Oct. 16, 1945. R. E. DAVIS 2,386,843

APPARATUS FOR SURFACING PLASTIC BODIES

Filed Dec. 3, 1941 2 Sheets-Sheet 1

FIG. 1.

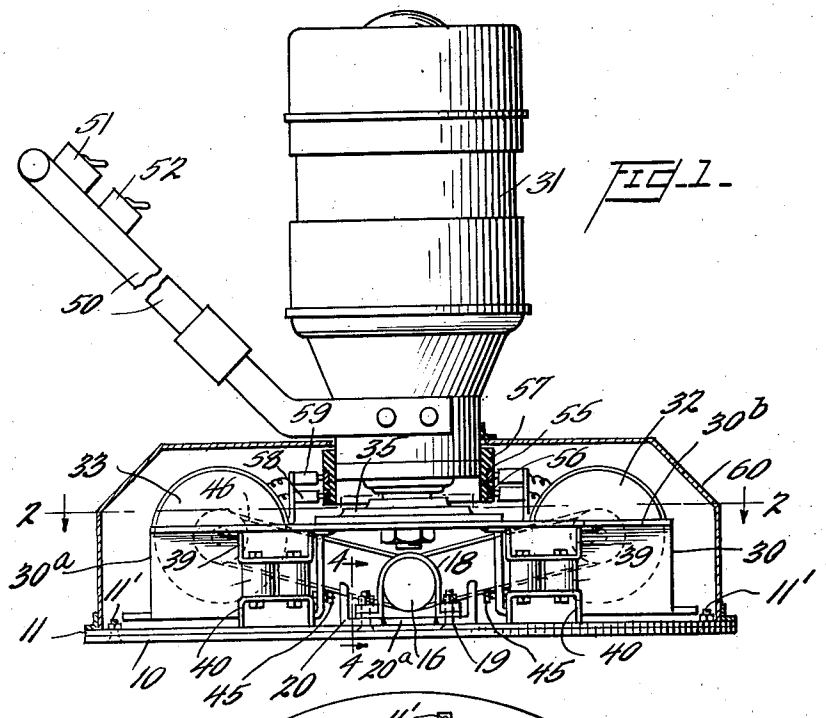
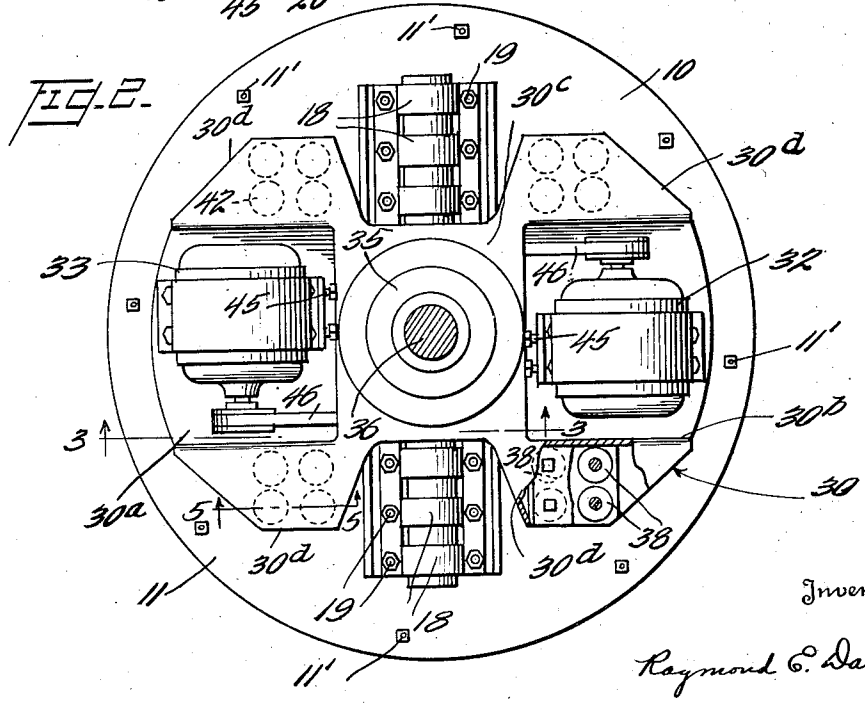


FIG. 2.



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Filed Dec. 3, 1941 2 Sheets-Sheet 2

FIG. 3.

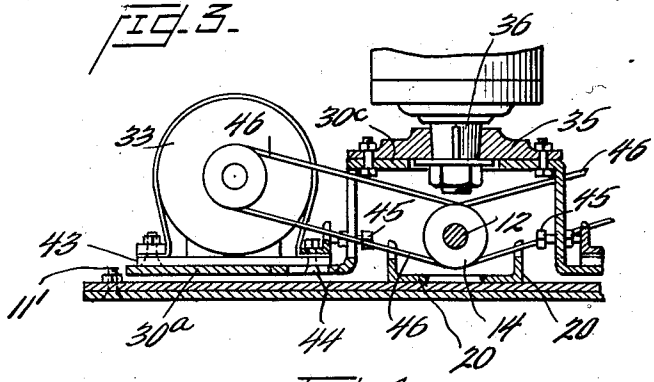


FIG. 4.

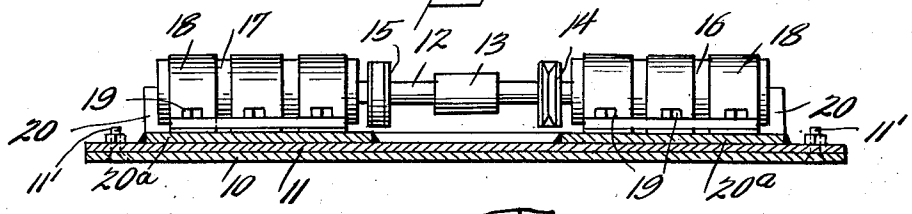


FIG. 5.

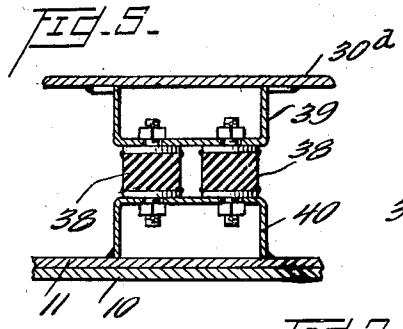


FIG. 6.

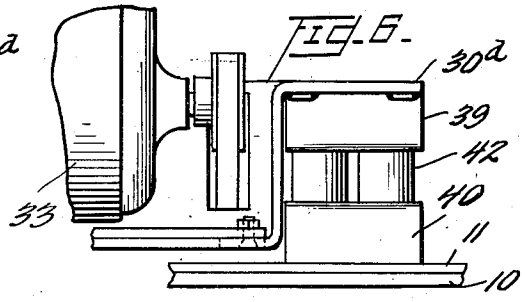


FIG. 7.

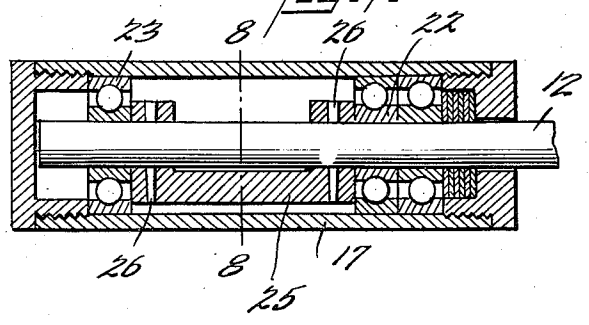
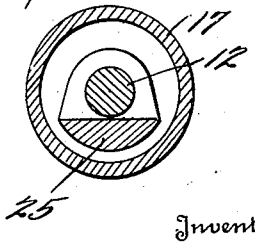


FIG. 8.



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Patented Oct. 16, 1945 2,386,843

UNITED STATES PATENT OFFICE

2,386,843

APPARATUS FOR SURFACING PLASTIC BODIES

Raymond E. Davis, Berkeley, Calif., assignor to Kalman Floor Company, Inc., New York, N. Y., a corporation of Delaware

Application December 3, 1941, Serial No. 421,507

10 Claims. (Cl. 94—45)

This invention relates to apparatus for the surfacing of plastic bodies and particularly to apparatus intended to be used for finishing surfaces of concrete slabs, such as floor slabs.

During recent years there have been developed various types of mechanically operated mechanisms designed and intended to reduce to the minimum the amount of manual labor which must be expended, and the time required, to reduce to a true plane and impart the desired surface finish to plastic bodies such as concrete floors, walks and roadways. A number of these mechanisms have come into widespread use, some particularly designed for use on roadways and others primarily intended for employment in the surfacing of floors. A known type of mechanically operated floor surfacing mechanism customarily comprises a work-engaging member, a motor superposed upon the work-engaging member for rotating the same, and a handle which prevents rotation of the motor casing and constitutes a means for moving the implement over the surface of a concrete body in the desired manner.

In an earlier application filed by me on the fifth day of June, 1940, Serial No. 338,991, now Patent No. 2,289,247, issued July 7, 1942, I have disclosed and claimed a surfacing apparatus of the type above generally described, but which includes as an entirely novel feature, mechanism for imparting to the rotating work-engaging member high frequency vibrations so that the plastic body below the apparatus is not only subjected to the action of the rotating disc, but is subjected to high frequency vibrations. Such apparatus is highly effective and enables the user to properly surface a plastic body such as a concrete floor in a vastly improved manner. Thus, by the aid of the rotating and vibrating disc an extremely dry concrete mixture may be surfaced, a mixture having such a low water-cement ratio that it cannot be surfaced by ordinary means or methods since it is impossible to laterally displace or horizontally push material from the higher areas of the concrete onto the lower areas. The levelling of the floor surface is brought about by vertically depressing the higher areas instead of laterally displacing these areas and the concrete slab or the like which is produced is of superior quality, being denser and free of voids. The surface is superior inasmuch as the novel method of levelling the same results in bringing to the surface a relatively stiff paste of cement and fine sand, barely sufficient in thickness for the final trowelling by hand. The improved method not only gives a superior product but insures substantial savings in time and labor costs, as compared with prior methods.

The present invention relates particularly to an improved apparatus for carrying out the method just described. In accordance with the invention a work-engaging member which comprises a substantially flat disc has directly mounted thereon an eccentric which, when rotated at high angular velocity, imparts to the disc vibrations at high frequency, for instance, 5000 or more vibrations per minute. Superposed upon the work-engaging member is a motor carrier, yieldably supported so that the vibratory motion of the said member will not be imparted to the motor carrier, the motor carrier being, however, constrained to rotate with said member about a vertical axis. Upon the motor carrier are three motors, a motor for rotating the carrier and with it the work-engaging member and two additional motors, symmetrically positioned on opposite sides of the axis of rotation of the eccentric, for rotating the eccentric, each of the last two motors being connected to the eccentric by a flexible driving means such as a belt.

The motor carrier is so formed that the two motors for driving the eccentric are positioned in close proximity to the work-engaging member, the center of gravity of the apparatus as a whole being thus maintained quite low. It will be appreciated that in the case of an apparatus of this type, which is intended to be moved manually from area to area over a floor by pulling or pushing, it is much to be preferred that the center of gravity be maintained as low as possible to eliminate any tendency toward overturning and to likewise prevent the leading edge of the disc from digging into the concrete.

All elements of the mechanism likewise have been constructed in such manner as to secure maximum strength for a given weight of metal, the greatest simplicity, the most efficient operation and the greatest ability to withstand rough handling.

One embodiment of the invention which has been selected for disclosure by way of example is illustrated in the accompanying drawings in which—

Figure 1 is a side view of the improved apparatus, partly in side elevation and in part broken away in order that various interior features may be observed;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a section on line 3—3 of Figure 2;

Figure 4 is a section on line 4—4 of Figure 1;

Figure 5 is a section on line 5—5 of Figure 2;

Figure 6 is a view of a portion of one of the eccentric driving motors and adjacent parts, shown in side elevation;

Figure 7 is an axial section through portion of the eccentric device; and

Figure 8 is a section on line 8—8 of Figure 7.

The work-engaging member preferably comprises two portions, a disc 10 which may be designated a wear-plate and which is preferably of hardened steel to offer increased resistance to the wear incident to rubbing of its lower surface against a relatively dry concrete mixture, and a base plate 11, the wear-plate 10 being removably secured to the base plate 11 by bolts 11' so that it may be removed and replaced by a new plate when it becomes excessively worn. Directly mounted upon the base plate 11 is the eccentric device by means of which the base plate and wear-plate may be vibrated at high frequency. This eccentric device includes a shaft 12 preferably formed in two portions connected by coupling 13, such shaft having fixed thereon adjacent the coupling 13, two belt pulleys indicated at 14 and 15, respectively, and the ends of the shaft, beyond pulleys 14 and 15, extending into cylindrical casings 16 and 17. These casings are secured by straps 18 and bolts 19 to spaced parallel angles 20 which are in turn welded or otherwise suitably secured to base plate 11. These angles extend substantially across the plate 11 and also serve to stiffen the work-engaging member. Filler plates 20a directly underlie casings 16 and 17 and are welded to disc 11.

Coupling 13 is so constructed that the two portions of shaft 12 are constrained to rotate together at all times when the apparatus is in use even when the axes thereof become angularly disposed to each other. By making the eccentric shaft in two parts flexibly connected together in this manner it is possible to simultaneously drive two eccentrics, which are spaced apart, in such manner that they are always in the same phase, despite any warping of the work-engaging member. It is desirable to place the rotating eccentrics outwardly of the center of the work-engaging member so that the outer areas of that member will be adequately vibrated, as well as the central portions.

Within the housings or casings 16 and 17, respectively, are anti-friction bearings 22 and 23 which encircle eccentric shaft 12 and support the same, and intermediate to each pair of bearings 22 and 23 is an eccentric weight 25, portions of which encircle the shaft 12 and are secured thereto by pins 26, constraining the weight to rotate with the shaft. The ends of cylindrical casings or housings 16 and 17 are closed by plugs, as indicated clearly in Figure 7 and the casing, therefore, comprises a substantially oil-tight chamber. Each is adapted to contain a small quantity of oil which, when the apparatus is in operation, will be beaten by the eccentric weight 25 into an oil fog, and the bearings will thus be maintained perfectly lubricated during the operation of the mechanism.

Superposed upon the work-engaging member which comprises discs 10 and 11 is a motor carrier generally indicated at 30, designed and intended to support three motors, the relatively large motor 31 by means of which the work-engaging member is revolved about a vertical axis, and the smaller motors 32 and 33 which are provided for the purpose of driving at high angular velocity the eccentric shaft 12. It will be observed that the motor carrier 30 includes the motor supporting portions 30a and 30b disposed just above and parallel to the base plate 11 and on opposite sides of the eccentric shaft, and an intermediate portion 30c which connects the portions 30a and 30b and bridges or arches over the eccentric shaft 12. The central part of the bridging portion 30c in turn supports a relatively thick disc-like collar 35 which is provided with a central frusto-conical aperture, the axis of which is vertical, to receive with a tight fit the downwardly tapering shaft 36, shaft 36 being operatively connected to the rotor of driving motor 31 by speed reduction gearing of known type. Driving shaft 36 is keyed to disc 35 so that, when motor 31 is energized, the motor carrier as an entirety will be revolved, although at a relatively low angular velocity due to the speed reduction gearing which is employed.

Rotation of the motor carrier is transmitted to the work-engaging member by resilient elements 38 which are generally designated rubber springs. Each such element comprises a rubber block shaped as a short cylinder together with bolts or the like secured to the ends thereof in any suitable manner by means of which the springs may be attached to adjacent parts such as the parallel webs of the U-shaped brackets 39 and 40. Brackets 39 are welded to portions 30d of the motor carrier and brackets 40 are suitably secured, as by welding, to the base plate 11. It will be observed from Figure 2 that there are four motor carrier portions 30d and four groups of rubber springs 38, or sixteen in all. By this means the motor carrier and motors are mounted on the work-engaging member in such manner that rotary motion is transmitted and at the same time all of the motors are shielded from vibration.

The eccentric driving motors 32 and 33 are disposed with their axes in parallelism to the axis of the eccentric shaft 12 and each is mounted in such manner as to be bodily adjustable toward or away from such shaft. Thus motor 33 is shown to be mounted upon a plate 43 which is slidably mounted upon the underlying motor supporting portion 30a of the motor carrier. Locking bolts 44, the lower ends of which are enlarged so as to lie in undercut slots formed in portion 30a are provided to secure the motor in any position to which it may be adjusted upon the motor carrier. This to enable the operator to adjust, as by means of an adjusting bolt 45, the motor to take up wear or slack in the driving belt 46 by means of which the motor is operatively connected to the eccentric shaft. The second motor 32 is similarly mounted and may be similarly adjusted.

It will be observed by this arrangement that the means for driving the eccentric is maintained at a very low elevation with respect to the work-engaging member and the center of gravity of the entire apparatus thus kept as low as possible. When the apparatus is moved over the surface of a body of concrete, as by means of the operating handle 50 one end of which is connected to the casing of motor 31, there is little or no tendency for the apparatus to tilt, the handle being so disposed angularly with respect to the mechanism that the thrust of the handle will pass approximately through the center of gravity of the apparatus.

The means for supplying electric current to the several motors may be as desired. Conveniently, electrical mains may pass down the han-

dle 50, being controlled by switches 51 and 52 fixed on the upper end of the handle, one circuit controlled by one of the switches being provided for the energization of the driving motor 31 and the second circuit, controlled by the switch 52, being provided to supply motors 32 and 33 with necessary current. By providing two circuits and two control switches an operator may, if he chooses, rotate the work-engaging member without vibrating the same or may vibrate said member without rotating it. As the motors 32 and 33 will revolve about the vertical axis of the apparatus when motor 31 is energized, it is necessary to provide slip rings such as indicated at 55 and 56, supported on insulating brackets 57 depending from the casing of motor 31, brushes 58 and 59 being provided to take current from the slip rings and to supply each operating motor 32 and 33. A light casing or housing 60 has its lower edge affixed to the periphery of base plate 11 and encloses the motor carrier, eccentric, and eccentric driving motors, the casing top having a central circular aperture to receive the lower end of the casing of motor 31. The housing or casing 60 prevents dirt or dust from settling upon the motor and operating parts of the enclosed mechanism, and also constitutes a safety shield enclosing the moving and electrically charged parts. The motors 32 and 33 are statically and dynamically balanced about the axis of motor 31. If only one such motor is used a counterweight must be employed to maintain such balance.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In an apparatus of the type described, in combination, a substantally flat plate for engaging the surface of a body of plastic material, an eccentric rotatably supported directly on said plate, a motor carrier above said plate and resiliently supported thereon, means connecting the carrier and plate for simultaneous rotation about an axis normal to the plate while permitting limited relative movement in the direction of said axis, a motor mounted on said carrier for rotating said carrier and plate, and a second motor mounted on said carrier and connected to said eccentric by a flexible driving means.

2. In an apparatus of the type described in combination, a substantially flat plate for engaging the surface of a body of plastic material, an eccentric rotatably supported directly on said plate, a motor carrier above said plate and resiliently supported thereon, means connecting the carrier and plate for simultaneous rotation about an axis normal to the plate while permitting limited relative movement in the direction of said axis, a vertically disposed motor mounted on said carrier, for rotating the carrier and plate, a horizontally disposed motor also mounted on the carrier, and driving means connecting the last mentioned motor to the eccentric.

3. In an apparatus of the type described, in combination, a substantially flat plate for engaging the surface of a body of plastic material, an eccentric rotatably supported directly on said plate, a motor carrier above said plate and resiliently supported thereon, means connecting the carrier and plate for simultaneous rotation about an axis normal to the plate while permitting limited relative movement in the direction of said axis, a motor mounted on said carrier for rotating said carrier and plate; two additional motors mounted on said carrier, on opposite sides of said eccentric and means flexibly connecting said motors and said eccentric.

4. In an apparatus of the class described, in combination, a substantially flat work-engaging plate, a motor operatively connected to the plate for rotating the same about an axis normal thereto, and means for vibrating the plate at high frequency, said means including an eccentric mounted on the plate for rotation about an axis parallel to the plate, and two motors positioned on opposite sides of the eccentric and operatively connected thereto by flexible means, said motors being resiliently supported on the plate for rotation therewith.

5. The combination set forth in claim 4 in which the eccentric comprises a shaft, an eccentric weight thereon, anti-friction bearings supporting the shaft on opposite sides of the eccentric weight, and a housing enclosing the weight and bearings, the shaft extending through an aperture in the housing end.

6. The combination set forth in claim 4 in which the two eccentric driving motors are disposed equidistantly from the axis of the eccentric and on opposite sides thereof, with the axes of the motors in parallelism with the axis of the eccentric and are operatively connected to the eccentric by belts.

7. In a device of the type described, in combination, a motor carrier, three motors mounted thereon the weight of which is symmetrically distributed about the vertical axis of one of the motors, a work plate upon which the carrier is resiliently mounted and with which it is constrained to rotate, an eccentric mounted on the work plate for rotation about an axis which is intersected by the aforesaid motor axis when prolonged, and means operatively connecting the eccentric to two of said motors.

8. In a device of the type described, in combination, a work-engaging disc, an eccentric mounted on said disc for rotation about an axis parallel to the plane of the disc, a motor carrier resiliently mounted on the disc and connected thereto for rotation therewith, said carrier being arched over said eccentric and having motor-supporting portions on opposite sides of said eccentric, a motor mounted on each such carrier portion, a substantially horizontal belt operatively connecting each motor to the eccentric, and means for rotating the disc, motor carrier, and elements supported thereon about a vertical axis passing through the axis of the eccentric.

9. The combination set forth in claim 8, in which said last mentioned means comprises a motor mounted upon the arch of the motor carrier, the rotor being operatively connected to said arch.

10. The combination set forth in claim 8 in which the eccentric comprises an elongated rotatable shaft having fixed on each end an eccentric weight.

RAYMOND E. DAVIS.