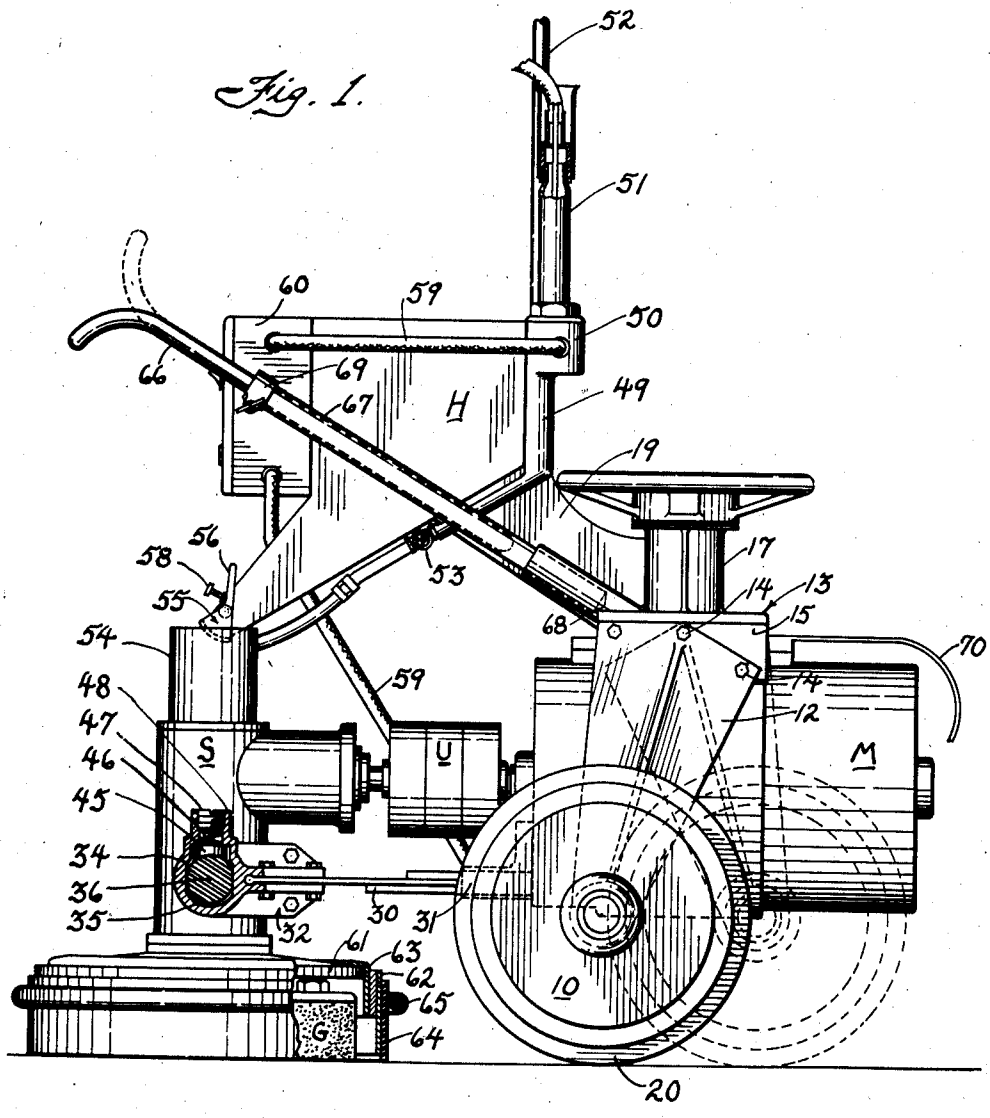
Nov. 3, 1942. A. W. MALL 2,301,164

FLOOR GRINDER

Filed May 13, 1940 4 Sheets-Sheet 1

Fig. 1.



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Fig. 4.

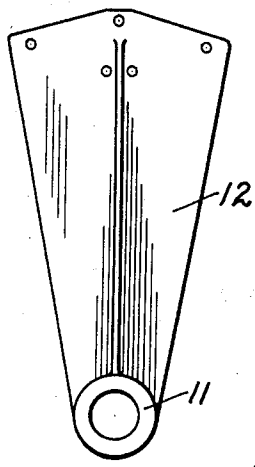


Fig. 2.

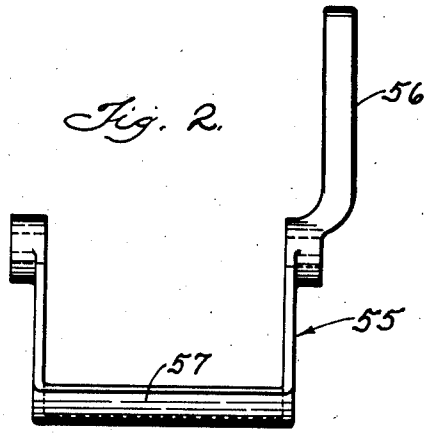
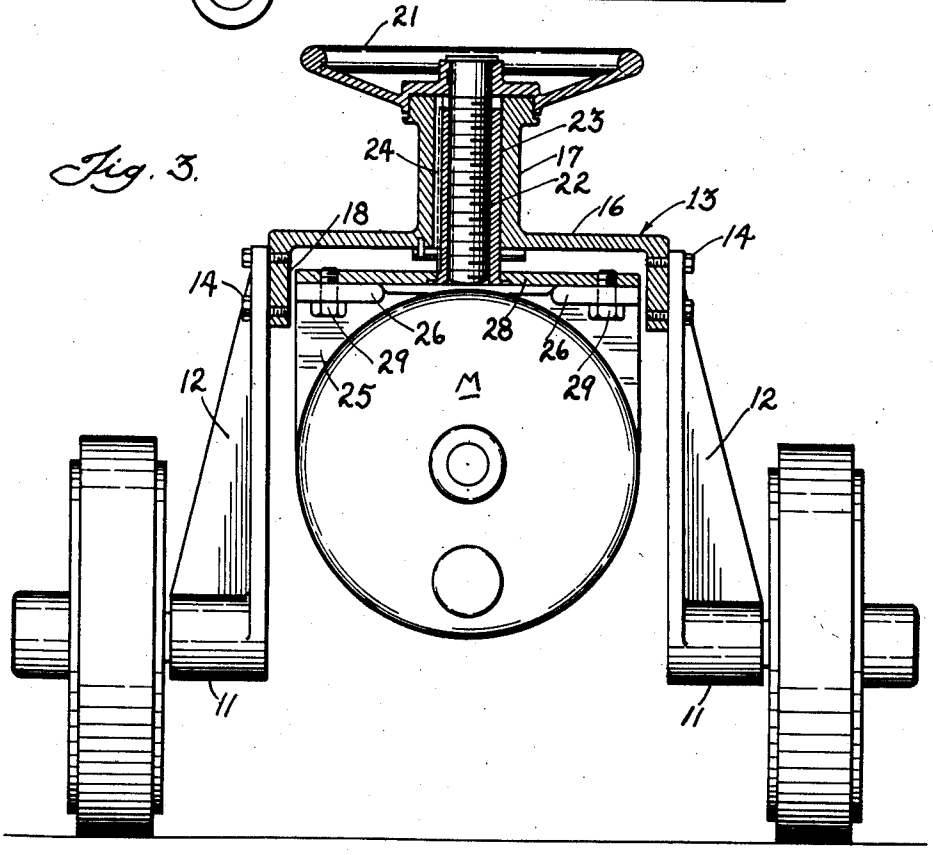


Fig. 3.



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Fig. 5

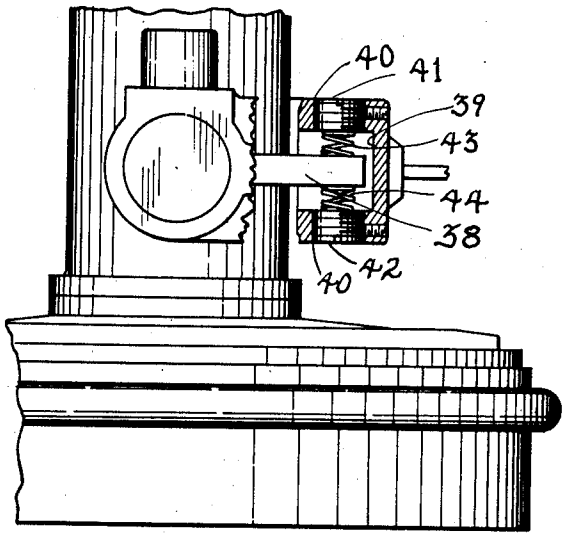


Fig. 8

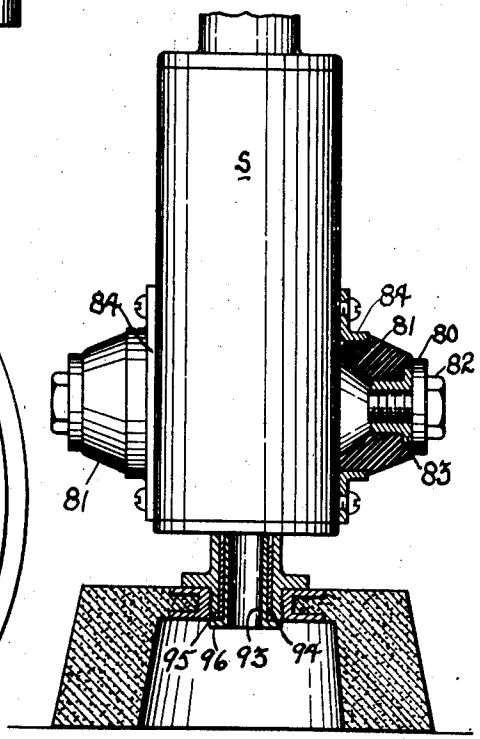
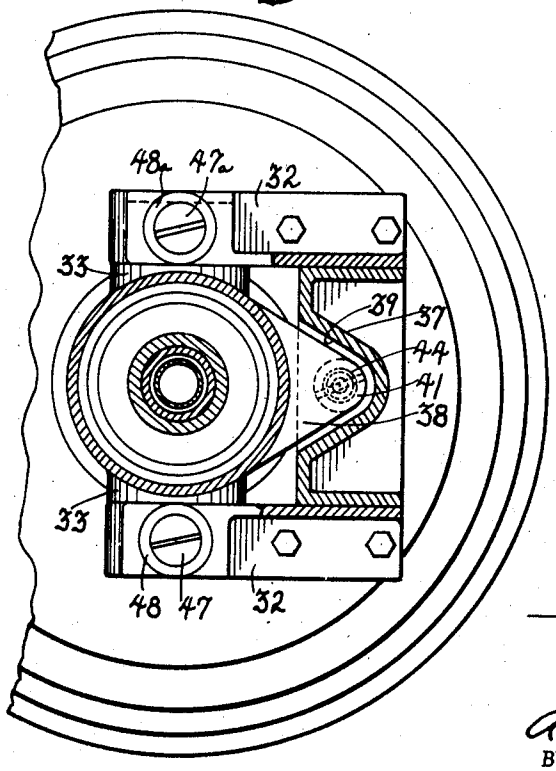


Fig. 6



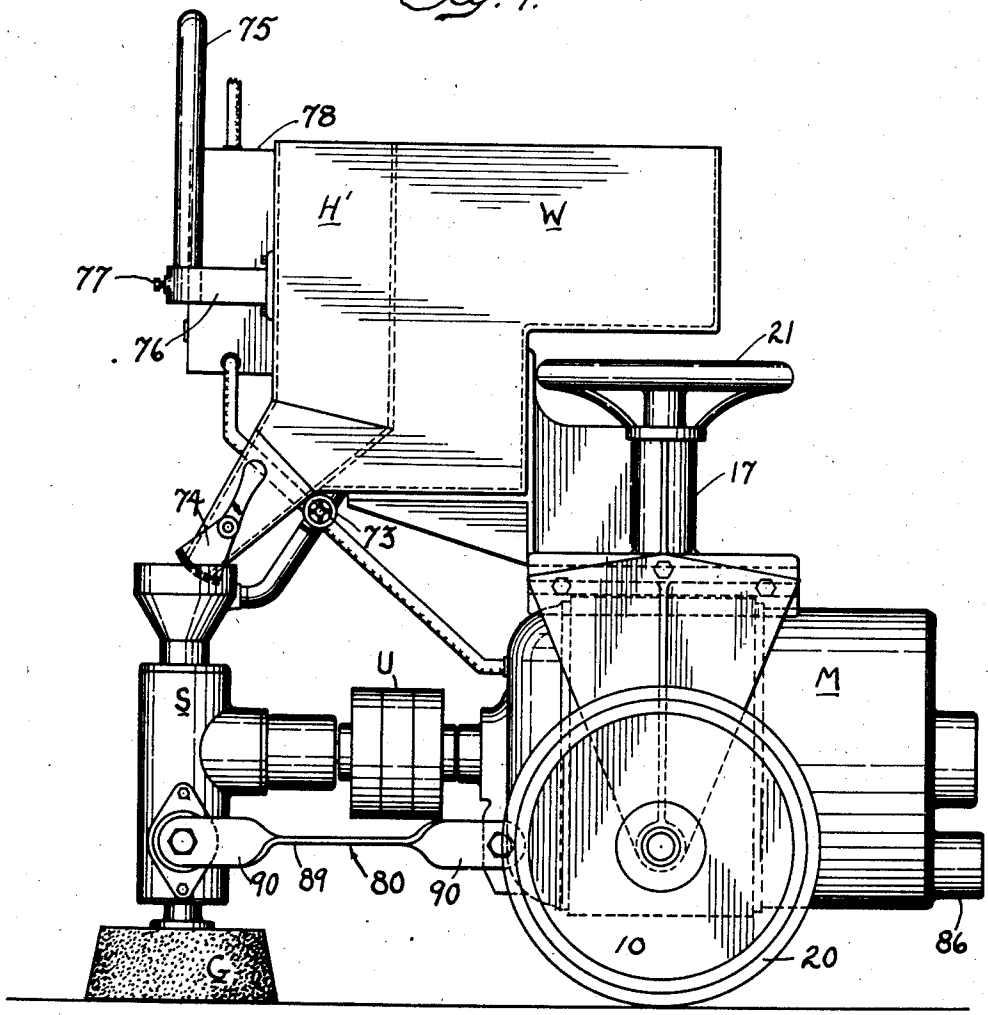
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FLOOR GRINDER

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Fig. 7.



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2,301,164

UNITED STATES PATENT OFFICE

2,301,164

FLOOR GRINDER

Arthur William Mall, Flossmoor, Ill.

Application May 13, 1940, Serial No. 334,791

2 Claims. (Cl. 51—177)

My invention relates in general to an improved floor grinding machine of the type specially adapted for high speed grinding of hard surfaces, such as terrazzo floors.

The invention relates more particularly to the type of floor grinder in which the weight of the grinding wheel and its associated parts provides the necessary inertia weight for maintaining the desired downward pressure on the grinding wheel during the grinding operation.

In the floor grinding machines which are commercially available today the grinding wheels are run at low speeds, seldom exceeding 800 R. P. M. In the grinding of floors having terrazzo surfacing it is necessary to grind away from 1/8" to 1/2" of the top surface of the floor depending upon the size of the chips or pebbles which are used in the terrazzo surfacing. With the present low speed floor grinders approximately 100 square feet of top surface can be ground away within an hour's time. By utilizing high speed grinding I have made it possible to grind 200 square feet of surface in an hour's time. The reason low speed grinding machines, only, are available commercially today is the fact that when grinding at higher speeds, it is more difficult to obtain a smoothly ground surface. With high speed grinding it is difficult to avoid the formation of small ridges in the surface being ground.

My invention primarily contemplates a combination of elements which unite to form a high speed grinding machine capable of grinding a greatly increased amount of floor space per unit of time and also capable of grinding the surface to a smooth finish.

One of the problems encountered in the construction of a machine of this type is to control the amount of inertia weight supported by the grinding wheel to compensate for the different types of surfaces to be ground and for the different types of motors that may be used to run the machine.

Another problem is to provide a flexible supporting means for the grinding wheel and in connection therewith to provide a drive shaft between the motor and the grinding wheel, which will permit the desired flexibility and which will absorb any shocks and jars resulting from irregularities in the surface of the floor and at the same time assure a constantly smooth running grinding wheel. In my prior floor grinding machines I have found that the use of a flexible shaft for driving the grinding wheel (such as is shown in my Patents Nos. 2,097,730 and 1,989,491) is not wholly satisfactory. Due to the tremendous torque transmitted through the shaft, its normal life is shortened. I have also found that it is not satisfactory to use a rigid drive shaft because such a shaft makes it impossible to flexibly support the grinding head assembly.

By using a single flexible coupling between the motor and grinding wheel, I have made it possible to flexibly support the grinding head assembly, to provide a constantly smooth running grinding wheel, and to shorten the over-all length of the machine.

Still another problem is to maintain the face of the grinding wheel level with the surface being ground so as to prevent any ridges being left in the surface.

The invention contemplates a solution to all of these problems.

One object of the invention is to provide means for controlling the amount of inertia weight resting on the grinding wheel.

Another object is to provide a more compact machine which is less expensive to manufacture, more efficient, and easier to operate.

A further object is to so arrange the parts of the machine that its weight is distributed more evenly throughout the entire device.

A further object is to provide means for effecting fine adjustment of the level of the grinding wheel with relation to the floor surface and for varying the ultimate flexibility of the grinding head assembly.

A further object is to provide a guard for the grinding wheel with wiping means for keeping the floor clean in the vicinity of the work.

Another object is to provide an improved means for controlling the flow of sand from the sand hopper into the spindle housing.

Another object is to provide improved means for supporting the grinding wheel so that it is universally flexible and tiltable.

Other objects and advantages will be more apparent from the following description, wherein reference is had to the accompanying drawings in which:

Fig. 1 is a side elevation of my improved machine with the grinding head broken in section and showing the adjustable wheel supports in an advanced position;

Fig. 2 is an enlarged view of the gate for controlling the flow of sand from the sand hopper;

Fig. 3 is a rear end view of the machine show-

ing in section the hand wheel adjusting means for raising and lowering the motor;

Fig. 4 is a side view of one of the adjustable wheel support arms;

Fig. 5 is a fragmentary view of the spindle housing and grinding head partly in section;

Fig. 6 is a plan view of the spindle housing partly in section;

Fig. 7 is a modification of my invention; and

Fig. 8 is a front view of the spindle housing shown in Fig. 7.

Referring to Fig. 1 my invention comprises generally a horizontally disposed motor M, a wheeled carriage for the motor, a spindle housing S with a cup-face grinding wheel G at the lower end thereof. The means for driving the grinding wheel may comprise generally the construction shown in my Patent No. 2,097,730 including bevel gears secured to a hollow spindle shaft and drive shaft, the shafts being journalled in suitable ball bearings. A conventional double acting universal joint U is interposed between the motor and spindle housing providing a flexible drive shaft, the reason for which will appear later. A tube extends through the hollow spindle shaft for conducting sand and water to the grinding wheel.

The motor M may be of a special type of heavy duty motor capable of operating at a free speed of 3600 R. P. M. and its capacity may be 5 H. P. or 10 H. P. depending upon the types of current available. The motor is carried by support wheels 10 which may be provided with rubber tires 20 for assuring a firm grip upon the floor during the operation of the machine and for preventing the possibility of marring and scratching the surface being ground. The support wheels 10 are rotatably journalled on stub shafts extending from hubs 11. The hubs may be formed integrally with the support arms 12 which are secured to frame member 13 by means of bolts 14. There may be a plurality of openings 15 in the frame member for receiving the bolts 14 so that the support arms 12 may be adjusted forwardly or rearwardly with respect to the motor.

When the support arms are adjusted to a forward position (as shown in Fig. 1) the motor acts as a counterbalancing weight, thereby reducing the total inertia weight supported by the grinding wheel and when the support arms are adjusted to a rearward position (as shown in dotted lines in Fig. 1) the total inertia weight supported by the grinding wheel is obviously increased. The importance of providing a means for controlling the inertia weight supported by the grinding wheel is two-fold. It makes it possible to adapt the machine to the grinding of surfaces which vary in substance and in hardness, such as wood, concrete, stone, or tile surfaces—it being obvious that more inertia weight upon the grinding wheel would be desired when grinding a hard surface than when grinding a softer surface. Secondly, when it is desired to change from a 5 H. P. to a 10 H. P. motor, it is necessary to increase the inertia weight carried by the grinding wheel because of the increased power being transmitted to the grinding wheel. Thus, when using a 10 H. P. motor the grinding operation is speeded up considerably.

The frame member 13 may be formed of a single casting including a base portion 16, a housing 17 extending upwardly therefrom, side members 18, a rib 19 for supporting the sand hopper H, a water pipe 49 for conveying water to the spindle housing, a support member 50, and a pair of handle support brackets 68. A handwheel 21 may be rotatably mounted upon the housing 17 directly above the motor and may be keyed to a screw 22 which is threaded into a sleeve 23. The sleeve is slidably journalled within the housing 17, spline 24 preventing the sleeve from rotating when the handwheel and screw is rotated. Secured to the motor M is a bracket 25 having feet 26 formed integrally therewith. The motor is removably secured to a mounting plate 28 by means of bolts 29. The mounting plate may have a centrally located opening for receiving the sleeve 23. Thus it may be seen that by rotating the handwheel, the screw member 22 causes the non-rotative sleeve 23 to slide up and down within the housing 17, thereby raising and lowering the motor which is supported by the sleeve. With the grinding wheel operating at such high speeds as 3450 R. P. M., it is essential that the working face of the wheel be maintained level with the surface of the floor. To accomplish this it is necessary to raise or lower the motor so that its longitudinal axis is in parallel alignment with the surface of the floor. When the motor is in this position, the grinding wheel operates best. The handwheel 21 and its associated parts perform this function. In addition, the motor may be lowered to compensate for grinding wheel wear.

To those who are skilled in the construction of concrete floors with terrazzo surfacing, it is known that slight waves and irregularities always appear on the surface after it has been trowelled and allowed to set—the surface is never 100% level. I have found that it is largely due to this circumstance, that the grinding head must be flexibly supported as well as maintained level with the surface of the floor. The flexibility assures that the grinding wheel will conform to the contour of the surface being ground. The importance of these features of flexibility and of maintaining the face of the grinding wheel at a true level with the surface being ground is emphasized as the speed at which the grinding wheel revolves is increased.

To obtain flexibility of the grinding head I have provided resilient leaf spring supports 30 extending from brackets 31 which are secured to the forward end of the motor. The outer ends of the leaf springs are received in longitudinal slots of brackets 32 which are mounted one on each side of the spindle housing S. The brackets 32 may be provided with hub portions 34 which slidably and loosely fit over studs 36 (best shown in Fig. 1) which extend outwardly from and are formed integrally with the spindle housing S. There may be a $\frac{1}{16}$'' clearance, designated at 35, between the inner wall of the hub portion 34 and the periphery of the stud 36, the reason for which will later appear. After the brackets are fitted onto studs 36, they are supported in position by means of an intermediate bracket 37 secured between and maintaining brackets 32 in a fixed spaced relation relative to each other.

Although the flexibility of the grinding head together with the means for raising and lowering the motor provide a means for adjusting the level of the face of the grinding wheel relative to the surface, yet this does not assure the precision adjustment necessary for high speed grinding. I have found that even after adjusting the motor up or down so that the face of the grinding wheel is flat upon the surface to be ground, yet when the grinding wheel is revolving at the high

speed of 3450 R. P. M., it usually has a tendency to "grab" on one side of the wheel, thus causing the entire machine to follow in the direction of the "grab." To eliminate this undersirable feature, I have provided means for effecting accurate adjustment of the level of the grinding wheel.

A shoulder or flange 38, preferably formed integrally with the spindle housing S, may extend outwardly therefrom into a recess 39 of bracket 37. The bracket 37 may be provided with centrally located bores 40 on its upper and lower sides into which set screws 41 and 42 are threaded. Compression springs 43 and 44 are interposed between the set screws and the flange 38 and may be retained in position by any suitable means, such as providing corresponding annular shoulders (not shown) on the set screws and on the flange 38.

Thus it can be seen that by tightening set screw 41 and loosening set screw 42, the tension on spring 43 is increased and the tension on spring 44 is decreased. Thus the shoulder 38 is urged downwardly and along therewith, the spindle housing and grinding wheel. Although the adjusting of the set screws 41 and 42 only slightly affects the levelling of the grinding wheel, yet it is this circumstance which assures accurate adjustment of the level of the wheel. This particular adjusting means just described only effects the levelling of the grinding wheel in its front and rear regions.

I have also provided a similar adjusting means on either side of the spindle housing for levelling the grinding wheel from the sides. As previously described, the brackets 32 are provided with hub portions 34 which loosely receive studs 36 extending outwardly from the spindle housing. The hub portions 34 are recessed in their upper regions to receive a tension shoe 45 (best shown in Fig. 1) which is interposed between stud 36 and set screw 47. The set screw is threaded into the retainer 48 which extends upwardly from and is preferably formed integrally with bracket 32. Corresponding adjusting means are provided on the opposite side of the spindle housing and are designated generally by corresponding numerals 45*a*, 46*a*, 47*a* and 48*a*. Thus it is apparent that when set screw is tightened, the increased tension on compression spring 46 causes the shoe 45 to urge the stud 36 downwardly and along therewith the spindle housing and grinding wheel. A similar action takes place when set screw 47*a* is tightened. The clearance 35 between the periphery of the stud 36 and the inner wall of the hub portion 34 allows a slight up and down movement of the spindle housing relative to its supporting brackets 32.

It is sometimes desirable to increase or decrease the flexibility of the grinding head assembly depending upon the type and condition of the surface being ground. I have provided for this by incorporating into the wheel levelling adjustment means compression springs for varying the flexibility of the grinding head assembly. It should be apparent that by tightening the set screws 41, 42, 47 and 47*a* the resulting increase of tension on the compression springs 43, 44, 46 and 46*a* limits the movement of the spindle housing relative to its supporting brackets 32 and 37 and as a consequence thereto limits the ultimate flexibility of the entire grinding head assembly, including the aforementioned brackets. Thus by tightening or loosening the set screws, the flexibility of the grinding head may be varied.

It is of special significance that the flexibility of the grinding head may be varied by tightening or loosening the set screws without affecting the adjusted level of the grinding wheel. For example if it is desired to increase the flexibility of the grinding head, all of the set screws may be loosened. By loosening each set screw the same number of turns it is apparent that the tension on each of the compression springs is correspondingly reduced and the adjusted level of the grinding wheel remains constant.

Secured to the rear and upper end of the sand hopper H is the water conduit 49 formed integrally with the support member 50. Upon the support number 50 is mounted an elongated casing 51 through which the power cable extends. An iron water pipe 52 is also mounted on the support member 50 and extends upwardly to substantially the same heighth as the casing 51. Thus it can be seen that the water line and cable are supported well above the machine so as not to interfere with the moving of the machine about the surface being ground. At the upper end of the water pipe a water hose (not shown) is connected and leads to a remote overhead water supply (not shown). A suitable valve 53 controls the amount of water allowed to flow into the receptacle 54.

At the mouth of the sand hopper H is a gate 55 comprising a handle 56 and a disc-shaped base portion 57 closing the mouth of the hopper. An adjustment screw 58 operating against the handle 56 accurately controls the amount of sand that is allowed to flow into the receptacle 54. It is of significance that the sand hopper can be easily cleaned out in case of clogging by opening the gate 55 and forcing a stick into the mouth of the hopper. A power cable 59 extends along the side of the hopper to the switch box 60 which is secured to the front hopper wall and thence to the motor M.

The grinding wheel G may be secured to the spindle shaft by any suitable securing means. Covering the grinding wheel is a guard assembly which comprises a mounting plate 61 secured to the spindle housing. A steel band 62 is welded or otherwise secured to several strap members 63 having inwardly turned flanges which rest loosely upon the mounting plate 61. Thus it can be seen that the guard automatically moves upwardly as the grinding wheel wears off. A band of rubber 64 is placed about the guard 62 and extends slightly beyond the lower edge thereof. As the machine is moved over the surface being ground, the rubber band scrapes it clean and the operator can see the work as it progresses, without having to stop the machine and manually clean the floor. The band may be moved downwardly as its bottom edge wears off. A removable rubber ring 65 is placed about the rubber band so that when the machine is grinding along a wall, the rubber ring prevents any possible scratching or marring of the wall. When the machine is grinding along a wall which is provided with a cove base, the rubber ring acts as a gauging device preventing the grinding wheel from coming into contact with the "coving."

A telescopic U-shaped handle 66 may be provided for manipulating the machine about the surface. The lower ends of the handle are slidably received by the elongated sleeve members 67 which in turn are received by the handle support brackets 68. The handle support brackets are preferably formed integrally with the frame member 13, there being one on each side of the

housing 17. The handle 66 may be adjusted up or down within the sleeves 67 and the clamp 69 retains the handle in its selected adjusted position. The handle may be withdrawn from the sleeves and reversed as shown in the dotted lines in Fig. 1 permitting operation of the machine close to the walls. A resilient bumper guard 79 extends beyond the rear end of the motor for protecting the walls from scratches, etc.

In Figs. 7 and 8, I have shown a modification of my invention wherein I provide a combined water tank W and sand hopper H' with a partition wall separating them. The flow of sand from the sand hopper is regulated by the gate member 74 and the flow of water from the water tank is regulated by valve 73. A U-shaped handle 75 is slidably received in brackets 76 mounted on each side of the switch box 78. Screw 77 retains the handle in any selected position of up and down adjustment. A rubber bumper member 86 is provided at the rear end of the motor housing and serves the same purpose as the spring bumper 70 shown in Fig. 1.

The grinding head assembly is flexibly supported by means of twisted spring members 80 which consist of two strips of flat spring steel twisted so that the middle portions 89 are horizontal relative to the floor surface and the end portions 90 are vertical. Thus it can be seen that the springs are flexible both laterally and vertically. The end portions of the springs are secured to the spindle housing and to the front of the motor housing. At the spindle housing the ends of the springs are secured to a rubber bushing 81 by means of a bolt 82 threaded into a nut 83. The nut 83 is bonded to the rubber bushing 81. The rubber bushing is secured to the wall of the spindle housing by means of a bracket 84 which is also bonded to the rubber bushing. Thus it can be seen that the spindle housing is flexibly supported by means of the spring members 80 through the medium of rubber cushions.

I have found that the combination of a flexible coupling together with the rubber mountings for the spindle housing are primarily instrumental in the provision of a high speed machine which will successfully grind a smooth surface on terrazzo floors at a greatly increased rate of speed.

In the spindle housing, as shown in Fig. 8, the sand and water tube 93 is journaled centrally therethrough. At the lower end of the tube I have provided a spacer bushing 94 between the hollow spindle shaft 95 and the tube and a flange 96 which prevents dust and dirt from searching into the spindle housing.

Having thus described my invention what I claim is:

1. A surface grinding device comprising a motor, a grinding wheel driven thereby, said grinding wheel adapted to rest of its own weight on the surface to be ground, a casting positioned directly above the motor, said casting having a base portion, a pair of side walls integral with the base portion and extending downwardly therefrom so as to partially embrace said motor, a tubular housing portion integral with the base portion and extending substantially vertically upwardly from the base portion, said housing portion being centrally located on said base portion, an arm integral with the base portion and integral with a wall of the housing portion, said arm extending angularly outwardly and upwardly from the base and housing portions, wheeled supporting legs secured to the side walls of said casting and embracing the motor, means for supporting the motor relative to the wheeled supporting legs said means also serving for adjusting the motor up and down relative to the floor surface, said means including a hand wheel supported by the housing portion and a threaded rod extending through the interior of the housing portion and having connection with the motor, and a fluid container tank supported by the free end of the arm in a plane above the upper level of the motor, said tank being located intermediate the motor and the surfacing wheel.

2. A surface grinding apparatus comprising a motor, a grinding wheel driven thereby, said grinding wheel adapted to rest of its own weight on the surface to be ground, a casting positioned directly above the motor, said casting having a base portion, a pair of side walls integral with the base portion and extending downwardly therefrom so as to partially embrace said motor, a tubular housing portion integral with the base portion and extending substantially vertically upwardly from the base portion, said housing portion being centrally located on said base portion, an arm integral with the base portion and integral with a wall of the housing portion, said arm extending angularly outwardly and upwardly from the base and housing portions, wheeled supported legs secured to the side walls of said casting and embracing the motor, means for supporting the motor relative to the wheeled supporting legs said means also serving for adjusting the motor up and down relative to the floor surface, said means including a hand wheel supported by the housing portion and a threaded rod extending through the interior of the housing portion and having connection with the motor, and a fluid container tank supported by the free end of the arm in a plane above the upper level of the motor.

ARTHUR WILLIAM MALL.