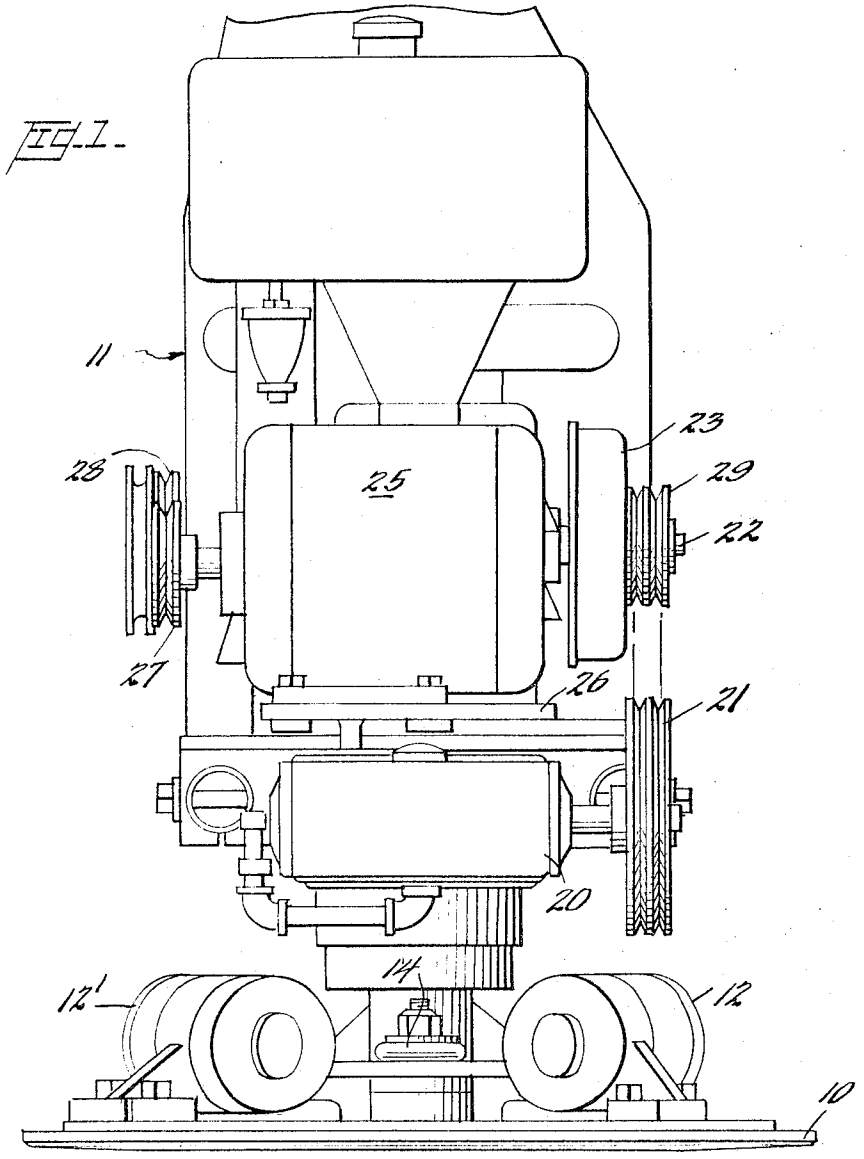
Feb. 6, 1968 R. F. YTTERBERG 3,367,250

CONCRETE SURFACING MACHINE

Filed Jan. 24, 1966 2 Sheets-Sheet 1

FIG. 1



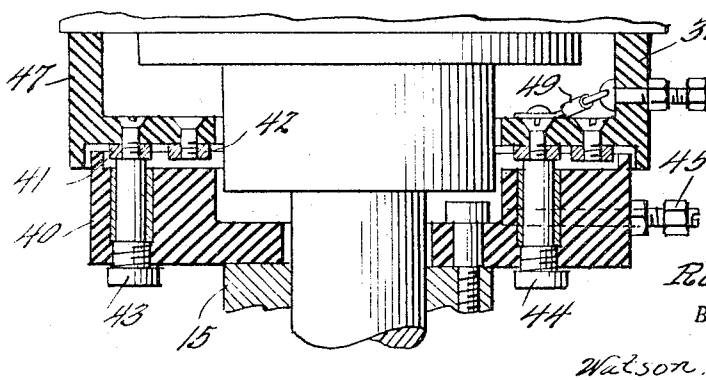




FIG. 3

INVENTOR.
Robert F. Ytterberg
BY
Watson, Cole, Grindle & Watson
ATTORNEYS

Feb. 6, 1968 R. F. YTTERBERG 3,367,250

CONCRETE SURFACING MACHINE

Filed Jan. 24, 1966 2 Sheets-Sheet 2

FIG. 2

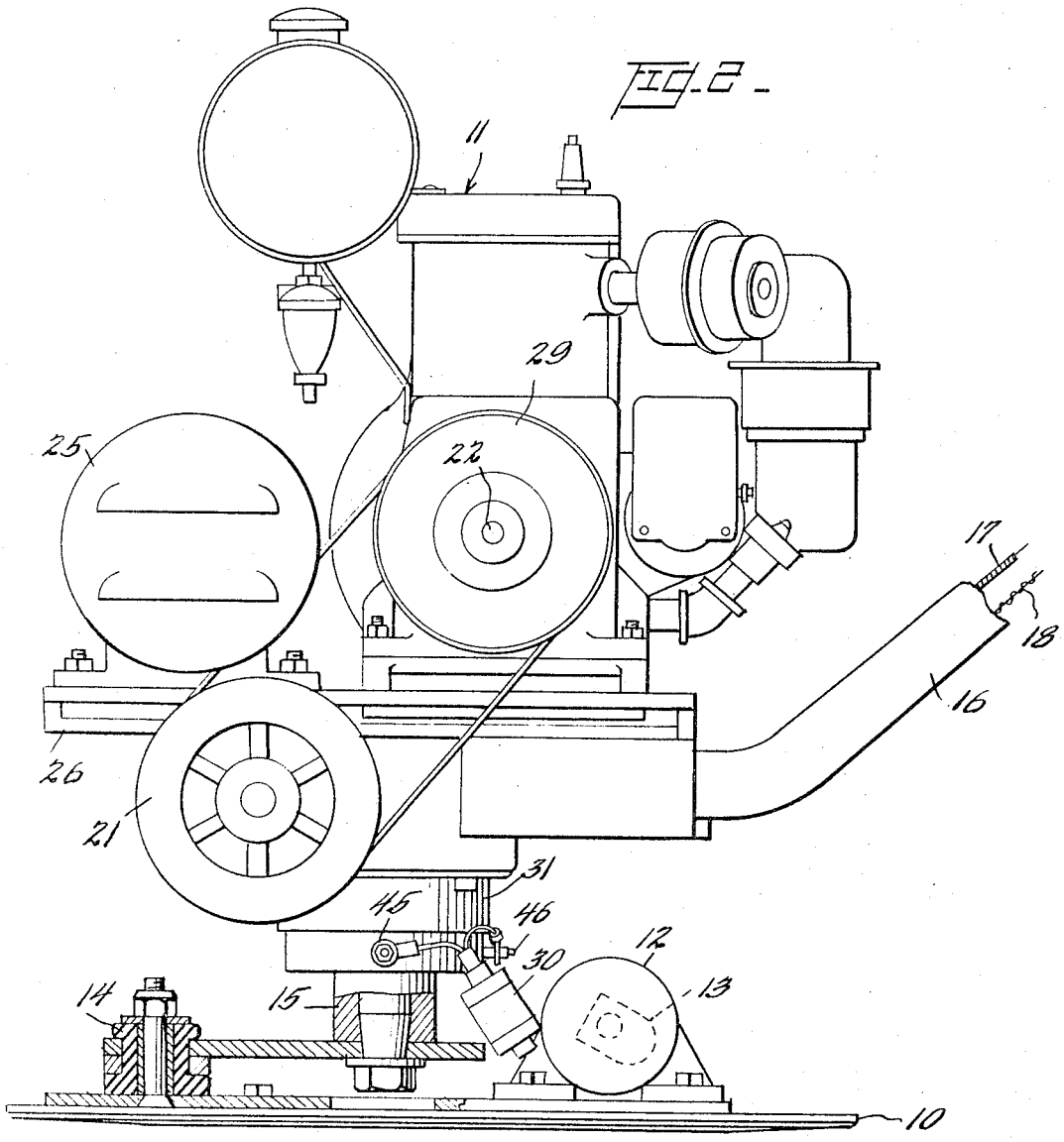
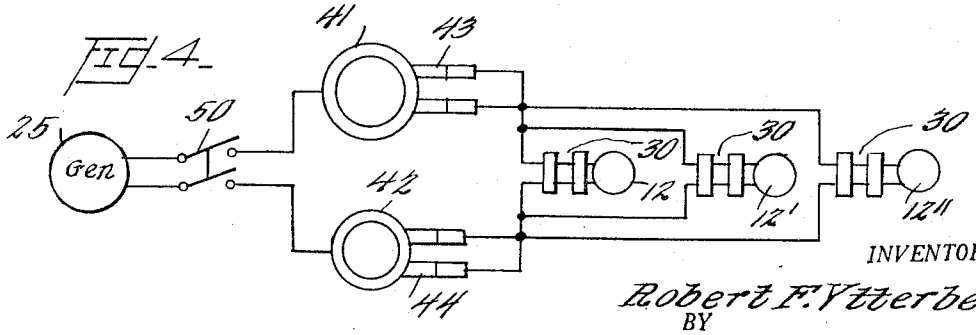



FIG. 4




INVENTOR.

Robert F. Ytterberg,

BY

Watson, Cole, Grindle + Watson

ATTORNEYS

United States Patent Office

3,367,250

Patented Feb. 6, 1968



3,367,250

# CONCRETE SURFACING MACHINE

Robert F. Ytterberg, Rye, N.Y., assignor to Kalman Floor Company, Inc., White Plains, N.Y., a corporation of New York

Filed Jan. 24, 1966, Ser. No. 522,528

7 Claims. (Cl. 94—45)

## ABSTRACT OF THE DISCLOSURE

An improved concrete surfacing apparatus is provided comprising a gasoline operated engine for rotating a trowelling member, an electric generator or alternator driven by the engine to produce a voltage proportional to the speed of the engine, and electrically operated vibrator means mounted on the trowelling member to produce a vibration of the trowelling member having a variable frequency and amplitude of vibration which is proportional to the generator voltage output. The trowelling member is thereby caused to vibrate in synchronism with its adjustable speed of rotation. The trowelling member may consist of a single disc, or a combination of discs, or a plurality of blade elements.

This invention relates to machines for finishing concrete surfaces and, more particularly, it relates to improved machines of the type that have trowelling means for working the concrete surface rotated at relatively low speeds such as 200 r.p.m. and vibrated simultaneously at relatively high speeds such as 3,600 r.p.m.

The art of vibrating trowelling means upon concrete surfacing machines at high speeds for releasing moisture from the concrete is exemplified by U.S. Patents 2,289,247 and 2,289,248 issued July 7, 1942, to Raymond E. Davis. Such machines have been in extensive use and have been developed to include such improvements as rheostatic speed controls on electric vibrators as shown in Davis Patent 2,395,399 issued February 26, 1946, and high speed vibrators actuated from the same prime mover source as the trowel means in Patent 3,066,583 issued to J. J. Moro-Lin on December 4, 1962.

Basically, the operation of all these prior art devices was for the purpose of permitting concrete to be laid down in relatively wet condition unsuitable for producing uniform surfaces of high strength which resulted by extracting as much of the water content as possible from the mixture, then working the dried concrete with the foregoing vibratory type surfacing machines. The same results could not be attained by an initial dry concrete base which would not fill voids or mesh together as well as the processed wet concrete base.

However, non-uniform concrete floor conditions exist which cannot be processed properly with these prior art machine configurations. For example, over a floor surface certain regions will be relatively wet and others quite dry dependent upon the settling out of different aggregate materials and sizes in different spots, which have properties either retaining more or less water. If the water is removed from the concrete base by a vibrator and spongy surface layer prior to use of the surfacing machine, as taught in the Davis Patent 2,289,248, this will leave some regions relatively quite dry with very little water content for the above reason; also, variations in thickness of the concrete base cause variations in drying. Such a variation with some quite wet regions therefore provides a problem in maintaining uniformity in the finished surface with any of the prior art surfacing machines. This comes in part because the high operational speed of the vibration is not sensed readily by a machine operator and even with a variable speed control or rheostat on the vibrator,



it is difficult to determine the correct proportion of trowelling and vibrating speed.

Therefore, it is an object of this invention to provide a concrete surfacing machine that will automatically adjust itself for uniform action in processing relatively wet and dry regions throughout a floor surface.

A general object of the invention is to provide improved floor surfacing machines.

These objects are realized by a new surfacing machine combination in which the elements cooperate in a manner to obtain a different objective than the prior art machines. Thus, the vibrator on a trowelling or surfacing member such as a set of blades or discs rotated from a master drive motor or engine is used in accordance with this invention to even out the variations of concrete wetness over a floor surface. This mode of operation may be contrasted to prior art vibrator operation set at an operation frequency to achieve maximum vibration, or to achieve acceptable average performance throughout the surface for different kinds of concrete or variations in surface thickness, etc.

Furthermore, vibrators in the prior art had a limited range of performance. Consider for example, that with an electric vibrator as provided by Davis Patent 2,395,399 which had a variable control for selecting the effective vibrator power, there is a limited operational range of variable control because the power line voltage (110 volts) can only be reduced, and limitations are imposed on maximum power available.

Thus, the machine configuration of this invention provides for a large control range of vibrator power which is synchronously selected to track with the rotational speed of the trowelling means which, by necessity, the operator adjusts as he encounters relatively dry and wet regions of the surface. This is accomplished with a gasoline engine prime mover for rotating the trowelling means under control of a throttle for speed adjustment, in combination with variable speed voltage responsive trowel vibrator means which is driven from an electric generator coupled with the gasoline engine to give a wide range of voltage variations as the engine speed varies. In this manner as the operator encounters very dry concrete areas in the surface, he must increase the engine speed to attain acceptable trowelling action, and such increased engine speed synchronously increases vibrator power enough to force water to the surface of even very dry zones, thereby producing a concrete surface paste which serves as a lubricant in the trowelling action so that the dry surface zone is processed to produce essentially the same uniform surface treatment as the relatively wet zones where lower trowelling speeds are used to prevent "digging in."

The foregoing and further features and objectives are attained in the machine configuration described in detail in the following specification with reference to the accompanying drawings, wherein:

FIGURE 1 is an elevation view of a floor surfacing machine afforded by this invention;

FIGURE 2 is an elevation view from one side, partly broken away in section of the floor surfacing machine;

FIGURE 3 is an expanded view, partly in section of a slip-ring assembly for conveying electric power between the stationary and rotating portions of the machine; and

FIGURE 4 is a schematic diagram of the electric circuit for supplying vibrator power.

FIGURES 1 and 2 show a floor surfacing machine operable with disc trowelling means **10** rotatable from the gasoline engine prime mover **11** at typical speeds in the order of 50 to 300 r.p.m. This drive speed is attained from an engine speed such as 1,500–4,500 r.p.m. by way of gear box **20** belt driven through pulley **21** from the gasoline engine pulley shaft **22** when the engine speed

exceeds that required by an intermediate speed responsive clutch **23**.

The trowelling means may be in the form of blades if desirable, but it is pertinent that high speed electric vibrating means in the form of one or more variable speed devices **12** (in this case, three) are distributed about the trowelling means **10** to provide substantially uniform vibrations thereover in a frequency range of from 3,600 to 12,000 r.p.m., for example. Each of these shown in this embodiment is a series wound AC–DC universal motor driving an internal eccentric cam member **13**.

In order to keep the high frequency vibrations from the gasoline engine, rubber shock bushings **14** couple the trowelling disc **10** to the rotating shaft **15** driven by the engine **11**.

A handle is extended by dual shafts **16** from the machine for operator manipulation of the machine position. Also, both a control cable **17** for the gasoline engine throttle and a pair of electrical wires **18** for switch control of the vibrator means is extended to the handle for control by the operator.

In accordance with this invention, a variable voltage generator **25** is mounted on the engine block member **26** for belt drive through pulley **27** on the generator from pulley **28** on the engine at the opposite end of shaft **22** from pulley **29**. This generator supplies power to the electric vibrators **12** rather than a remote power source through an intermediate electric power cord as provided in the prior art. This not only makes the machine easily portable without dependence upon accessibility to power lines, but also the operational speed of the vibrators can be made independent of other loading on the power lines or losses in cables as frequently encountered at construction sites.

Power to the vibrators **12** is supplied through a short cable interconnected by plug assembly **30** to a slipring unit **31** as shown in the broken away portion of FIGURE 3. This slipring assembly is required to transmit electric power from the stationary generator **25** to the vibrators **12** which are mounted on the rotating trowelling disc **10**. Essentially, the insulating cap **40** rotates with the trowelling disc to convey current from two slip-rings **41**, **42** by way of brushes **43**, **44** to corresponding terminals **45**, **46**. The stationary insulation shoulder **47** is provided with terminal bolts **48** or leads **49** from each slipring **41**, **42** which in turn are connected by a cable (not shown) to the output terminals of the generator **25**.

As may be seen from the electrical circuit diagram in FIGURE 4, therefore, each of the three vibrators **12**, **12'**, etc., is connected through a plug **30** and slipring **41**, **42** to the handle switch **50** which connects the vibrators to the generator **25** power source.

From the foregoing specific embodiment it may be recognized that the gasoline engine prime mover operates both the vibrators **12** and the trowelling disc **10** in substantial synchronism as the engine speed is controlled by the operator, so that as the trowelling disc varies in speed over the range 50 to 300 r.p.m. for example, the generator supplies a voltage in the order of 30 to 190 volts. This upper limit is in excess of that attainable from a 110-volt constant voltage line and thus the range of energy supplied by the vibrator is greatly enlarged over a corresponding rheostat line control which, furthermore, could not provide the desired automatic following of corresponding trowel and vibrator speeds as the combination herein provided.

In the vibrator **12** it is to be seen that with a series wound AC-DC universal motor the speed varies with voltage. The vibration energy can be stated in impact pounds and as the speed of the motor increases the number of vibrations increases to accordingly increase the impact pounds over a typical relationship such as follows:



| Volts | Frequency | Impact Pounds |
|---|---|---|
| 70 | 5,000 | 95 |
| 95 | 7,000 | 180 |
| 115 | 9,000 | 300 |
| 130 | 11,000 | 450 |

Thus, an alternating or direct current generator with the voltage ranges specified can serve to produce a surfacing machine capable of handling a wide range of dryness variations in a floor surface without special processing or special operator skills.

The same relationship may be attained with an alternator which varies in frequency as well as voltage when the vibrators are of the electromagnetic type (Davis 2,395,399) where both the amplitude and frequency vary with the gasoline engine speed.

Accordingly, the present surfacing machine has advanced the state of the art and therefore those features believed to distinguish the nature of the invention and the scope of the invention are defined with particularity in the appended claims.

What is claimed is:

**1.** A machine for surfacing concrete floors comprising trowelling means resting upon the surface of a freshly deposited concrete floor having different areas therein of relatively dry and wet concrete mix, a variable speed gasoline drive engine rotating said trowelling means at a speed in the order of 50 to 300 r.p.m. controlled by a manually operated throttle on said engine, at least one variable-speed voltage-responsive 110 volt electric motor including eccentric means mounted on said trowelling means for vibrating said trowelling means at a high frequency in the order of above 3,600 r.p.m., a variable voltage generator driven by said gasoline drive engine and responsive to variations in its speed to provide a voltage output range of the order of 30 to 190 volts over the speed range of said gasoline drive engine, and an electrical circuit selectively coupling the generator voltage to said electric motor to vary the electric motor speed as a function of the gasoline motor speed effected by said throttle such that an operator in adjusting the gasoline engine speed at a relatively low speed for wet concrete floor areas automatically selects less vibrator energy to drive out water from the concrete mix than when the motor speed is increased for relatively dry concrete floor areas where greater vibrator energy derived as a result of the greater electric motor speed serves to derive enough water from the dry concrete to produce a moist lubricant concrete paste near the floor surface serving to improve the operational efficiency of the trowelling means.

**2.** In a machine for surfacing fresh concrete floors by rotating trowelling means with a variable speed gasoline engine, a variable speed electric motor positioned on the trowelling means and coupled to eccentric means to vibrate the trowelling means at a high frequency of at least 3,600 r.p.m. dependent upon the voltage to the motor, a variable voltage generator driven by the engine to produce a voltage proportional to the speed of the gasoline engine, and a slipring assembly coupling the generator voltage to the electric motor to establish a vibration frequency proportional to the speed of the trowelling means.

**3.** A machine for surfacing fresh concrete floors comprising in combination, rotary trowel means, a variable speed engine driving the trowel means, an electric generator driven by said engine to produce a voltage proportional to the speed of said engine, an electric vibrator means on said trowel means coupled to be driven by the electric generator to produce a frequency and amplitude of vibration proportional to the generator voltage.

**4.** A machine as defined in claim **3** wherein the elec-

tric generator provides a D-C potential varying with the speed of the engine, and the vibrator means comprise at least one series wound D-C electric motor with an eccentric cam rotated thereby.

5. A machine as defined in claim 3 wherein the electric generator is an alternator and the vibrator means is an electromagnetic device having a vibration frequency dependent upon the frequency of the alternator.

6. A machine according to claim 3 wherein said trowel means comprises at least one disc-shaped element.



7. A machine according to claim 3, wherein said trowel means comprises a plurality of blade-like elements.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 2,386,843 | 10/1945 | Davis | 94—45 |
| 2,395,399 | 10/1945 | Davis | 94—45 |
| 3,066,584 | 12/1962 | Moro-Lin et al. | 95—45 |

JACOB L. NACKENOFF, *Primary Examiner.*