Sept. 1, 1964 G. W. WILKINSON 3,146,559

FLOOR FINISHING MACHINE

Filed Feb. 4, 1963 3 Sheets-Sheet 1

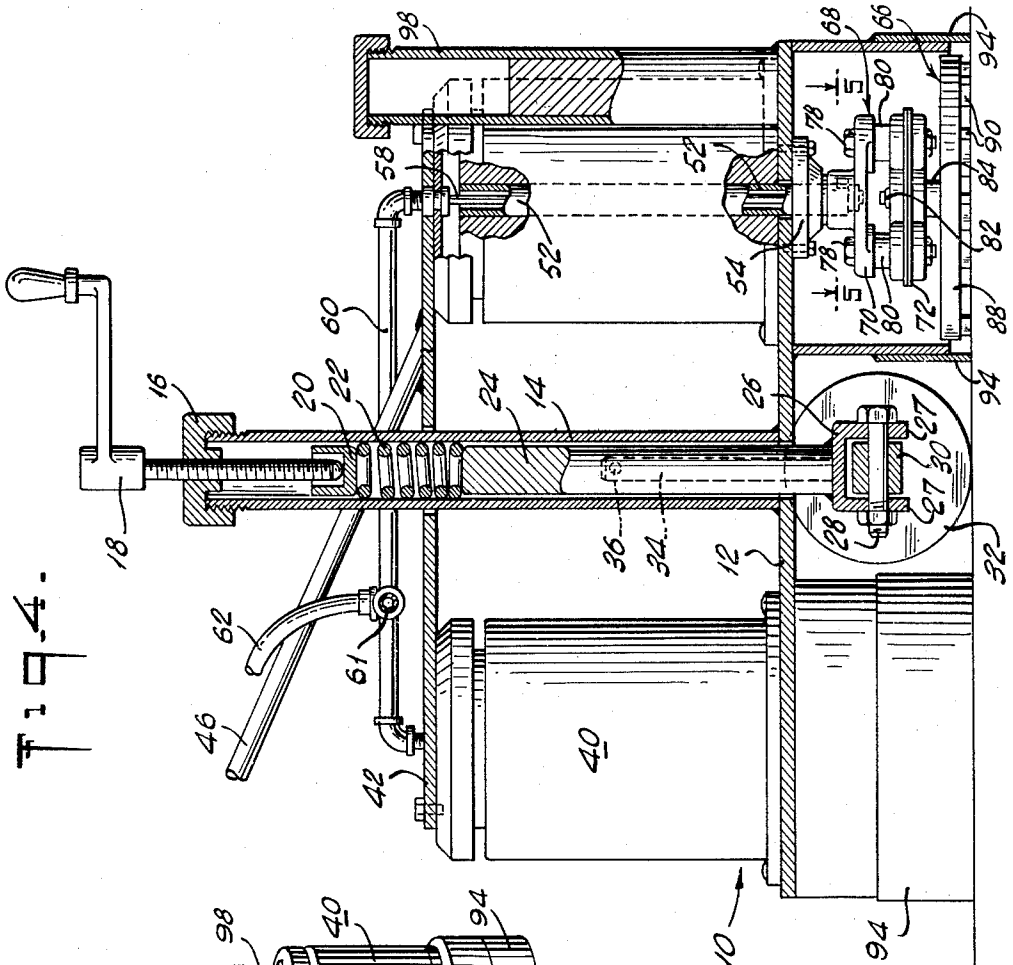


FIG. 4.

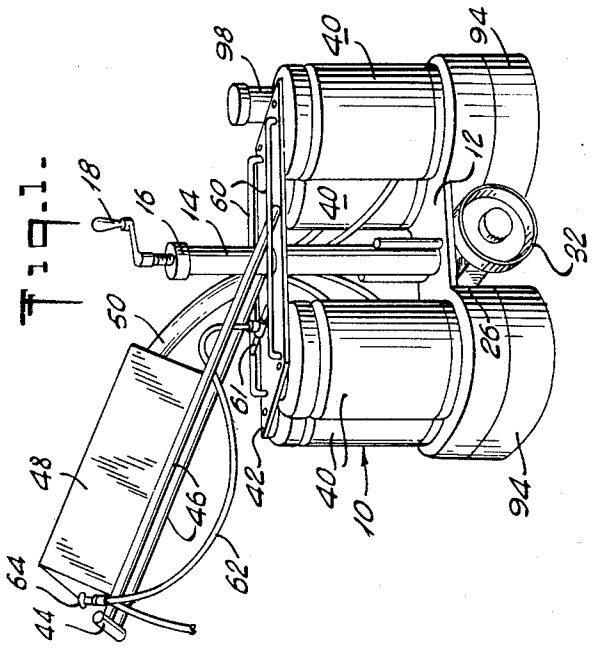


FIG. 1.

INVENTOR.
GEORGE W. WILKINSON
BY
Nolte & Nolte
ATTORNEYS

Sept. 1, 1964 G. W. WILKINSON 3,146,559

FLOOR FINISHING MACHINE

Filed Feb. 4, 1963 3 Sheets-Sheet 2

Fig. 2.

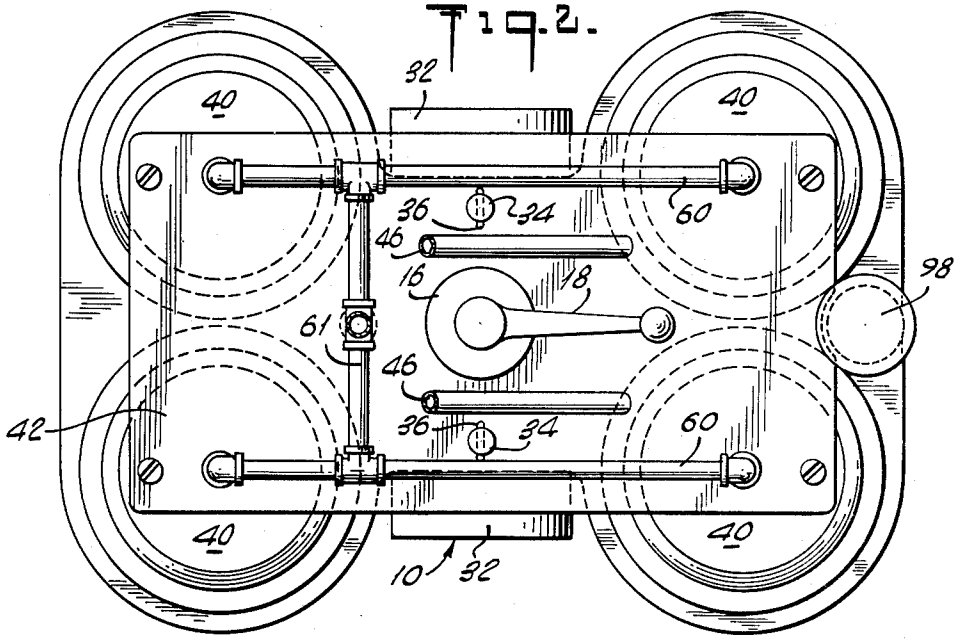
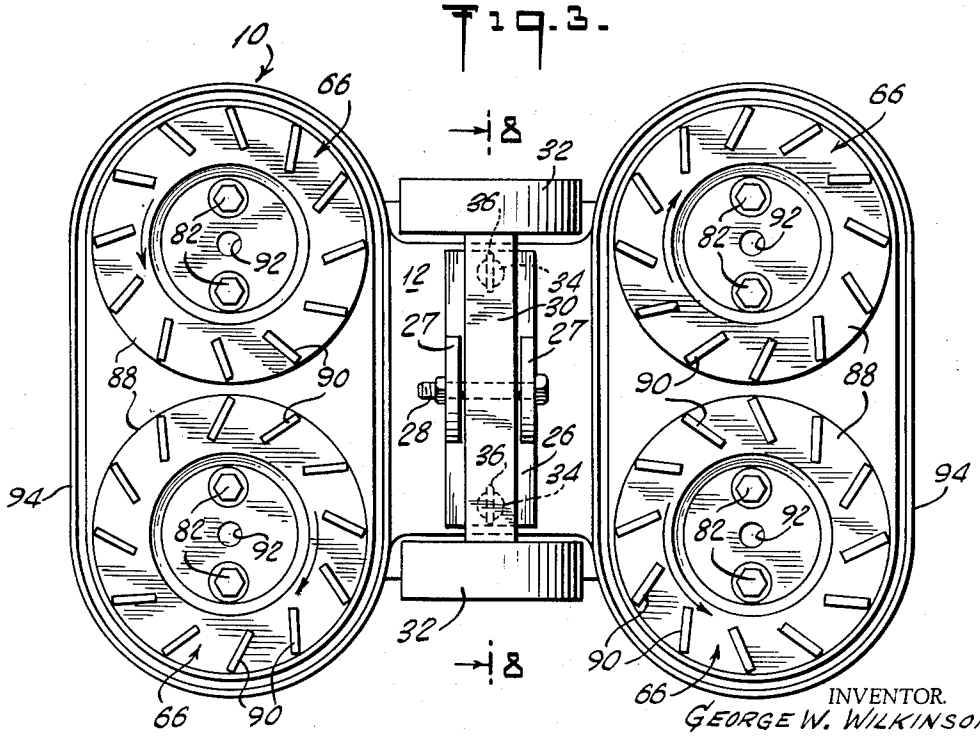


Fig. 3.



INVENTOR.
GEORGE W. WILKINSON

BY

Nolte & Nolte
ATTORNEYS

Sept. 1, 1964 G. W. WILKINSON 3,146,559

FLOOR FINISHING MACHINE

Filed Feb. 4, 1963 3 Sheets-Sheet 3

Fig. 5.

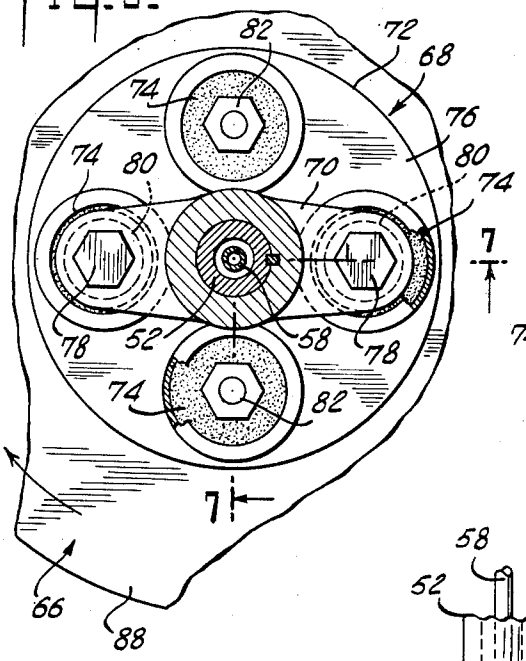


Fig. 6.

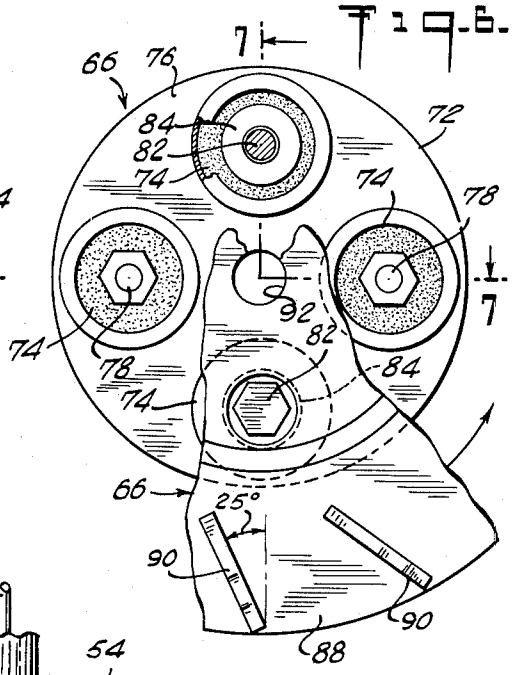


Fig. 7.

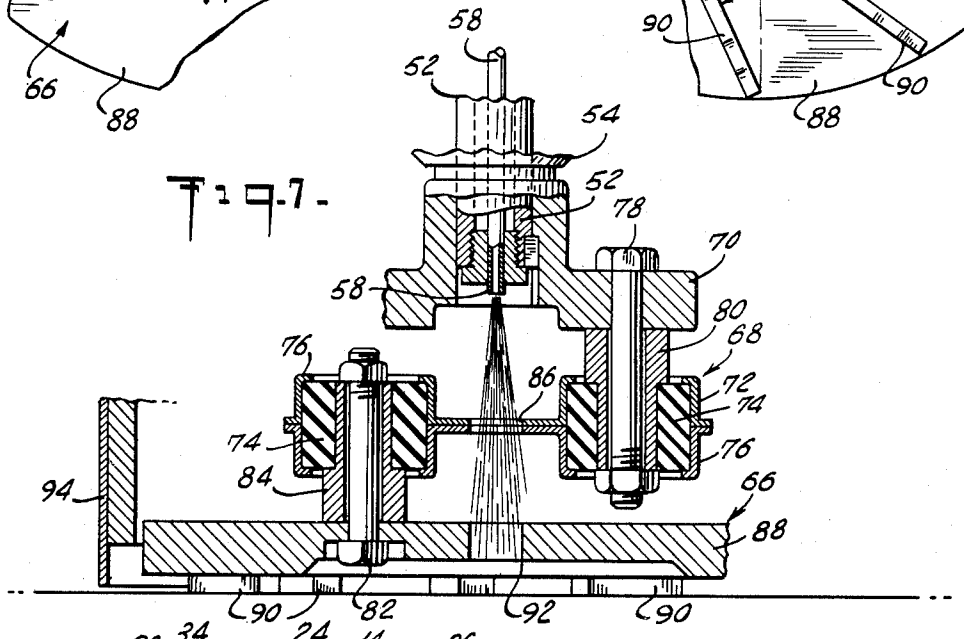
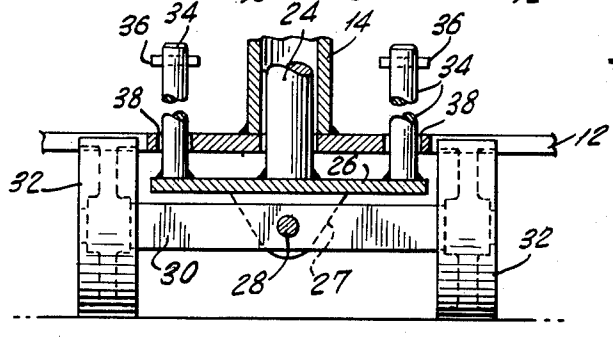


Fig. 8.



INVENTOR.
GEORGE W. WILKINSON
BY
Nolte & Nolte
ATTORNEYS

United States Patent Office

3,146,559

Patented Sept. 1, 1964

3,146,559

FLOOR FINISHING MACHINE

George W. Wilkinson, Mine Road, R.D. 2, Somerville, N.J.

Filed Feb. 4, 1963, Ser. No. 256,030
9 Claims. (Cl. 51—177)

This invention relates in general to floor grinding machines and in particular to improvements in machines used to grind terrazzo floors. The invention relates specifically to a novel combination of elements which cooperate to produce a grinding machine capable of surfacing a greatly increased amount of floor area per unit of time at the least possible cost.

Terrazzo floors are fabricated by using small chips of marble as the principal aggregate in cement. It is customary after the cement has set to grind off the surface roughness of the floor with a floor surfacing machine to expose and polish the marble aggregate chips and give such floors their characteristic appearance. While such floors have a fairly high cost per unit area in comparison to alternate flooring materials, such additional cost has generally been found to be justified in the construction of commercial buildings because of their low subsequent upkeep expense, easy maintenance and good wearing ability.

Because a large proportion of the cost of a terrazzo floor is associated with the labor involved in the finishing operation, and the fact that labor costs generally have risen substantially in the cement finishing industry in comparison to the labor cost in the other floor finishing techniques, the price spread therebetween has widened in recent years. Also affecting the competitiveness of terrazzo floors with other floor materials are the recent technological advances made in, for instance, vinyl plastic floor tiles which have many competitive aspects in their favor one of which includes a lower initial cost. The lower cost of vinyl, and its wide range of available colors has led to its use in commercial buildings hithertofore employing terrazzo.

Accordingly, it is the principal object of this invention to significantly lower the labor cost per unit area of terrazzo floor so that this type flooring remains competitive with alternate types of floor coverings.

This principal object of the applicant's invention is accomplished by applicant's novel arrangement of a simple high speed surface grinding machine capable of production rates considerably in excess of any present day machine constructed for similar purposes. Applicant's novel arrangement includes the use of a multiplicity of diamond abrasive cutting heads secured, as by welding, in an annular ring to the lower surface of a rotatable plate. Each plate is directly connected through a flexible coupling to a hollow output shaft of its respective drive motor. In applicant's novel arrangement the diamond grinding heads are mounted in adjacent pairs and connected for opposite, torque balancing rotations. The drive shaft of each of the motors is tubular to allow passage therethrough of a water supply conduit which discharges water through an aperture in the flexible coupling and through a corresponding aperture in the grinding head to supply water centrally to the diamond abrasive wheel. Applicant's invention includes the specific arrangement of the diamond abrasive segments on the grinding head in a novel manner so that the centrally discharged cutting lubricant is not only maintained under the grinding head by a centripetal pumping action thereof, but the peripheral water lying on the floor being finished is picked up and impelled inwardly thereby toward the center of rotation of the head.

The invention as embodied includes four individual drive motors arranged in rectangular relation, adjacent motors being adapted to rotate in opposite torque balancing rotation. In applicant's preferred embodiment 5 hp., 1750 r.p.m. motors are used. Coupled directly thereto via flexible couplings are the grinding discs mounting the spaced diamond abrasive portions. Cutting lubricant, such as water, is fed under pressure downwardly through each of the drive motor tubular armature shafts, through an aligned central aperture in the flexible coupling, through the center of the lower surface of the grinding head. The selection of diamond abrasive means, which may be, and preferably are rotated at a high r.p.m. in comparison to typical prior art grinding machines, permits the elimination of the hithertofore common reduction gear drive employed therein. Prior art machines employing carborundum grinding heads operate most efficiently at a low r.p.m. and invariably incorporate complex reduction gearing so that adequate torque could be applied thereto from a small high speed motor.

The present invention eliminates the costly gear drive arrangement of typical prior art machines by providing a diamond surfaced cutter capable of optimum performance at standard motor speed of 1750 to produce a floor finishing machine capable of area production rates 50% greater than typical prior art arrangements. Because of applicant's increased surface finishing capability per machine, the cost of terrazzo floors has been maintained competitive with alternate surface finishes in spite of the labor wage spiral experience in this industry.

Accordingly, a principal object of the present invention is to produce a novel combination of elements which form a high speed grinding machine capable of grinding a greatly increased amount of floor space per unit of time.

A further object of the invention is to provide a gearless terrazzo floor finishing machine wherein the grinding heads operate at the same high speed as the driving motors.

Another object of the invention is to provide a high speed terrazzo floor finisher employing diamond abrasive grinding segments arranged in a spaced spiral relation to enhance cutting lubrication efficiency.

Another object of the invention is to provide a terrazzo floor finisher wherein the grinding heads have negligible wear.

Another object of the invention is to provide a floor finisher employing four drive motors and individual grinding heads attached to the output shafts of each of said motors.

A further object of the invention is to provide a floor finisher which is extremely simple in design, employs a minimum number of parts, rugged in construction, trouble free in operation, low in maintenance and economical to manufacture.

These and other objects and advantages will become apparent and the invention will be fully understood from the following description and drawings in which:

FIG. 1 is a perspective view of the machine according to the invention;

FIG. 2 is a top plan view of the motor portion of the machine;

FIG. 3 is a bottom plan view showing the quadruple grinding heads of the invention;

FIG. 4 is a side elevational view of the machine with portions thereof in section;

FIG. 5 is an enlarged fragmentary sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary bottom view of the cutter head with portions broken away to show the universal coupling;

FIG. 7 is a fragmentary sectional view of the grinding head coupling arrangement taken along line 7—7 of FIGS. 5 and 6; and

FIG. 8 is a fragmentary cross-sectional view of the invention taken along line 8—8 of FIG. 3.

Referring to the drawing in particular, the floor grinding machine shown generally at **10** includes a horizontially extending frame plate **12** to which is welded a centrally located tubular support column **14** extending upwardly therefrom. The upper end of the support column **14** includes a threaded portion (FIG. 4) to which is secured a threaded cap **16**. Extending through the center of the cap **16** and threaded thereto is a crank arm **18** whose lower end contacts a cup-shaped member **20**. Axially beneath the cup **20** is a coil support spring **22** whose lower end abuts the upper end of a main support post **24**.

The support post **24** (see FIGS. 4 and 8) extends downwardly through the column **14** to connect at its lower end with a U-shaped channel cross member **26**. The cross member **26** includes a pair of downwardly depending ear portions **27** which provide support means for opposite ends of a pivot bolt assembly **28**. The bolt **28** passes through a transverse axle **30** which mounts wheels **32** at opposite ends thereof. A pair of guide rods **34** are secured at their lower ends to the upper surface of the cross member **26** and extends upwardly through clearance apertures **38** in the frame plate **12** to prevent relative rotation between the frame and the axle member. The upper ends of each of the guide rods **34** includes a transverse pin **36** to prevent the dropout of the wheel assembly upon elevation of the machine.

Bolted, or secured by other means, to the upper surface of the frame **12** are four vertically disposed drive or grinding motors **40**. The motors are preferably arranged as indicated in a contra-rotating first pair forward of the wheels **32** and a contra-rotating second pair aft thereof. The upper end of each of the motor **40** casings is secured to a rectangular plate **42** which acts to provide a mounting surface for purposes described herebelow, and at the same time to rigidify the uppermost ends of the motor housings. Extending obliquely upward from a central portion of the plate **42** are a pair of parallel tubular members **46** which connect with a transverse operator's handle **44** at their uppermost ends. Secured to the members **46** is a motor control box **48** which contains the conventional necessary starting controls for the individual motors **40**. An electrical feed cable (not shown) supplies the necessary energy to the control box **48** which is channeled via connecting cables **50** to the individual drive motors **40**.

Each of the motors **40** includes a tubular armature output shaft **52** which extends downwardly through a clearance aperture in the plate **12**.

An annular collar or bushing **54** is secured, as by threads, to the lower end of the output shaft **52** to act as a bearing for the support of the lower end of a water supply conduit **58** extending downwardly throughout the length of the tubular shaft **52**. While not specifically shown, it should be understood that each of the motor output shafts includes a similar conduit **58** and that each are connected in common by a pipe manifolding arrangement **60**. The cross member **61** of the pipe **60** joins with a flexible hose member **62** which includes a flow control adjustment valve **64** therein. The valve **64** is disposed adjacent the operator's handle **44** to facilitate easy adjustment of the water flow during operation of the machine. The output torque of each motor shaft **52** is transmitted downwardly to their respective grinding head **66** via an intermediate flexible coupling shown generally as **68**. Each coupling **68** includes an upper cross arm **70** keyed to the lower end of the output shaft **52**. A central spider member **72** includes a pair of complementary upper and lower steel shells **76** which are secured together to encase opposite pairs of resilient bushings **74** therebetween. (Refer to FIGS. 5, 6 and 7.) One pair of the bushings **74** is secured by a pair of bolt members **78** and stepped spacers **80** to cross member **70**. The other pair of resilient bushings **74** is similarly attached by bolts **82** and spacers **84** to the circular

support plate **88** of the grinding head **66**. The shells **76** and the circular plate **88** include central apertures **86** and **92**, respectively, which allow passage of the water discharged from the lower end of the conduit **58** vertically downward to the center of rotation of the grinding head **66**.

Each head **66** includes a plurality of elongated rectangularly-shaped diamond abrasive blocks **90** secured, as by brazing, in spiral or oblique relation to the outer periphery thereof. The longitudinal axis of each abrasive block **90** is inclined at an acute angle of approximately 25° relative to a radial line extending from the center of the plate **88** through the outermost tip of the block **90**. The orientation of the diamond abrasive blocks **90** is effective to retard the outward flow of the cutting lubricant from under the head as well as to inwardly impel any liquid that the head tends to pick up at its periphery as it is moved by its operation about the terrazzo floor. The blocks **90** are inclined with their outermost ends pointing in the direction of rotation of the shaft of the drive motor. As is best shown in FIG. 3, it can readily be seen that the left-most pair of heads **66** have opposite directions of rotation as do the right hand most pair of heads **66**. However, it should also be noted that the uppermost horizontal pair of heads also have contra-rotating directions as do the bottommost horizontal pair of heads. In this manner, counterbalancing cutting torques will always occur regardless of whether the majority of the weight is supported by the fore or aft pair of grinding heads or alternatively by the left or right pair of grinding heads. It should also be noted that the adjustment of the crank arm **18** is effective to raise or lower the entire motor and frame assembly upwardly from the wheels to thereby alter the cutting force on the grinding heads **66** and that the entire assembly is free to wobble within confined limits in both a transverse and longitudinal axis about the pivot bolts **28** and wheels **32**. The frame is also provided with an upstanding counterweight in the form of a lead filled pipe **98** which balances the weight of the control box **48**.

Each of the pairs of grinding head means **66** is surrounded by an oval-shaped skirt member **94** which acts to prevent undue splashing of lubrication liquid from the periphery of the heads. Because applicant's diamond abrasive cutting heads have little and almost insignificant wear or change in dimension throughout their life, the splash skirt **94** may be directly secured to the edge of the plate **12** without provision of height adjustment thereof, as is necessary for an effective splash plate about a carborundum wheel which will wear with usage.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What I claim is:

1. A surface grinding machine comprising a frame, a first pair of drive motors mounted on said frame each having a tubular output shaft disposed in a substantially vertical relation, said motors connected to have their respective shafts rotate in opposite directions, a second pair of drive motors mounted on said frame each having a substantially vertical tubular output shaft parallel to the output shafts of said first pair of motors, said second pair of drive motors being connected to have their respective shafts rotate in opposite directions to each other and in opposite directions to the direction of rotation of the adjacent drive motors of the first pair, a plurality of circular grinding means, means for flexibly coupling each of said grinding means directly to the lower end of each output shaft, and means for supplying a cutting lubricant downwardly, under pressure, through each motor output shaft to the center of its respective grinding means, said grinding means including a plurality of spaced elongated diamond abrasive means, said abrasive means being ar-

ranged about the periphery of said grinding means with the longitudinal axis thereof angularly acute to the radius of said circular grinding means and having their outermost ends pointed in the direction of rotation of its respective grinding means whereby the outward flow of cutting lubricant is retarded by the centripetal pumping effect of said abrasive means.

2. A surface grinding machine according to claim 1 including wheel means for movably supporting said frame above the surface to be ground, and means securing said wheel means to said frame between said first and second pair of drive motors, said securing means including means for allowing a limited longitudinal and transverse rocking of the frame relative to the surface to be ground.

3. A surface grinding machine according to claim 2 including means for adjusting the height of said frame above the level of said wheel means.

4. A surface grinding machine according to claim 2 including plate means affixed to the upper ends of each of said drive motors, and control means secured to said plate means, said control means including means for starting said drive motors and means for regulating the flow of cutting lubricant through the motor output shafts.

5. A surface grinding machine according to claim 3 including in addition a pair of oval skirt means rigidly secured to said frame, said skirt means respectively peripherally enclosing the grinding means of said first and second pair of drive motors.

6. A surface grinding machine according to claim 5 including counterweight means affixed to said frame for offsetting the weight of said control means thereby balancing said machine symmetrically about said wheel means.

7. A surface grinding machine comprising a pair of drive motors each having a tubular output shaft and connected to have their respective shafts rotate in opposite directions, a pair of circular grinding means, means for flexibly coupling each of said grinding means directly to the lower end of each motor output shaft, and means for supplying a cutting lubricant downwardly under pressure through each output shaft to the center of its respective grinding means, each grinding means including a plurality of spaced elongated diamond abrasive means, said abrasive means being arranged about the periphery of said grinding means with the longitudinal axis thereof angularly acute to the radius of said circular grinding means and having their outermost ends pointed in the direction of rotation of its respective grinding means whereby the outward flow of cutting lubricant is retained by the centripetal pumping effect of said abrasive means.

8. A surface grinding machine comprising a pair of drive motors each having a tubular output shaft and connected to have their respective shafts rotate in opposite directions, a pair of circular grinding means, means for flexibly coupling each of said grinding means to the lower end of each motor output shaft coaxially therewith, and means for supplying a cutting lubricant downwardly under pressure through each output shaft to the center of its respective grinding means, each grinding means including a circular plate, a plurality of spaced elongated abrasive means, said abrasive means being fixedly attached to said plate and oriented thereon in such a manner with regard to the direction of rotation of its associated output shaft that the outward flow of the centrally fed cutting lubricant is retarded by the centripetal pumping effect of said abrasive means.

9. A surface grinding machine comprising a frame, a first pair of drive motors mounted on said frame each having a tubular output shaft disposed in a substantially vertical relation, said motors connected to have their respective shafts rotate in opposite directions, a second pair of drive motors mounted on said frame each having a substantially vertical tubular output shaft parallel to the output shafts of said first pair of motors, said second pair of drive motors being connected to have their respective shafts rotate in opposite directions to each other and in opposite directions to the direction of rotation of the adjacent drive motors of the first pair, a plurality of circular grinding means, means for flexibly coupling each of said grinding means to the lower end of each output shaft coaxially therewith, and means for supplying a cutting lubricant downwardly, under pressure, through each motor output shaft to the center of its respective grinding means, each grinding means including a circular plate, a plurality of spaced elongated abrasive means, said abrasive means being fixedly attached to said plate and oriented thereon in such a manner with respect to the direction of rotation of its associated output shaft that the outward flow of the centrally fed cutting lubricant is retarded by the centripetal pumping effect of said abrasive means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,032,023	Prugh	July 9, 1912
1,069,803	Nelson et al.	Aug. 12, 1913
1,116,145	Smith	Nov. 3, 1914
1,302,404	Mills	Apr. 29, 1919
1,452,926	Orlando	Apr. 24, 1923
2,106,035	Mall	Jan. 18, 1938
2,171,060	DeSpirt	Aug. 29, 1939
2,793,476	Lombardo	May 28, 1957
2,883,807	Titcomb	Apr. 28, 1959
2,913,855	Vinella	Nov. 24, 1959

FOREIGN PATENTS

156,388	Switzerland	Oct. 17, 1932
530,723	Great Britain	Dec. 18, 1940