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Matson

[11] **3,817,644**

[45] **June 18, 1974**

[54] **MACHINE FOR VIBRATING, LEVELING AND SCREEDING CONCRETE IN A FORM**

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[52] **U.S. Cl.** **404/114,** 404/120

[51] **Int. Cl.** **E01c 19/48**

[58] **Field of Search** 404/114, 119, 118, 120; 164/260; 425/424, 456

[56] **References Cited**

UNITED STATES PATENTS

2,054,263	9/1936	McCrery	404/119
2,219,247	10/1940	Jackson	404/114
2,430,816	11/1947	Jackson	404/114
2,636,719	4/1953	O'Connor	425/456
3,015,260	1/1962	Pelsue	404/101
3,051,062	8/1962	Apel et al.	404/119
3,113,494	12/1963	Barnes	404/114
3,147,678	9/1964	Lewis	404/120
3,220,322	11/1965	Lewis	404/114
3,247,770	4/1966	Perkins et al.	404/114

FOREIGN PATENTS OR APPLICATIONS

615,597	2/1961	Canada	404/119
868,510	5/1961	Great Britain	404/119
897,917	5/1962	Great Britain	404/119
888,823	9/1953	Germany	425/424

Primary Examiner—Marion Parsons, Jr.

[57] **ABSTRACT**

A self-propelled, automated machine for operating over a form to which concrete is introduced, the main functions of the machine being to level, vibrate and screed the concrete to provide a concrete slab without voids, and especially a slab in which both upper and lower surfaces, as well as opposite side edges and other sectional configurations are finished.

7 Claims, 10 Drawing Figures

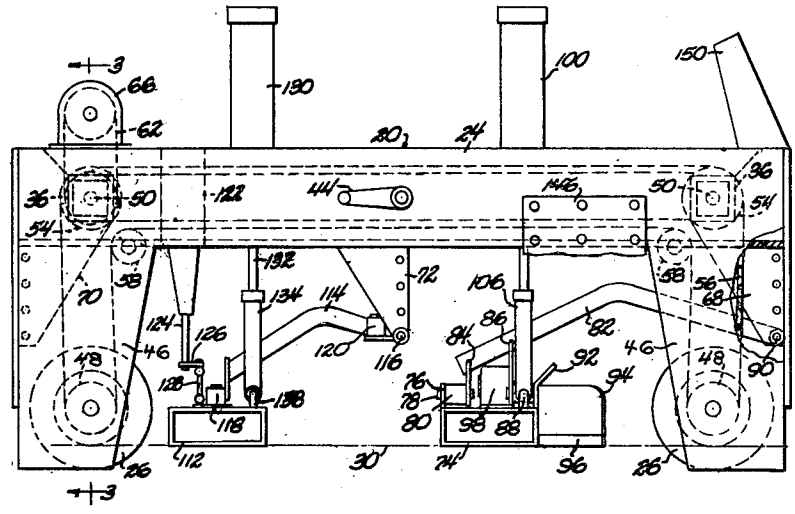


FIG. 1

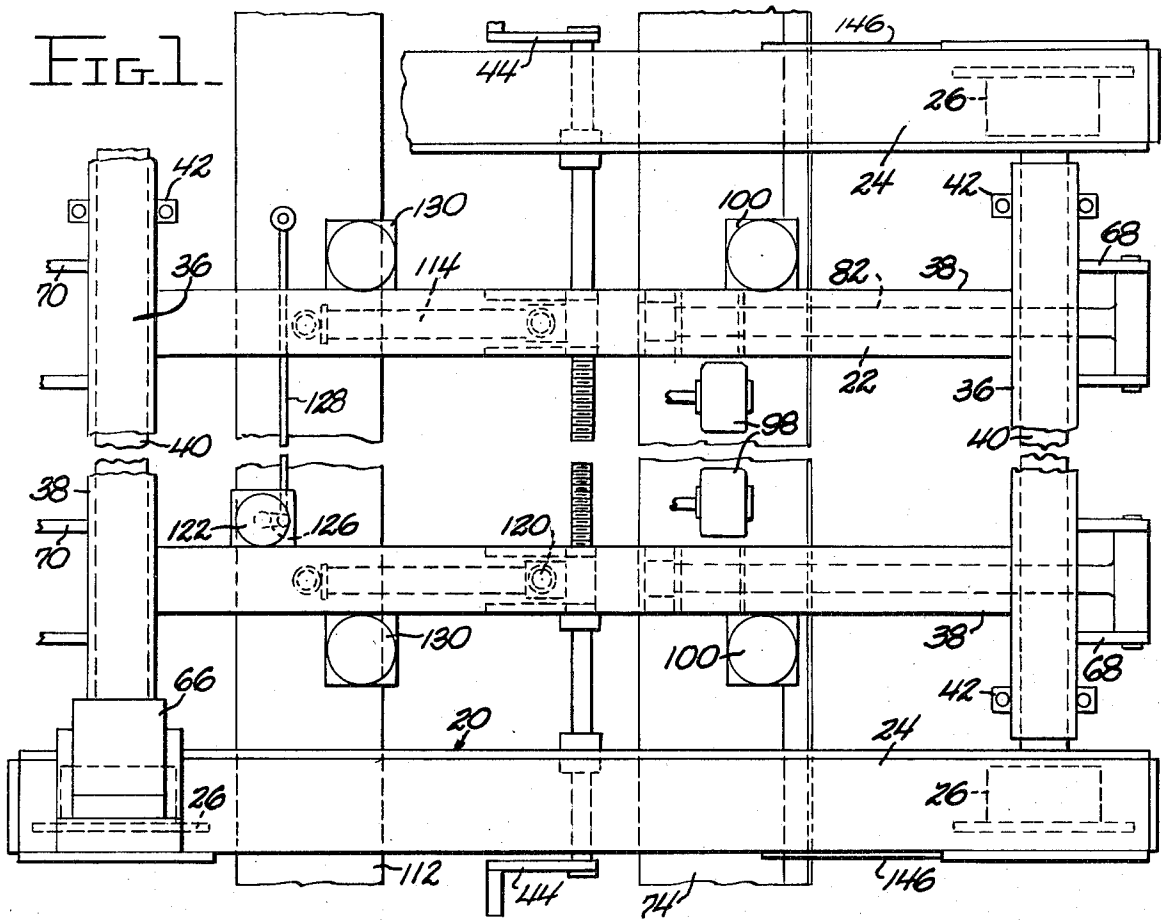

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FIG. 2

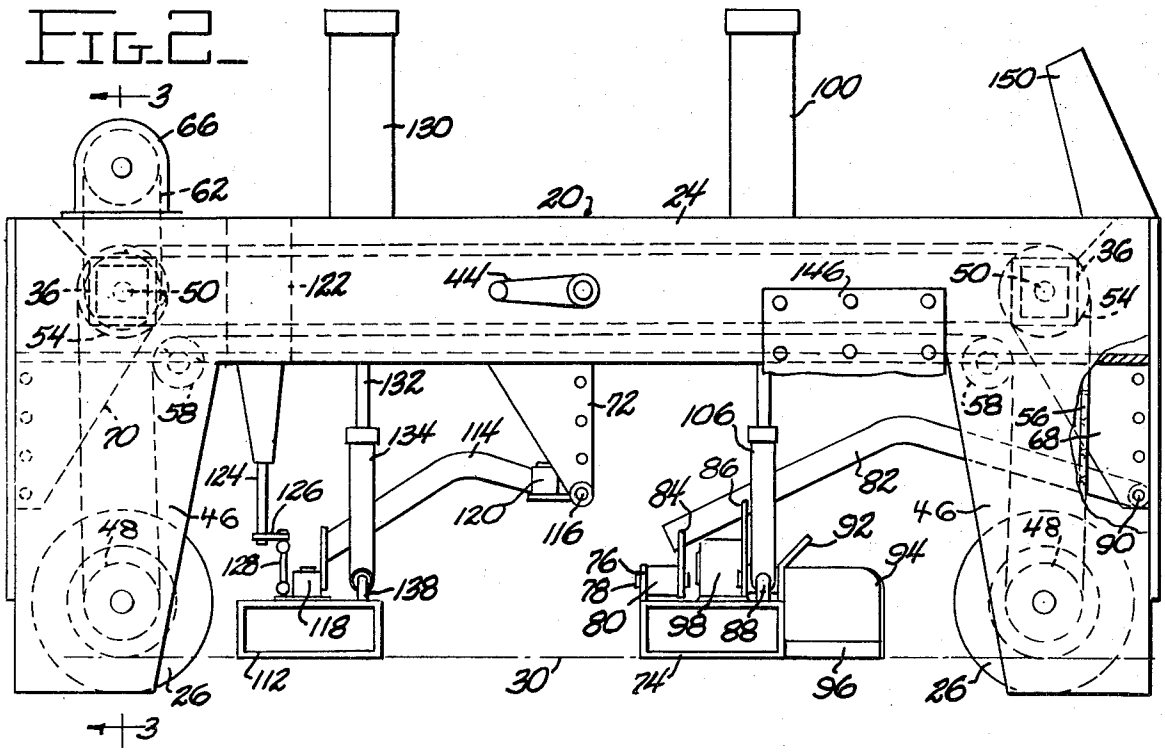

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FIG. 3

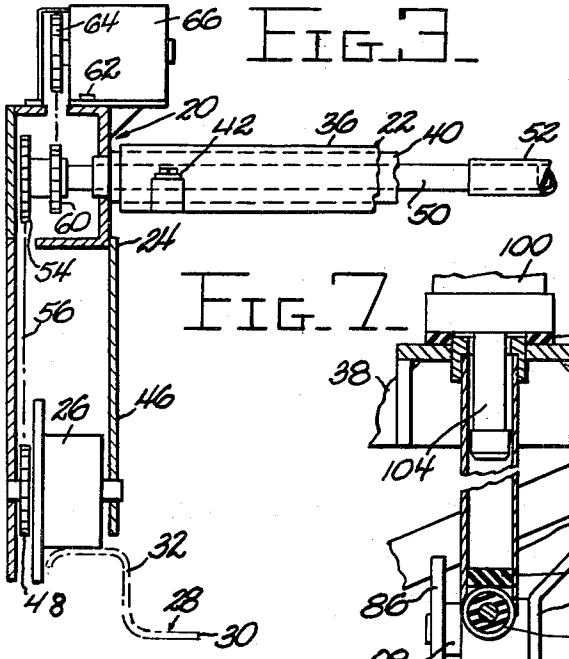


FIG. 4

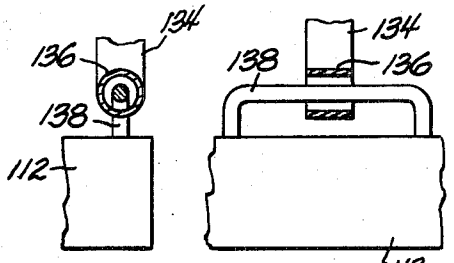


FIG. 5

FIG. 7

FIG. 6

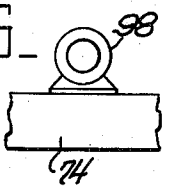


FIG. 9

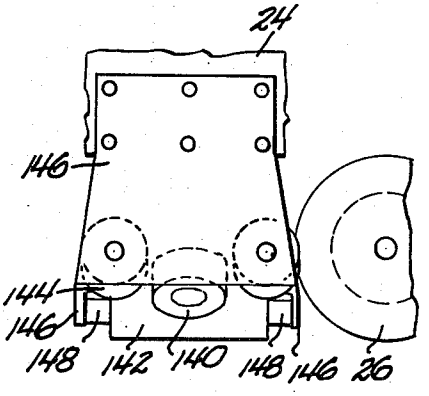


FIG. 8

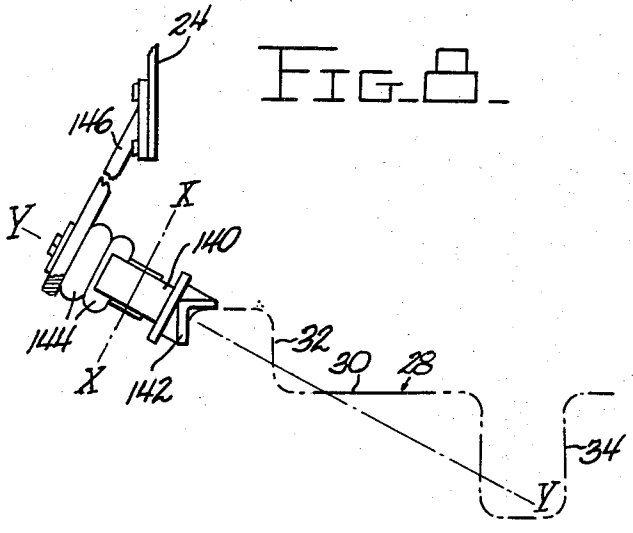
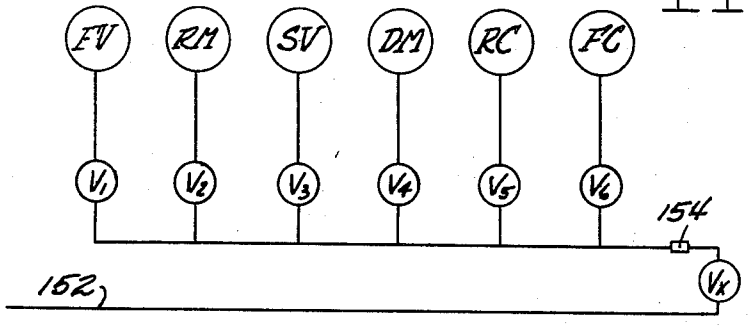


FIG. 10



MACHINE FOR VIBRATING, LEVELING AND SCREEDING CONCRETE IN A FORM

BACKGROUND OF THE INVENTION

Basically, the art of casting concrete in roadways and the like is quite old and well known and has been developed to an acceptable state because the finished product must exhibit only a top surface, and perhaps upper portions of side edges, that are acceptable from the standpoints of appearance and structural soundness. This is mainly the result of pouring the concrete in a form in which the sides are of some suitable structure, such as steel, and the bottom of the form is simply the pre-excavated part of the earth, sometimes supplemented by any of the well-known aggregates. Consequently the bottom is never seen and no one ever knows what it looks like or whether it is properly settled and formed until such time as the roadway is broken up to be repaired or replaced, at which time, appearance, etc. is obviously of no consequence.

With the advent of pre-casting concrete slabs, walls, etc., the typical roadway-building methods have been carried over, but these have proved to be inadequate because prior experience has failed to develop a technique for perfecting an overall result that is satisfactory in appearance, durability, etc., primarily since, in the production of such slabs, walls, etc., the form must include a bottom integrated with the form sides, and the end product must exhibit acceptable characteristics from the bottom and sides as well as from the top. The problem is even more accentuated where the bottom of the form is configured to develop ribs, projections, etc., all of which must usually involve reenforcement in the form of rods, wires, mesh and the like.

The roadway techniques have demonstrated a markedly inferior product, because little attention has been paid to the bottom, and customary vibration methods fail to take into account the need for settling the concrete relative to reenforcing elements. For example, it is not unusual in a roadway system to employ manually controlled vibrators known as "stingers," an elongated "probe" that is thrust into the mass of concrete and vibrated in areas judged by the operator to be critical, but experience shows that the operator will, in his zeal to avoid entanglement between the stinger and reenforcing rods etc., consciously or otherwise avoid these areas, leaving critical areas replete with voids, unbonded aggregate etc. This of course is totally unacceptable in the pre-casting of slabs, walls and like structures.

SUMMARY OF THE INVENTION

According to the present invention, and when especially adapted to pre-casting systems other than roadways, a prefabricated form having integral sides and a bottom is filled, leveled, vibrated and screeded by a self-propelled machine having the requisite elements to produce an end product that meets the most stringent requirements. Fundamentally, a main frame is carried by flanged wheels that ride and follow the form sides. The frame carries a front or leveling screed, ahead of which concrete is introduced. This screed is vibrated to assure proper settling of the concrete and further has a blade to push surplus concrete ahead. Each end of this screed is provided with a "batwing" for urging laterally surplus concrete inwardly and ahead of the blade. A rear screed follows the front screed and is reciprocated or otherwise moved in a plane parallel to or coincident with the desired finished surface and this screed assures the proper finish. Additionally, the form is vibrated by means acting on the form and not in the concrete itself, which eliminates guesswork peculiar to the usual stinger.

The screeds are trailed by drawbars designed to develop the proper lines of "draft" forces, and the screeds are arranged for free vertical "floating" over the concrete. In a preferred embodiment, the screeds are raised and lowered by two-way force-exerting means by which downward as well as upward forces may be exerted, the downward forces being availed of to elevate the main frame for various purposes, especially during lateral adjustment of the flanged wheels to adapt the machine to forms of different widths.

Further features in the improved design reside in rubber or equivalent mountings to isolate vibrational forces from possibly adversely affected parts, a central control console enabling the operator to easily manipulate the machine and its components, flexibility of use and operation, reversibility of the drive means, drive to all wheels, telescopic shafting to accommodate lateral adjustment of the frame elements when different form widths are encountered, the ability of the machine to pass over joints, irregularities etc. with ease, and other characteristics that will be described in or apparent from the ensuing description of a preferred embodiment.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a plan view, with intermediate portions omitted to conserve space.

FIG. **2** is a side elevation, with portions broken away and other parts shown in section.

FIG. **3** is a fragmentary section on the line **3—3** of FIG. **2.**

FIG. **4** is a fragmentary view, on an enlarged scale, showing the manner of connecting the rear screed to one of its lift devices.

FIG. **5** is a rear view of the structure shown in FIG. **4.**

FIG. **6** is a fragmentary rear view showing a vibrator mounted on the front screed.

FIG. **7** is an enlarged sectional view showing a raise and lower cylinder mounting.

FIG. **8** is an enlarged front view with intermediate portions omitted, showing the mounting on the main frame of a form-vibrating device.

FIG. **9** is a side view of the structure shown in FIG. **8.**

FIG. **10** is a schematic illustrating a representative control system.

DESCRIPTION OF A PREFERRED EMBODIMENT

The machine has a main frame **20** made up of a central structure **22** and opposite, parallel fore-and-aft side elements **24** carried on track guides, here in the form of four flanged wheels **26,** the left rear one of which is omitted from the drawing. The wheels carry the frame **20** for advance and reverse travel over a form **28** (FIGS. **3** and **8**) constructed of steel and having a bottom **30** and opposite parallel sides **32** which provide tracks for the wheels. The flanges of the wheels lie respectively outside the tracks or sides **32.** In practice the

form 28 may come in various widths, the most common being 8' and 10', and differs from the typical roadway in that the roadway has no specially constructed bottom except the earth upon which the finished roadway rests. In the present case, it is not uncommon to provide the bottom with elongated, upwardly opening channels 34 (FIG. 8), and there may be several of these running parallel to the sides 32 so that the finished product has ribs or "stems."

The central structure comprises front and rear tubular cross members 36 rigidly interconnected by a pair of fore-and-aft members 38, and each side element 24 has rigidly united therewith front and rear inwardly extending transverse members or elements 40 that telescopically fit the respective cross members 36 so that the side elements may be adjusted inwardly or outwardly relative to the central structure 22 to accommodate forms of different widths. Suitable clamps or locking means are provided at 42 to maintain the selected adjusted positions. Screw-threaded cranks 44 are provided as means for adjusting the width or "tread" of the frame 20.

As best seen in FIG. 3, each side element 24 has depending box-like legs 46 within the lower ends of which the associated flanged wheel 26 is journaled, and each wheel has a sprocket 48 fast therewith. The cross members 40, like the cross members 36, are tubular and coaxially contain cross shafting 50, interior portions of which are telescopic as shown at 52 in FIG. 3 to accommodate transverse adjustment of the frame 20. Each outer end portion of the shafting has keyed thereto a sprocket 54, and at each side of the machine an endless chain 56 is trained about the sprockets 48 and 54 as well as about a pair of idlers 58. The right hand end of the rear shaft 50 has a second sprocket 60 keyed thereto and this sprocket is driven by a chain 62 from a sprocket 64 on a shaft driven by a reversible motor 66 mounted on the frame side element 24. The chains and sprockets and motor thus provide drive means for advancing and reversing the frame in its travel over the form 28. The motor 66 is preferably air-driven; although, this does not limit the invention.

Rigidly connected to and depending from the central structure 22 are front, rear and intermediate hitch elements 68, 70 and 72, FIG. 1, showing that there are a pair of each. Each element has a plurality of vertically spaced apart holes to provide different points of attachment for mechanisms drawn by the frame, and the elements are substantially symmetrically arranged so that trailing mechanisms may be selectively connected thereto according to the direction of travel of the frame as driven by the motor 66.

In the present case, and considering that forward travel of the frame is from left to right as seen in FIGS. 1, 2 and 9, the mechanism or device trailed from the front hitch 68 is a front screed 74 having transversely spaced apart connection points 76 including both a fore-and-aft pivot 78 and a rubber or equivalent bushing or mount 80 to which a pair of drawbars 82 are connected by a depending plate 84 and a second or forward depending plate 86 having a pivotal and rubber-bushed connection 88 to the screed just ahead of the mount 80. The front end of each drawbar 82 is pivotally connected at 90 to the associated front hitch element 68 at a selected one of the adjusting holes, preferably such that the line of draft force is downwardly and rearwardly inclined. This, combined with other details to presently appear, assures that the screed has the proper "float" and can pass over joints, etc. in the form tracks 30.

The screed 74 is preferably of rectangular box section and carries ahead of it a blade much like a "dozer" blade 92 for leveling concrete introduced to the form ahead of the screed. Each outer end of the blade has an angled "batwing" 94 to sweep excess concrete back into the form, and each batwing has a lower resilient strip 96 enabling the batwing to ride over joints etc. in the track 30. For the purpose of settling the concrete in the form ahead of the screed 74, a pair of vibrators 98 are mounted on the screed and the rubber mountings 80 and 88 serve to isolate the vibrations from the main frame 20. The vibrators may be of any suitable type; e.g., as seen in the U.S. Pat. No. to Peterson 2,917,290, which like the motor 66, is preferably air-driven.

The screed 74 may be raised and lowered by means including a pair of fluid motors 100, again preferably airpowered. Each motor is mounted on the central structure 22 by means including rubber mounts 102 (FIG. 7), and the exterior end of the motor piston rod 104 telescopically fits within a sleeve 106 having a rubber-bushed connection 108 to the screed 74 and further having a rubber or equivalent stop 110 at its bottom end against which the end of the piston rod may abut when down pressure is applied by the cylinder. Normally, the piston rod is extended to a position in which its head is spaced between the stop 110 and the bottom of the cylinder so that the screed has a limited amount of vertical "float." At times, as when adjusting the width of the frame 20—or the tread of the wheels 26—it may be desirable to elevate the frame to clear the wheels from the track. This may be done by raising the screed 74 and inserting blocks, say 6 inches –10 inches high, beneath the screed and then applying a downward force against the screed and blocks by extending the piston, it being understood that each cylinder is of the two-way type. The mount 88 of course includes a transverse pivot to accommodate raising and lowering of the screed as the drawbar 82 swings in a vertical plane.

A rear screed 112, like the front screed 74, spans the form and, also like the front screed, has a length sufficient to cover the widest form over which the machine is intended to be operated, so that, when adjusting the frame 20, it is not necessary to adjust the screed. As to the front screed, the batwings 94 may be laterally adjustable to accord with changing form widths. The rear screed is trailed by a pair of drawbars 114 from pivotal connections 116 with the intermediate hitch elements 72, and each drawbar has a combined pivot and rubber-bushed connection 118 with the screed. In addition to the transverse pivot 116, the front drawbar connection includes a vertical pivot 120, because the rear screed is capable of being reciprocated transversely of the form as a concrete finisher.

The means for reciprocating the rear screed is shown here as comprising an air motor 122 having a depending shaft 124 to the lower end of which is affixed a crank 126 connected by a transverse pitman 128 with the screed. The pitman is provided with ball-joint connections to accommodate float and raising and lowering of the rear screed by means of a pair of rear air cylinders 130 which may be mounted to the central frame structure 22 by means similar to those for those front

cylinders **100.** Likewise, the piston rods **132** of the cylinders **130** are connected to the rear screed by means of sleeves **134** having interior structure like that of the sleeves **106.** The lower end of each rear screed sleeve **134** has a cross tube **136** within which is relatively loosely received a member in the form of a bail **138** attached to the rear screed and having a substantial transverse extent to enable free reciprocation of the rear screed (FIGS. **4** and **5**). Down pressure for raising the frame by means of extending the rear screed cylinders is available because the tubes **136** can engage the tops of the bails to apply the downward force.

As a further means for assuring a properly finished product, the form **28** is vibrated, preferably by means of at least a pair of vibrators **140** carred by the main frame **20** and operative against the upper outer portions of the tracks or sides **30** (FIGS. **8** and **9**). These vibrators may again be of the type referred to above.

Each vibrator **140** is rigidly affixed to an angle **142** which engages the upper outer corner of the respective track **30** and the angle is pressed against the track by force-exerting means such as any conventional air "springs" **144** connected at one end to the angle and at its other end to a support **146** connected to the main frame sides so that the vibrators act against the form just ahead of the front screed and just behind the front wheels **26.** Because of the fore-and-aft yieldability of the air springs **144,** the support carries front and rear abutments **146,** including rubber bumpers **148,** engageable front and rear with the angle **142.** The combination of the air springs and rubber bumpers isolates the main frame from the forces developed by the vibrators **140.** The vibrators are so mounted that their axes of rotation are angled, each on a line X—X, which results in vibrational forces developed in inwardly and downwardly inclined planes Y—Y intersecting the bottoms of the respective form channels **34** (FIG. **8**). This assures proper settling of the concrete in the deeper parts of the form.

As already described, the vibrators and motors are preferably of the air-driven type and these may be controlled from a convenient control panel or console **150** at the front of the main frame, readily accessible to the operator who also performs the duties of adding concrete, attending to the form, etc. A representative control system is shown rather schematically in FIG. **10,** where the legends FV, RM, SV, DM, RC and FC denote the form vibrators **140,** the reciprocating motor **122,** the screed vibrators **98,** the drive motor **66,** the raise and lower cylinders **100** and **130** and the clamps or air springs for the vibrators **140,** each controlled by respective valves V_1, V_2, V_3, V_4, V_5 and V_6, all suitably connected to an air supply line **152** in which is provided a safety valve V_x. In a typical installation, a supply line **152** may run along each side of the form, being pressurized by a suitable central source of compressed air. Where two lines **152** are provided, connections may be made at either side of the form according to the direction of travel of the machine, and it is preferred that such connections be made by means of self-sealing quick-couplers as suggested at **154.** In the event of an emergency, the safety valve V_x may be used to cut out all motors and vibrators. Obviously, the controls may be individually operated or "ganged" according to the situations.

In instances where the machine is intended to be operated in a direction the reverse of that described, the front and rear screeds may be interchanged, the front screed being connected to the hitch element **70** and the rear screed to the intermediate hitch **72.** The hitch elements are such that other attachments may be connected thereto in place of the screeds, or the rear hitch **70** may be used to tow, for example, a rotary brush or the like to clean the form **28.**

I claim:

1. A machine for vibrating, leveling and screeding concrete in a form having elongated parallel sides and a bottom, the sides providing tracks, comprising a main frame having guide means supporting the main frame on and for advance along the tracks, drive means for advancing the main frame, a front screed transverse to and spanning the tracks, front drawbar means articulately connecting said screed to the frame for advance therewith, a rear screed transverse to and spanning the tracks, rear drawbar means articulately connecting the rear screed to the frame for advance therewith, and each drawbar means extending downwardly and rearwardly from the frame to its screed so as to exert downwardly and rearwardly inclined draft forces on the respective screeds.

2. A machine for vibrating, leveling and screeding concrete in a form having elongated parallel sides and a bottom rigidly connected to the sides, the sides providing tracks, comprising a main frame having guide means supporting the main frame on and for advance along the tracks, drive means for advancing the main frame, a front screed transverse to and spanning the tracks, means connecting said screed to the frame for advance therewith, a rear screed transverse to and spanning the tracks, means connecting the rear screed to the frame for advance therewith, means associated with and operative in advance of the front screed for leveling concrete introduced into the form ahead of said front screed, and form-vibrating means carried by the frame for advance therewith and engageable with the form sides.

3. The invention defined in claim **2,** in which the form-vibrating means is operative to exert forces transverse to the length of the form.

4. The invention defined in claim **2,** in which the form-vibrating means is operative to exert forces in planes transverse to and inclined downwardly and inwardly relative to the length of the form.

5. The invention defined in claim **2,** especially for use with a form having at least one upwardly opening channel running lengthwise thereof, further characterized in that the form-vibrating means exerts forces in planes converging downwardly and inwardly and substantially intersecting a lower part of the channel.

6. A machine for vibrating, leveling and screeding concrete in a form having elongated parallel sides and a bottom, the sides providing tracks, comprising a main frame having guide means supporting the main frame on and for advance along the tracks, drive means for advancing the main frame, a front screed transverse to and spanning the tracks, a rear screed transverse to and spanning the tracks and spaced to the rear of the front screed, a front hitch element on the frame ahead of the front screed, an intermediate hitch element on the frame ahead of the rear screed, a rear hitch element on the frame behind the rear screed, a first drawbar connecting the front screed to the front hitch element, a second similar drawbar connecting the rear screed to the intermediate hitch element, said drawbars and

hitch elements being so constructed and arranged the first and second drawbars are interchangeable respectively to the rear and intermediate hitch elements and to the rear and front screeds for operating the machine in the opposite direction.

7. The invention defined in claim 6, in which the drive means is reversible for selectively advancing and reversing the machine.

* * * * *