



## UNITED STATES PATENT OFFICE

2,542,979

## SCREED FOR CEMENT SURFACES

Ralph G. Barnes, Reno, Nev., assignor of one-half to Jesse J. Gard, Portland, Oreg., and one-half to Jesse J. Gard, as trustee

Application September 7, 1944, Serial No. 553,041

13 Claims. (Cl. 94-48)

1

This invention pertains to road and pavement laying, and more particularly to a vibratory screed for smoothing and surface treating freshly deposited concrete material.

The use of vibratory screeds for striking off and finishing concrete is heretofore known in the art, wherein the vibratory motion has usually been reciprocatory in the direction of longitudinal extent of the screed. In the present instance vibratory action is induced in lateral and vertical directions perpendicular to the longitudinal axis of the screed.

Heretofore screeds possessing a natural period of vibration produced a wave action having nodes or dead points at uniformly spaced intervals. In the present disclosure there is contemplated a construction in which the vibratory effect is more widely and evenly distributed, thereby eliminating the nodes or dead points.

Furthermore in the present instance the vibratory action is utilized to facilitate the advancement of the screed over the surface of the concrete deposit.

The object of the invention is to improve the construction as well as the means and mode of operation of vibratory surfacing screeds, whereby they may not only be economically manufactured, but will be more efficient in use, automatic in operation, uniform in action, comprise a minimum number of operating parts, and be unlikely to get out of repair.

A further object of the invention is to provide a vibratory finishing screed which will rapidly simultaneously strike off and compact fresh concrete material in less time than heretofore required and with minimum use of labor, and by distribution of vibration will produce an improved surface finish from which coarse aggregate will be forced to lower strata and water spots will be eliminated.

A further object of the invention is to provide a vibratory screed which is adjustable to size proportionate to the area to be treated and universally applicable to inside work, in corners or adjacent to walls and also for outside work in the open.

A further object of the invention is to provide an improved resilient mounting for the screed, and to provide lifting lever connections to facilitate positioning the screed relative to the surface to be operated upon.

A further object of the invention is to provide improved vibrator unit and means for mounting it on the screed.

A further object of the invention is to provide a vibratory screed having the advantageous structural features, and inherent meritorious characteristics and the mode of operation, hereinafter described.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention intended to be protected by Letters Patent consists of the features of construction, the parts and combinations there-

2

of, and the mode of operation, or their equivalents, as hereinafter described or illustrated in the accompanying drawings.

In the drawings, wherein is shown the preferred but obviously not necessarily the only form of embodiment of the invention,

Fig. 1 is a perspective view of an assembled screed embodying the present invention.

Fig. 2 is an end elevation partly in section on line 2-2 of Fig. 1.

Fig. 3 is an end elevation.

Fig. 4 is a side elevation of one end of the assembly showing a lifting lever engaged therewith.

Fig. 5 is a detail sectional view through the vibrating unit.

Fig. 6 is a detail perspective view of a modification.

Like parts are indicated by similar characters of reference throughout the several views.

As illustrated in the drawings, the screed forming the subject matter hereof includes a beam 1, which preferably comprises a standard structural T beam or a structural I beam longitudinally severed through its web to afford two screed beams 1'. A length of pipe 4, substantially equal to that of the beam 1 is welded to the margin of the upstanding web of the beam. In lieu thereof, as illustrated in the modification Fig. 6, the screed may comprise two continuous angle bars 2-2 secured together back to back having interposed therebetween a flat bar 3 to the top margin of which is welded a continuous pipe 4 having a length substantially equal to that of the angle bars.

The beam is resiliently supported at its opposite ends upon frames each including an inverted U shaped standard 5 adjustably connected with the beam in straddle relation with the upstanding web of the beam 1 (Figs. 1 to 5) or with the upstanding webs of the angle bars 2-2 (Fig. 6) and the superposed pipe 4, and a pair of relatively spaced angular supporting legs 6 interconnected with the standard 5 by a flat spring blade 7. Longitudinal adjustment of the frames 5 relative to the beam is permitted by insertion of bolts 5' through different holes of the series 5a in the upstanding web of the beam. The angular supporting legs 6 are provided at their lower ends with angle shoes 8 for sliding engagement with lateral forms or rails 9 between which the concrete to be surfaced is deposited, and which define the extent of the concrete area. Thus the beam is resiliently supported for limited vertical vibration relative to the form sides or rails and the concrete surface operated upon.

Mounted on the beam in parallel relation therewith at a mid length point is a vibrating unit comprising a cylindrical casing or housing 10 through which axially extends a rotary shaft 11. Mounted upon the shaft 11 for unison rotation within the cylindrical casing is an unbalanced segmental weight 12 which rotates in a plane transversely of the beam 1. The vibrator housing 10 is clamped to the pipe 4 and to short filler or

brace rods 13 interposed in contacting relation with the vibrator housing and welded to the pipe 4 at opposite sides thereof, as is shown in Fig. 5. Superposed upon the vibrator housing is a table or motor support 14 secured to the beam 1 by clevises 15 which embrace the vibrator housing and the pipe 4, and extend transversely through the web of the beam 1, or angle bars 2 and interposed pipe supporting bar 3 in the case of the embodiment of Fig. 6. Mounted upon the table or support 14 is a motor 16, which may be an electric motor or a gasoline engine, or other form of driving unit.

In the event an electric motor is employed the electric conductor cable is extended through the pipe 4 to the side of the work area to prevent its interference with the travel of the beam. If an engine is employed engine control cables or operating rods may be extended through the pipe 4 to a point within convenient reach of the operator at the side of the work area. The motor of whatever type is resiliently mounted on the support table 14 by interposed rubber spacers 17 surrounding tie bolts 18 which carry coil springs 19 beneath the table 14.

The vibrator unit shaft is actuated by a drive belt 29 connecting a drive pulley 20 on the motor shaft, whether of an electric motor or an explosive engine, with a driven pulley 21 on the vibrator unit shaft 11.

Secured to the screed assembly adjacent to each end thereof are tri-lobed links 22 with which are engageable draft cables 23 by which the screed may be drawn along the form rails 9 while it is being vibrated by rapid rotation of the unbalanced weights 12.

It is not incumbent upon an inventor to know or explain the theory of operation of his invention, so long as he structurally describes the construction of the apparatus by which the desired result is accomplished. The following statement is volunteered merely for explanatory purposes as result of experimentation and use of the apparatus, without any intention, however of limiting the scope of the invention.

The angle bars 2 or T element of the screed beam possess a natural period of vibration under influence of the rapidly rotating unbalanced weights 12 which is manifested in waves of vibratory action of uniform length, having uniformly spaced nodes of nonvibration or dead spots at the junctures of succeeding waves. It has been found that such vibratory reaction produces an ununiform and unsatisfactory surface finish. However, addition of the pipe 4 appears to destroy the natural period of vibration of the beam, eliminating the objectionable nodes or dead spots heretofore encountered in devices of this type.

The vibratory action of the present screed is distributed and substantially equalized throughout the length of the beam and nodes or dead spots of the composite beam are eliminated. This induces a uniform finishing influence on the concrete surface throughout the length of the beam, and the aggregates are thoroughly and evenly displaced from the surface and fines are brought to the top of the concrete to afford a uniformly smooth surface.

The screed is adapted to be manually drawn slowly along the form rails 9 over the surface operated upon by the cables 23. It is found however, that the vibration tends to automatically advance the screed, and reduces its resistance to advancement in one direction. Under favorable conditions the screed may be caused to advance

automatically without pulling assistance of the cables 23, which may then be used merely for guiding purpose and keeping the screed properly aligned. This traveling action is induced by the rotation of the unbalanced weights 12, the momentum of which while rotating upwardly through the rearward lateral quadrant of their path of travel affords a slight upward impulse in opposition to gravity and momentarily reduces the frictional resistance of the beam on the fresh concrete surface. Before the screed has again settled, the momentum of the unbalanced weight during its travel through the top quadrant of its path, providing its rotation is in the direction of desired travel of the screed, transmits a forward impulse to the screed which materially reduces the pulling force necessary to move it. In some instances the screed will be advanced a limited distance without other assistance causing it to "walk." To the contrary the downward movement of the unbalanced rotary weight 12 through the forward quadrant of its rotation adds the momentary impulse of its momentum to the influence of gravity and increases the frictional engagement of the screed on the concrete surface which effectively prevents any retrograde motion during the travel of the weight rearwardly through the bottom quadrant of its path.

Thus the rotation of the unbalanced weight in the proper direction not only provides vibratory action which compacts the concrete and displaces the aggregates downwardly therein, and produces a desirable smooth even homogeneous surface, but it also materially reduces the effort necessary to move the screed over the surface of the work.

To facilitate lifting the screed into position across the area to be surfaced and removing it at completion of the finishing operation there are provided at each end of the beam, coincident with the standard 5 an arch 24.

Secured to the top of the standard 5 is a plate 25, the inner end of which projects beyond the standard and is bifurcated at 26. A lever 27, comprising an ordinary 2 x 4 timber may be thrust through the arch 24 and fulcrumed at its end between the furcations 26 of the plate 25 to serve as a handle.

While for economy and convenience of manufacture the screed beam preferably comprises a standard structural T beam, or one-half of a structural I beam, for some conditions of manufacture and use the screed beam may comprise a pair of angle bars 2 between which is interposed a flat bar 3, to the top edge of which a pipe 4 is welded, as shown in Fig. 6. The countervibrating element may be either a pipe section or a length of solid shafting welded to the upturned web of the T beam or to the edge of the bar 3, as illustrated in Figs. 2, 3 and 6. To attain the proper phase of the periods of vibration of the component parts or elements of the screed, the beam may be "tuned" by adding or removing material from one or the other of the vibratory members until the desired cooperation and compensating condition is achieved.

For finishing specially contoured areas other than plane surfaces, as for example in surfacing inverts for concrete flumes or conduits, or for production of crowned sections, the bottom surface of the beam may be correspondingly shaped. The vibration of the screed in the present instance being in a plane perpendicular to the lineal extent of the screed, as distinguished from the usual longitudinal vibratory action, transversely crowned or depressed contours may be accurately

maintained in accordance with the contour of the screed.

The flat spring arms 7 disposed parallel with the screed beam in horizontal planes are responsive to vertical vibratory impulses. There is a material difference in the response of the screed beam to vertical and horizontal vibratory impulses. The flexible flat spring arms 7 being disposed in horizontal planes, respond more readily to vertical impulses by which the screed beam is vibrated against the surface of the concrete deposit relative to the terminal supports 6. The arms being stiffer in edgewise directions tend to resist the fore and aft vibratory impulses which are thereby transmitted to the terminal supports 6. Under such influence the resistance of the unit to forward movement under draft upon the cables 23 is greatly reduced, which assisted by the momentary relaxation of frictional resistance of the beam upon the concrete surface incident to the preceding upward vibratory impulse, facilitates advancement of the screed by sliding the terminal supports 6 upon the side form members 9. It is found that in some instances under such influence the screed beam tends to automatically advance. Wherefore, the greater response of the resilient arms 7 in vertical direction than in a horizontal direction is of material advantage.

This application is supplemental to and a continuation in part of pending application for patent of this applicant, Serial No. 489,845, filed June 5, 1943 and since abandoned, to all benefit of which original filing date rights are asserted as to all subject matter common to the respective applications.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of several modes of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described my invention, I claim:

1. A screed for surfacing fresh concrete to be bridged across a deposit thereof, comprising a vibratory beam having a base and an upstanding flange, an elongated vibratory member attached to the upstanding flange, flat spring blades extending in horizontal planes parallel with the beam contiguous to the opposite ends thereof, adjustable brackets connecting the blades with the beam at optionally selective positions in spaced relation with the ends of the beam, arch shaped supports aligned with the beam with which the outer ends of the spring blades are connected, shoes on the legs of the arch shaped supports for sliding contact with side forms confining the concrete deposit, a rotary shaft medially mounted on the beam in parallel relation therewith, an unbalanced rotary weight carried by the shaft revolving in a plane perpendicular to the beam, and a driving motor for the shaft, by rotation

of which the beam and vibratory member are simultaneously vibrated, the construction and arrangement being such that the development of non-vibratory nodes of the beam will be minimized.

2. An apparatus for surfacing fresh concrete, including a screed beam to be bridged across a fresh concrete deposit, a resilient supporting assembly for each end of the screed beam, each including an inverted U shaped bracket straddling the screed beam and engageable therewith in selective positions at different longitudinally spaced positions upon the beam, an arch shaped support the legs of which have sliding bearing upon side form members confining the concrete deposit, spring arms disposed in longitudinal parallel relation with the beam connecting the crown of the inverted U shaped bracket with the crown of the arch shaped support to facilitate vibratory motion of the beam relative to the supports, a rotary shaft mounted in parallel relation upon the beam, an unbalanced revoluble weight carried by the shaft, and an actuating motor therefor.

3. A concrete finishing apparatus, including a screed having a contoured surface for contact with a body of fresh concrete across which the screed is to be bridged, horizontally disposed flat spring arms longitudinally aligned with the screed and attached thereto adjacent to its opposite ends, supports having sliding engagement with side forms which confine the fresh concrete deposit, to which the flat spring arms are attached in spaced relation with their points of attachment to the screed, and a vibrating unit mounted directly on the screed transmitting vibration thereto in a plane perpendicular to the longitudinal extent of the screed incident to the resiliency of said flat spring arms.

4. A concrete finishing apparatus, including a finishing screed comprising an elongated beam to be bridged across a deposit of fresh concrete, the bottom surface of which is contoured to define the desired transverse contour of the finished surface of the concrete deposit, spring arms disposed in longitudinal parallel relation with the opposite ends of the beam, a coupling device for adjustably connecting the inner ends of the spring arms with the beam at longitudinally spaced positions, arch shaped supports disposed in approximate straddle relation with projected ends of the beam to the crowns of which the outer ends of the arms are connected, the legs of said arch shaped supports having sliding engagement with side form members confining the deposit of concrete, a cylindrical housing medially mounted in parallel relation upon the beam, a revoluble shaft axially disposed within the cylindrical housing, a segmental unbalanced weight carried by the shaft within the housing, a driving motor carried by the beam and actuating the revoluble shaft to transmit vibrations to the beam in a vertical plane perpendicular thereto.

5. A concrete finishing apparatus, including a screed beam to be bridged across a deposit of fresh concrete, a resilient supporting assembly for each end thereof comprising an inverted U shaped mounting member adjustably engageable with the beam at selective position spaced from the end thereof, a fulcrum bearing thereon for a lifting lever, a bail attached to said mounting member for engagement with the lifting lever, a flat horizontally disposed spring blade, the inner end of which is attached to the mounting

member, an arch shaped support to the crown of which the outer end of the spring blade is attached, the legs of which have sliding engagement upon side form members confining the concrete deposit.

6. A concrete finishing apparatus, including a composite screed beam to be bridged across a deposit of concrete, comprising a longitudinally extending inverted T shaped portion and a longitudinally extending circular portion possessing different natural periods of vibration, said circular portion being secured to the top of the inverted T shaped portion, a vibrating unit associated with the composite beam transmitting vibratory motion simultaneously to the respective portions thereof to simultaneously vibrate said portions, the construction and arrangement being such that the vibratory effect of the vibrating unit is effectively distributed throughout the length of the screed beam.

7. A concrete surfacing apparatus, including a screed beam to be bridged across a deposit of fresh concrete, a pair of arch shaped terminal supports therefor the legs of which have travel engagement with side form members confining the concrete deposit, flat spring arms disposed in substantially parallel relation with the beam adjustably interconnecting the crowns of the arch shaped supports with the beam at optionally selective points thereon in spaced relation with the ends of the beam, the ends of the beam being projectable various distances through the arch shaped supports upon relative adjustment thereof in a direction longitudinally of the beam.

8. A concrete surfacing apparatus, including a structural metal angle beam having a base flange and an upstanding flange to be bridged across a deposit of fresh concrete, a length of pipe secured to the upstanding flange, the angle beam and the pipe possessing different natural periods of vibration, terminal supports having travel engagement with side form members which confine the concrete deposit, longitudinally disposed spring arms vertically flexible and resiliently interconnecting the ends of the beam with the traveling supports, and a vibrating unit associated with the beam and pipe transmitting concurrent vibratory influence thereto the construction and arrangement being such that the beam and pipe are responsive to vertical vibration independently of the traveling supports, but resistant to horizontal vibration independently thereof.

9. A concrete surfacing apparatus, including a vibratory screed beam to be bridged across a concrete deposit, terminal supports therefor having travel engagement with side form members confining the deposit of concrete, flat spring arms in alignment with the screed beam and connecting the opposite ends of the screed beam with the terminal supports, and a vibrating unit mounted above said screed beam, said unit comprising a rotary eccentric weight, rotating on an axis parallel to the screed beam and transmitting to the screed beam vibratory impulses in progressively changing directions perpendicular to the beam, the spring arms being responsive to greater degree to vertically directed vibratory impulses, by which the beam is vibrated against the concrete independently of the terminal supports, and are more resistant to horizontal impulses whereby such horizontal impulses are transmitted from the screed beam to the terminal supports.

10. A concrete surfacing apparatus, including

a vibratory screed beam to be bridged across a deposit of concrete, terminal supports for the screed beam having travel engagement with side form members confining the concrete deposit, a vibrating unit mounted on said beam, said unit comprising a rotary eccentric weight, rotating on an axis parallel to the beam and transmitting to the screed beam vibratory impulses in progressively changing directions perpendicular to the beam, and unidirectional resilient connections between the ends of the screed beam and the terminal supports comprising flat springs, enabling the screed beam to vibrate in one plane independently of the terminal supports and causing the terminal supports to vibrate in a different plane in unison with the vibration of the screed beam.

11. A concrete finishing apparatus, including a composite screed beam to be bridged across a deposit of fresh concrete, said beam comprising two members longitudinally disposed in parallel superposed relation and secured one to the other, resilient supporting means comprising flat springs projecting longitudinally of the beam at opposite ends of the composite beam having travel engagement with concrete confining side forms, the resilient supporting means being secured to the lower of the two superposed beam members, and a vibratory unit carried above the composite beam said unit comprising a rotary eccentric weight, rotating on an axis parallel to the beam and transmitting thereto a series of vibratory impulses, the construction and arrangement being such that the upper member of the composite beam is supported upon the lower member independently of the resilient supporting means.

12. A composite screed for a concrete surfacing apparatus, consisting of two superposed interconnected parallel portions possessing different natural periods of vibration and one of which is tubular, a vibrating unit secured thereto comprising a rotary eccentric weight rotating on an axis parallel to the screed, and means including flat springs arranged parallel to the screed for resiliently supporting said composite screed upon concrete supporting side forms, said means being connected to the non-tubular portion of the screed.

13. Concrete surfacing apparatus, including a vibratory screed beam, means for vibrating the screed beam comprising a rotary eccentric weight, rotating on an axis parallel to the beam and movable terminal supports in cooperative relation with the ends of said beam, and flat flexible blades extending in a plane parallel to the horizontal plane of the screed beam and interconnecting said beam and said terminal supports to enable vertical vibration of said screed beam independently of said supports and to preclude independent motion of said beam in horizontal planes.

RALPH G. BARNES.

#### REFERENCES CITED

The following references are of record in the file of this patent:

#### UNITED STATES PATENTS

| Number    | Name          | Date          |
|-----------|---------------|---------------|
| 2,042,156 | McCrery       | May 26, 1936  |
| 2,110,413 | Baily         | Mar. 8, 1938  |
| 2,160,462 | Schieferstein | May 30, 1939  |
| 2,306,126 | Jackson       | Dec. 22, 1942 |