United States Patent

McKie et al.

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[54] **METHOD FOR SURFACING POURED MATERIAL**

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[63] Continuation of Ser. No. 601,935, Dec. 15, 1966, abandoned.

[52] **U.S. Cl.** **264/34,** 52/251, 94/48, 249/18

[51] **Int. Cl.** **E04b 1/16**

[58] **Field of Search** .....94/48; 52/251, 365, 364; 249/13, 18, 19, 26, 28, 30, 34; 25/131.5 A; 264/34

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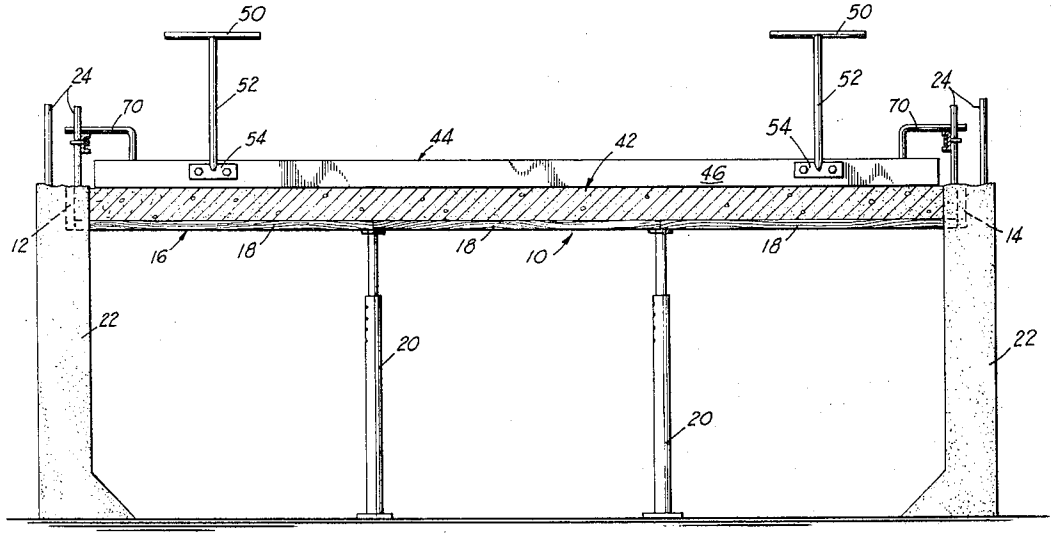
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[57] **ABSTRACT**

A method for surfacing poured concrete material to make a slab with less manual labor and more strength by vibrating a straight edge guided at the proper height and supported on the building structure. The apparatus comprises vibrating straight edge for surfacing low slump concrete mix with less manual effort.

6 Claims, 5 Drawing Figures



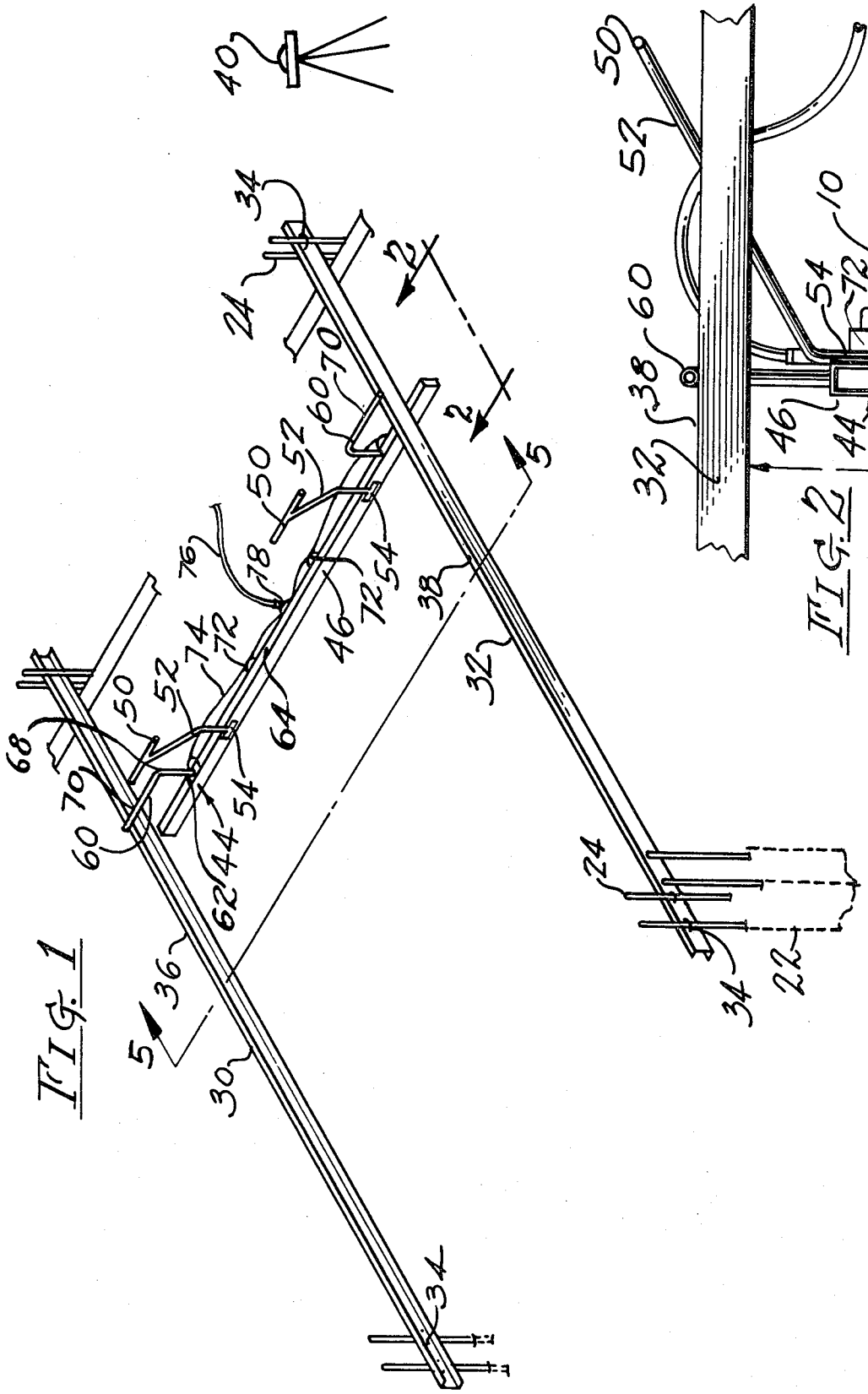

40
34
24
2
2
70
60
52
50
5
76
78
54
72
46
38
32
74
64
68
62
44
36
30
22

FIG. 1

50
52
84
10
54
72
60
38
46
44
32
42

FIG. 2

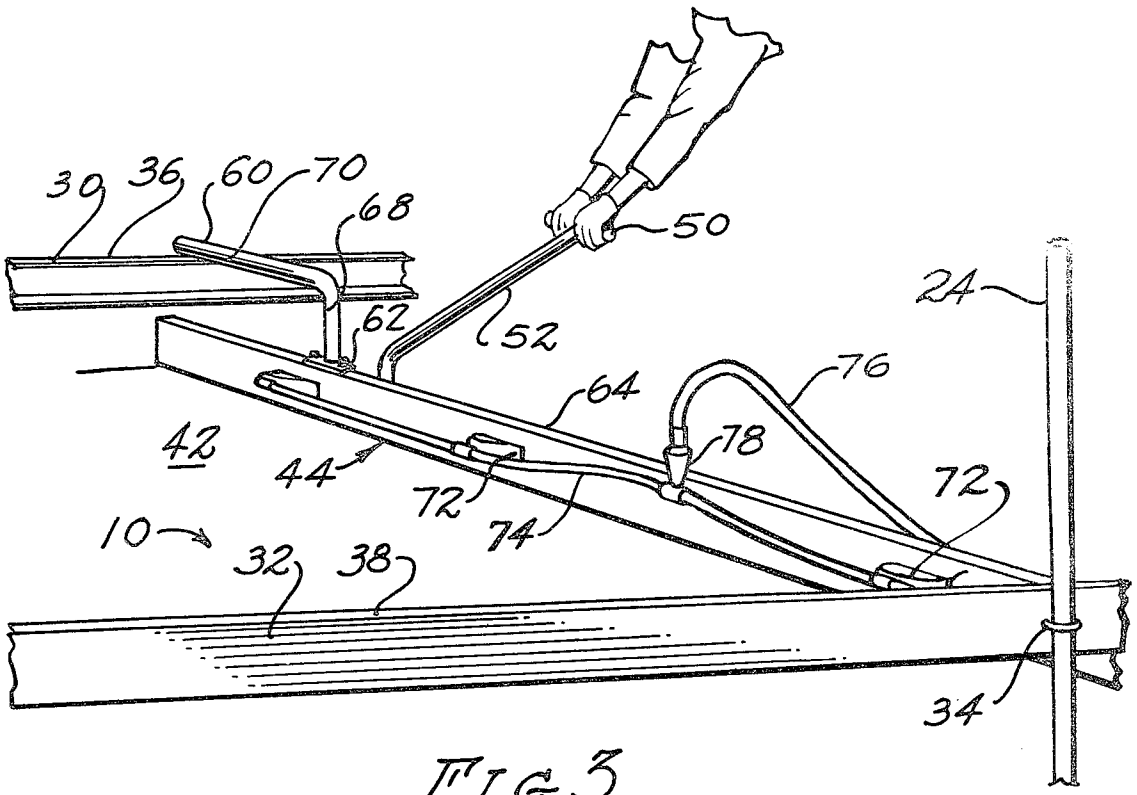

30
36
60
70
68
50
24
62
52
64
76
42
44
78
72
72
74
10
32
38
34

FIG. 3

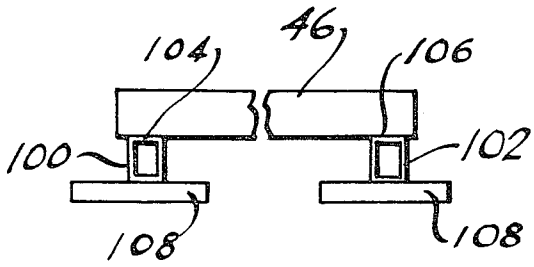

104
46
106
100
102
108
108

FIG. 4

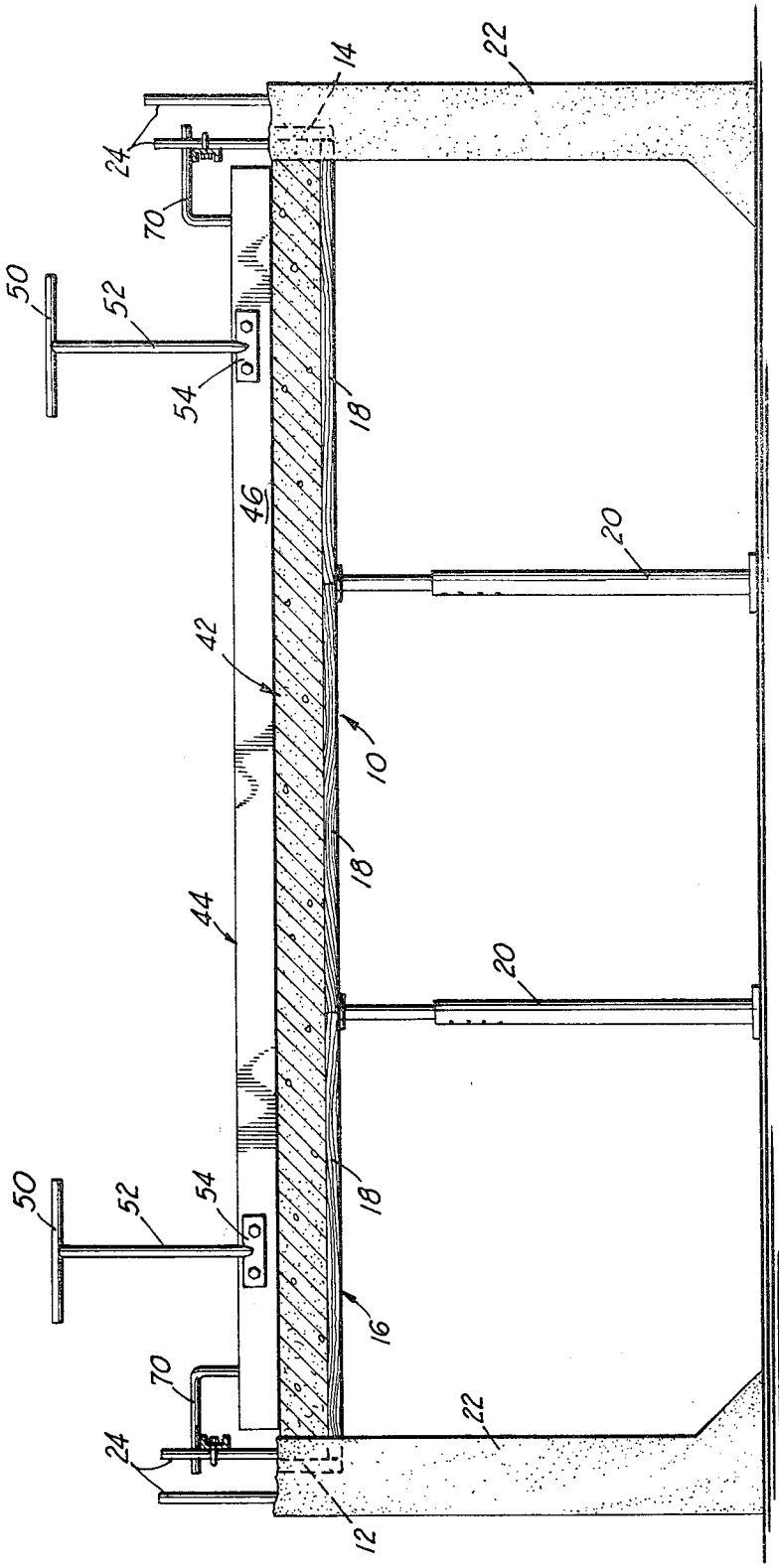


FIG. 5

METHOD FOR SURFACING POURED MATERIAL

This application is a continuation of application Ser. No. 601,935 filed Dec. 15, 1966, and now abandoned.

BACKGROUND OF THE INVENTION

Present day building construction very often uses a poured reinforced concrete and many multi-story buildings use a poured concrete slab for each of the floors. One noticeable problem in the construction of poured concrete slab floors is the handling of the wet concrete mixture to spread it out evenly and rapidly since it is being delivered regularly and also to work the poured concrete until an acceptable surface is achieved, keeping in mind the cost of labor for handling, placing and finishing; the cost in construction expense which results from delays; and the cost for correction of unacceptable portions of the structure. Buildings are built to specifications which relate to the type of concrete mixture to be used a delivered from the concrete plant including the amount of water (slump) in the mixture which ultimately will disappear from evaporation during the setting period. The strength of the concrete in the finished slab is related to the amount of mixing water used and the less water used (assuming sufficient water to produce hydration of the cement) the more strength obtained. In addition, although a wet concrete mixture is easier to handle and requires less physical exertion and labor to manipulate and work, it also has the unwanted water which must be removed during the finishing of the concrete slab that takes place after the slab has been poured and is setting. Expensive machinery exists in the prior art having to do with handling the concrete in a poured slab. However, this machinery not only is expensive but is heavy, difficult to move from floor to floor, difficult to handle, and requires extensive and heavy bracing to work from. It is generally easier and better to work with the older hand methods than attempt to use some of the machinery that is available. The present invention provides an easier method for handling poured products such as concrete and also discloses one form of an apparatus of relatively inexpensive construction which is lightweight and easily manipulated by a minimum number of laborers.

Generally described, without restriction on the scope of my invention as defined in the appended claims, the method may be applied to the pouring of a concrete slab which conventionally involves preparing a form corresponding to the periphery or edge of the slab, and thereby defining the dimensions of the slab as to length and width, and also by the height or depth of the sides of the form defining the thickness, depth or height of the slab to be poured. One typical multi-story installation would use removal and reusable metal forms supported by jacks about which is constructed the sides of the forms which defines the thickness of the slab. According to the present method, there will be supports adjacent the poured slab to which members may be attached and leveled by means of engineer's level or other conventional method. Typically in a multi-story construction there would be columns and reinforcing rods vertically arranged adjacent to the poured area. However, if these do not exit then it will suffice to construct such supports or to drive metal reinforcing rods in the ground or otherwise create a support surface. Ready-mixed concrete with a minimum amount of water may be used by the present method. As the concrete is poured into the form an elongated, substantially straight member is applied to the poured concrete and pulled thereacross and simultaneously therewith the elongated member is vibrated by any suitable means of vibration, while supporting the edge on opposed, straight and leveled support surfaces, whereby the surface of the slab is worked to a substantially level, even and flat surface.

One apparatus which may be used to practice the present method comprises a pair of elongated support members, such as aluminum channels, which are supported on rigid surfaces and leveled by means of an engineer's level so that the upper edges of the elongated members are accurately horizontal. An elongated, straight edge vibrating member is positioned transversely of the two opposed supporting members and the surfaces and said vibrating member has rear adjacent, opposite ends detachable support guide members resting on the edge and running along the elongated opposed members. Handles provided at spaced intervals on the elongated, transverse member to be grasped respectively by a laborer for manipulating the vibrating member. The elongated member is vibrated continuously and constantly during use by means of vibrators which in one form are conventional pneumatic vibrators attached at intervals to the elongated, transverse member and inner-connected with an air line and connected to a suitable force of compressed air such as a portable air compressor. In the use of the present apparatus, the slab area is prepared and provided with the usual concrete form. Then the two, opposed channels are attached, for example, to respective vertical reinforcing rods by means of clamps, and the edges of the two opposed members are leveled by an engineer's level, which is a common procedure in the construction industry during the construction of a building. Following the usual procedure of pouring concrete, the concrete mix is delivered by concrete buggies or otherwise and dumped into the form area and the present apparatus may be pulled manually at each handle to vibrate the concrete into substantially level position in the form. Then after the concrete reaches substantial position, the support members on the elongated, transverse member are resting on the horizontal edge of the respective channels and the concrete is worked back and forth with the elongated vibrating member until the surface is correct. This is done from one end of the slab to the other working the poured concrete until the surface is completed and ready for the finisher. As mentioned previously, the present apparatus makes it possible to use concrete mix of far less water than normally worked by hand because the stiffer mixtures are too hard to handle by hand but are handled satisfactorily by the present apparatus.

A primary object of this invention is to provide a method for surfacing poured material.

A further object of this invention is to provide a method of surfacing poured material by vibrating the poured material along a line as for example through the use of a straight edge operating on opposed horizontal surfaces.

Still another object of this invention is to provide a method for surfacing poured concrete comprising constructing opposed horizontal support surfaces and

thereafter vibrating the straight edge supported for horizontal movement along said edges.

Another object of this invention relies in a particular form of apparatus which is operated to vibrate poured concrete and to work stiffer mixtures done ordinarily by hand in order to create a poured slab with less water and a more accurate surface.

An additional object of this invention is found in the inexpensive construction and arrangement of an apparatus for handling poured material.

Also an object of this invention is to control the surfacing of a concrete slab while the concrete mix is wet to accurately control the surface thereof with a level straight edge supported horizontally.

Other and further objects and advantages of my invention will become apparent upon reading the following specifications taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of a typical apparatus set-up on a conventional slab form for practicing the present method and showing one form of the present apparatus.

FIG. 2 is an elevation view taken substantially along lines 2—2 in FIG. 1.

FIG. 3 is an enlarged perspective view of one end of the vibrating straight edge apparatus of the present invention which is also shown in FIG. 1.

FIG. 4 is a diagrammatic view of an alternative form of the support for the straight edge.

FIG. 5 is an enlarged vertical sectional view taken along line 5—5 of FIG. 1, with certain parts being added thereto for purpose of clarity.

Referring initially to FIG. 1, it is to be understood as mentioned previously that the present method and the present form of the apparatus may be used on virtually any type of construction where a slab is being poured irrespective of the particular architectural design of the structure. It is only generally required, as normally and customarily found in the pouring of any slab, that there be a support form, or an area directly on the ground, on which the concrete may be poured and evened to construct a slab. The present disclosure uses for illustration the type of construction normally found in multi-story buildings of the sort for office buildings and apartment houses where the design is reinforced concrete using concrete columns reinforced with steel rods and using poured slab floors from one level to the next. Therefore, while the drawing in FIG. 1 shows an upper level of a multi-story building, it is to be understood that the slab could be poured directly on the ground as in the case of some commercial and residential buildings and the form could be constructed accordingly. In the disclosure in FIG. 1, a typical concrete from designated generally by reference numeral 10, is constructed from steel side rails 12, 14 supported on a deck or flooring 16 which may be made in conventional manner from a series of removable level forms or boxes 18 supported from beneath by screw jacks 20 resting on the ground or on the level below. Typically, reinforced concrete columns 22 extend vertically from the ground or from the floor below and the steel reinforcing rods 24 are exposed and extend from the poured columns 22. According to conventional construction technique, the subsequent columns 22 are tied into the previous columns 22 through the rods 24 and pouring thereabout for the next level. According to the present invention, it is sufficient that there be some sort of form or support provided for the slab which is essential on any construction project using poured slabs and that there be some type of fixed and rigid, and spaced position such as reinforcing rods 24 of columns 20 to which the present invention may be attached.

A pair of aluminum channels 30, 32 of identical construction are mounted and attached in place by U-bolt clamps 34 and spaced, opposed relationship as shown in FIG. 1 to respective reinforcing rods 24. Each channel 30, 32 as designated herein, has an upper, support horizontal surface 36, 38 which is leveled accurately horizontally by means of an engineers level shown diagrammatically and represented generally by reference numeral 40 which is sighted by an engineer, or someone else, to accurately establish a horizontal positioning of members 30, 32 and the surfaces 36, 38. As mentioned later on, the location distance-wise of the top edges 36, 38 of the respective channels 30, 32 is determined according to the thickness of a slab designated generally by reference numeral 42 herein and according to the lower edge of the vibrating edge to be described now.

An elongated, vibrating edge means is designated generally by reference numeral 44 and comprises an aluminum box-channel 46 of a length selected to accommodate the maximum width of a slab 42 to be poured. While the box-channel 46 may be an aluminum channel as mentioned, it could also be stainless steel or any other material. However, aluminum and magnesium are lightweight and therefore easier to handle than steel. The member 46 is provided at spaced locations with handles 50, there being two in the present invention, which are attached in place respectively by means of pipe tongues 52 bolted by brackets 54 to one side of the member 46. As will appear hereinafter, workmen or laborers grab and hold on to a respective handle 50 for manipulating and moving the member 46. Support members 60 are attached on the member 46 and as the surface of the slab 42 becomes finally defined, the supports 60 are supported on and travel across the horizontal surfaces 36, 38 of the respective members 30, 32. Each support 60 in the present invention is a bent steel pipe that has one end bolted by means of a flanged attachment bracket 62 to the upper edge 64 of the member 46. There is one support 60 adjacent each end of the member 46 and each member 60 comprises a substantially vertical portion 68 and a horizontal portion 70 which rests on the upper edge 36, 38 of the respective members 30, 32. While the ultimate purpose of the supports 60 are to support the straight edge of member 46 on the already accurately leveled and horizontal edges 36, 38, it should be understood the laborers or workmen will be pulling the bottom straight edge of member 46 above the ultimate surface of the slab 42 and the support 60 will not always rest accurately on the edges 38, 36 until the surface of the slab has reached its approximate final level. Initially, blobs and piles of concrete mixture will be filling in spaces ultimately occupied by slab 42 and the workmen pull the handles 50 to work these piles of concrete into the level slab area finally occupied by the slab 42. This is one of the advantages of the present apparatus since it can be used with low slump (hard to work) concrete mix in the

initial stages of pouring the concrete to spread out the concrete piles usually caused by intermittent loading of the area until the entire area has received the amount of concrete that is necessary. Customarily in pouring concrete slabs, the member **46** is generally worked from one end by the slab **42** to the other end and once the surface is substantially surfaced it is left until it has dried sufficiently for the finisher.

Member **46**, as mentioned previously, is a vibrating member with a vibrating bottom edge. Vibration along the length of member **46** is accomplished in the present embodiment by means of pneumatic vibrators **72** bolted at spaced locations longitudinally of the member **46**. Vibrators **72** are common articles of commerce and one suitable and typical vibrator called the "Martin" vibrator. Each vibrator **72** is operated pneumatically by compressed air from a compressed air line **74** leading to all of the respective vibrators **72** and in turn line **74** is supplied from a main compressed air line **76** detachably attached at a coupling **78** on the member **46**. Compressed air line **76** is a conventional rubber-hose air line leading from a typical construction air compressor (not shown) which is usually a power-driven air compressor operated from a gas or diesel engine and mounted on wheels to be located wherever desired. Vibrator **72** operates continuously, that is, as long as compressed air is directed to the vibrator **72** the vibration continues and the air is dissipated from a vibrator device **72** itself. According to this construction, the entire member **46** vibrates constantly and the vibration is determined to some extent by the number of vibrators **72** and the distance between them along the length of member **46** as well as the characteristics of the individual vibrator as to force, speed, etc. The vibration should be sufficient to work the concrete mixture but not so great as to cause any significant physical discomfort to the laborers or operators that are holding handle **50**. The distance from the supports **60** (as for example will appear in FIG. **2**) to the bottom straight edge of member **46** will determine the thickness of the slab **42** above the initial floor, such as the plywood deck **84**, and this thickness may be varied according to the original positioning of the members **30**, **32** with respect to the distance from the plywood deck or floor **84** to the upper edges **36**, **38**. Therefore, the thickness of the slab **42** may be selected initially and the members **30**, **32** secured in place and positioned at a level determining the thickness of slab **42**.

It is significant to note the freedom of movement of the member **46** which is readily manipulated by the operators on the handles **50**. There is substantially unrestricted forward, rearward lateral and arcuate movement which is useful initially in bringing the piles of concrete to substantially the final level of the slab **42**. The surface of the slab **42** will be level and within the limits of the specification regardless of the initial slope of the plywood deck **84** since the members **30**, **32** and the respective edges **36**, **38** and in conjunction with the supports **60**, determine the ultimate level of the surface of the slab **42**. This should be contrasted with any procedure which uses the base or deck, such as plywood **84**, as the reference point for the determination of the level of the surface of the slab.

FIG. **4** illustrates how the present method may be practiced without attaching channels **30**, **32** on rods **24**, as, for example, when practicing the method on the ground. Supports **100**, **102**, which may be elongated beams or channel members, have surfaces **104**,**106**, and are leveled at the proper height by an engineer's level, and are fastened in place as by clamping or otherwise securing same to temporary supports **108** on the ground. The vibrating edge means channel **46** is used on the upper surfaces of supports **100**, **102** in the same manner as with supports **30**, **32**.

While I have described and illustrated a particular procedure to perform the method of my invention and I have also shown and described an apparatus or system which may be constructed as one means for practicing the present method and an alternative arrangement, this is by way of illustration only and does not constitute any sort of limitation on the scope of my invention since various alterations, changes, deviations, substitutions, additions, modifications and departures may be made from the method and the apparatus shown herein without avoiding the scope of the invention as defined in the appended claims.

What is claimed is:

1. In a method for constructing a slab of synthetic material, such as concrete, at a predetermined elevation vertically spaced above a supporting surface, including the steps of:

a. providing a plurality of laterally spaced support columns extending vertically upward from said supporting surface;

b. supporting a material retaining floor form means between said vertically extending support columns adjacent said predetermined elevation above said supporting surface and below the ends of said columns;

c. clamping laterally spaced guide rails onto said vertically extending support columns in substantially parallel relationship and at a predetermined vertically spaced elevation above said floor form means and independent of said form supporting means;

d. pouring onto said floor form means an amount of workable synthetic material sufficient to construct said slab;

e. supporting a straight edge means from said guide rails at a position over and adjacent said poured material; and,

f. manipulating said straight edge means along said guide rails into contact with and against said poured material a sufficient amount to work the top surface of said poured material to a predetermined elevation.

2. In a method for constructing a slab of synthetic material as described in claim **1** further including the step of, power vibrating said straight edge means while working the top surface of said poured material to said predetermined elevation.

3. In a method for constructing a slab of synthetic material as described in claim **1** further including the step of, adjusting the elevation of said spaced guide rails independent of said form support means.

4. In a method for constructing a series of vertically spaced slabs of synthetic material, such as concrete, with each of said slabs being located at a predetermined elevation above a supporting surface, including the steps of:

a. providing a plurality of laterally spaced support columns extending vertically upward from said supporting surface;

b. supporting a material retaining floor form means between said vertically extending support columns adjacent a first predetermined elevation above said supporting surface and below the ends of said columns;

c. clamping laterally spaced guide rails onto said vertically extending support columns in substantially parallel relationship and at a predetermined vertically spaced distance above said floor form means and independent of said form supporting means;

d. pouring onto said floor form means an amount of workable synthetic material sufficient to construct said slab;

e. supporting a straight edge means from said guide rails at a position over and adjacent said poured material;

f. manipulating said straight edge means along said guide rails into contact with and against said poured material a sufficient amount to work the top surface of said poured material to a first predetermined elevation;

g. extending said laterally spaced vertical support columns above said first predetermined elevation to a second predetermined elevation;

h. supporting a material retaining floor form means between said extended vertical support columns adjacent said second predetermined elevation;

i. repeating steps (c–f) until a second slab is constructed at said second predetermined elevation; and,

j. repeating steps (g–i) until the desired number of vertically spaced slabs are constructed.

5. In a method for constructing a series of slabs of synthetic material as described in claim **4** further including the step of power vibrating said straight edge means while working the top surface of said poured material to said series of predetermined elevations.

6. In a method for constructing a series of slabs of synthetic material as described in claim **4** further including the step of, adjusting the elevation of said guide rails independent of said form support means at each of said predetermined elevations.

* * * * *