lever engageable by abrasives larger than a predetermined size for preventing installation thereof, and a cable structure operably joining said lever and the control device for positioning the control device when the lever and the finger are moved to allow the installation of a larger size abrasive on the spindle, whereby the maximum speed of said power means is predetermined by the size of the abrasive installed on the spindle.

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