Dec. 6, 1955 W. P. DAY ET AL 2,725,799

ROAD WORKING APPARATUS

Filed July 28, 1952

2 Sheets-Sheet 1

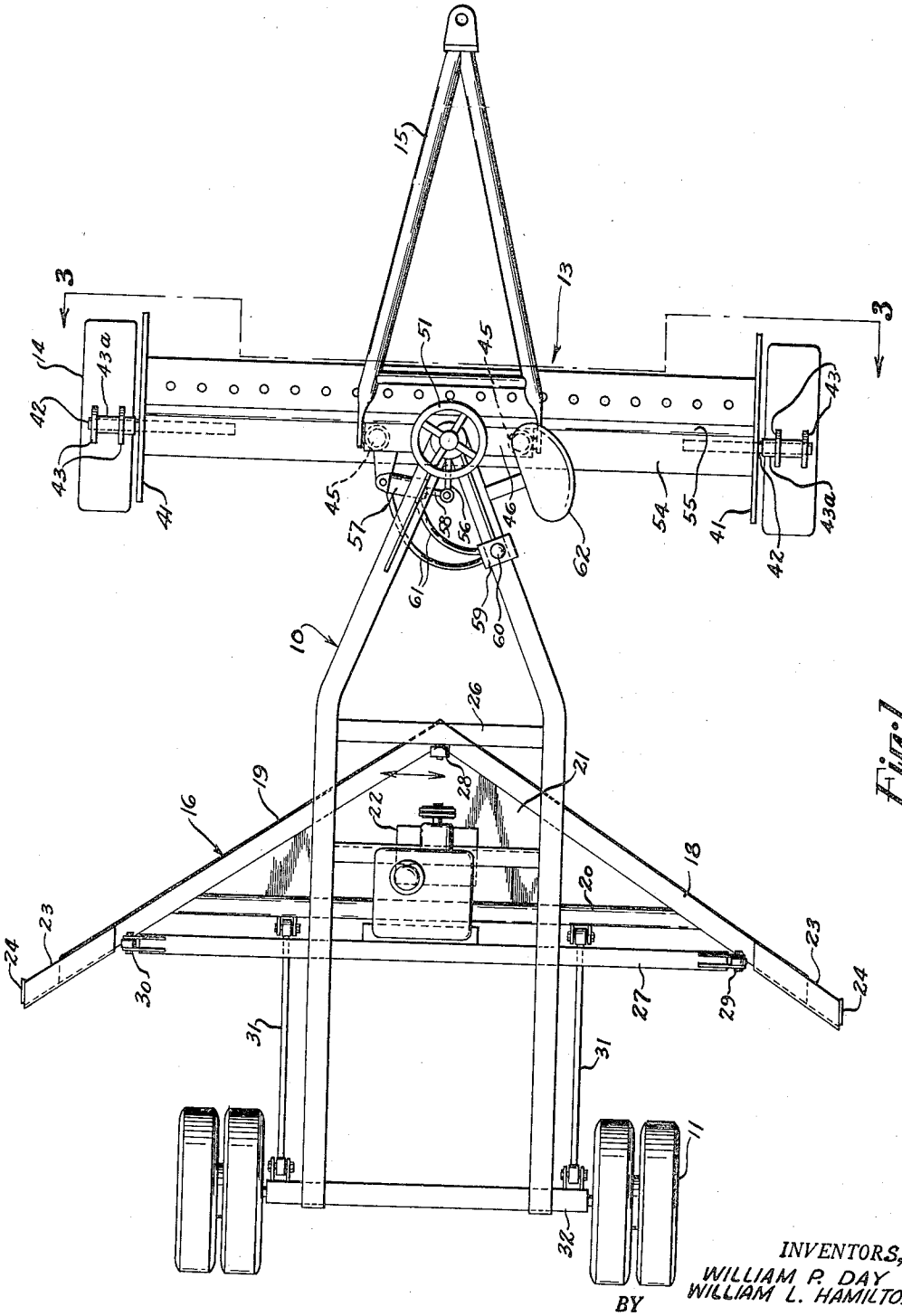


Fig. 1

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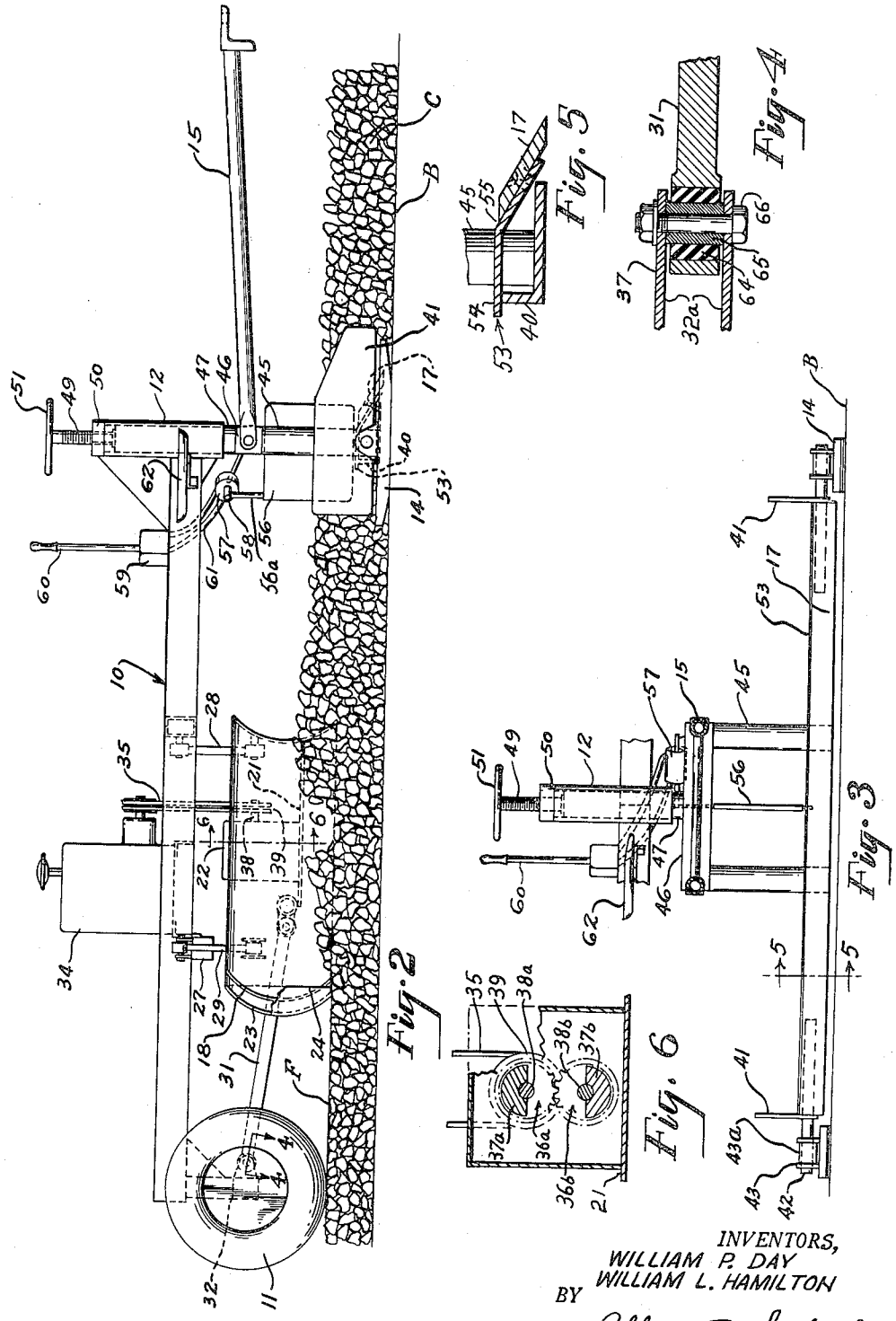


Fig. 2

Fig. 5

Fig. 4

Fig. 3

Fig. 6

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ROAD WORKING APPARATUS

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6 Claims. (Cl. 94—44)

The present invention relates to improvements in road working apparatus and more particularly in spreaders or leveling machines for distribution of road building materials.

In the construction of roads or similar structures, gravel aggregate or other sub-base material is generally distributed in piles of a given amount on the prepared ground surface, along a section of the road being built. In modern practice, the weight of material in each pile and the pile spacing are chosen, usually by having substantially equal pile weights and spacing, so that the sub-base material is uniformly distributed along the road bed, though in discrete piles. Thereafter the piles are bladed down with a bulldozer or similar bladed machine traversing the length of the road and working from the sides of the piles to form a long mound or windrow of substantially uniform cross section continuous along a length of the road. Then by means of a spreading or leveling machine, this mound is spread to uniform width and thickness extending across the road width, or a convenient selected part of the road width, and finally compacted or tamped to key the material and reduce it to a desired thickness and density.

With the method and apparatus used by the prior art for carrying out such operations, the wheels or treads of the road working vehicles cause localized compaction of the material being spread before the passage of the spreader blade which determines the final distribution before compacting, so that after the last pass of the spreader or leveling machine, although the thickness may be substantially uniform, the density is not. This, then, tends to cause a lack of uniformity in weight distribution of the material, so that after the tamping and compacting operations bring the sub-base or the road materials to a uniform density, an uneven surface results; or, conversely, after the material is brought to a uniform compacted thickness, the density varies. Either type of lack of uniformity, if not remedied, is deleterious to the final road structure, and hence inspection and immediate remedial steps are required to avoid such defects. Such remedial procedure, of course, entails additional operational expenses. By the method and apparatus of this invention, a blade is passed beneath the windrowed material to lift and loosen such material, and so eliminate local compaction, just before the passage of the spreader blade which brings the material to final level preparatory to compacting operations.

It is an object of the present invention to provide a material spreading apparatus and method for road building and like construction whereby aggregate, gravel, or similar construction materials may be spread and leveled with substantial uniformity on a weight distribution basis. Another object of the invention is the provision of an apparatus by which suitable spreading may be obtained more readily than by the apparatus and procedures of the prior art. Other objects and advantages of the invention will appear from the following description and the drawings in which:

Fig. 1 is a plan view of the apparatus of this invention;

Fig. 2 is a side elevational view of the apparatus showing it in operational relation to material being spread;

Fig. 3 is a fragmentary front view taken from the lines 3—3 in Fig. 1, to show the forward structure of the machine;

Fig. 4 is a sectioned detailed view of the connections used at the ends of the hanger arms or struts by which the spreading blade of the apparatus is supported; and

Fig. 5 is a fragmentary view taken along the line 5—5 in Fig. 3 to show in section details of the material lifting blade; and

Fig. 6 is a detail in transverse vertical section of the spreader blade vibrating unit.

The drawings show an apparatus comprising a vehicle frame **10** having double-tired wheels **11** at the rear, a front center post **12**, a transverse steering and gravel lifting blade supporting structure **13** pivotally mounted in the post **12** and provided at each side with skids or runners **14**, and a drawbar **15**, which constitute a road working vehicle adapted to be moved by a tractor unit for carrying the V-shaped spreader blade **16** and gravel lifting blade **17** through gravel or aggregate C distributed along a road base surface B for spreading the gravel to a spread finish level F. The spreader blade **16** comprises two curved blade arms **18** and **19** joined at the apex, a transverse strut **20** and a supporting plate **21** within the apex portion for connecting the arms as a rigid unit, a vibration unit **22** secured rigidly to the top of the support plate, and on each blade arm an extensible end member **23** having an end plate **24**, the end member being connected to its corresponding arm by bolt and slot connections to allow extension in adjusting the effective blade width. The blade **16** is suspended at the apex from the transverse frame member **26** and near the ends of the arms **18** and **19** from the ends of the transverse frame member **27** by the hanger arms **28**, **29** and **30** respectively, the arms being pivotally connected as hereinafter described, to the frame members and blade to allow lateral oscillation of the blade under the influence of the vibration unit **22**. The strut arms **31—31**, with the rear ends connected to the rear axle bracket member **32** of the frame and the forward ends connected to the transverse blade strut **20**, support the rearward thrust of the blade developed during passage through material being spread.

To provide the requisite freedom of lateral movement in the blade **16** and to insulate the vehicle frame from vibration developed in the blade, the connections of the blade supporting arms **28**, **29** and struts **31** to the blade and frame are such as that shown in Fig. 4 for the back end of a strut **31** attached to the rear axle bracket **32** of the frame. This connection comprises a rubber bushing **64** inserted in an eye at the end of the strut member **31**, a center sleeve **65** in the bushing and a pivot bolt **66** through the sleeve held by a nut **67** for securing the strut member end between the perforated ears **32***a* of the bracket **32**. Each member **28**, **29**, **31** is provided at opposite ends with similar connecting means to a corresponding suitable bracket on the frame or blade as the case may be. The rubber sleeve may be surrounded by a second sleeve and be bonded to both inner and outer sleeves to provide a unit which is adapted to press fitting in a support member and eye. The pivot axes of the connections of hanger arms **28**, **29**, **30** are parallel to the length of the vehicle. Though the pivot axes of struts **31** are transversely disposed, the resilient bushings in the connections permit the requisite movement.

The vibrator unit **22** may be any vibration inducing unit adapted to produce a lateral oscillation of the spreader blade, but preferably is a unit such as that described in my co-pending application Serial No. 5,388,

now Patent No. 2,633,781 of April 7, 1953. In the present apparatus such unit as shown in Fig. 6 would include a pair of simultaneously driven like coplanar eccentrically weighted wheels **36***a*, **36***b* with the weights **37***a*, **37***b* mutually rotationally positioned in such fashion that the mass centers of the wheels pass during rotation simultaneously in the same direction through the plane of the axes of rotation of the wheels. The respective shafts **38***a*, **38***b* are journalled in the housing of unit **22** with the axes of rotation of the wheels parallel and disposed in a vertical longitudinal plane passing through the apex of the spreader blade, so that as the wheels are driven the non-lateral reaction components of the rotating wheels counterbalance each other, while the lateral or horizontal components directed transversely to the vehicle are additive to impart lateral vibration through the unit housing to the spreader blade upon which the vibration unit is mounted. Preferably the weighted wheels are meshed gear wheels so that the shaft **38***a* of one may be used as a power input shaft to the unit and the wheels simultaneously driven. As shown in the drawings, the vibration unit is driven by the power or engine unit **34** mounted on the frame through a belt **35** driving a pulley **39** on the input shaft **38***a* of the vibrator.

The steering and lifting blade supporting structure **13** and adjuncts are best seen in Fig. 2 and Fig. 3. Therein a transverse beam member **40** of L-shape bears on its outer ends side plates **41** forming aggregate guides, beyond which project the skid mounting axles **42** extending through the sleeves **43***a* in the bracket plates **43** of skids **14** to provide a limited pivotal mounting for the skids. Beam member **40** is connected by vertical members **45** to a yoke **46** provided with a stem **47** journaled within the hollow front post **12** to swivel mount the member **40** for steering by the tractor unit connected to the vehicle through the drawbar **15** secured to either side of the yoke **46**. Further, for a vertical adjustment of the spreader blade height there is provided jack screw **49** threaded in the top plate **50** of the center post to bear on the top of the stem **47** and operated by the hand wheel **51**. A plate member **53**, having a flat top surface **54** and an inclined forward surface **55** mounting the blade **17**, is secured to member **40** forming therewith a single hollow transverse beam. Between vertical members **45** a gravel rudder **56** is located on a vertical shaft having the top end journaled in the yoke member or in the stem and the bottom journaled either in the top surface **54** of plate member **53** or in the transverse member **40**. For power adjustment of the rudder position, a hydraulic cylinder **57** is pivotally mounted to a bracket extending from the yoke and has a piston rod **58** linked to the gravel rudder through a vertical bar **56***a* fixed on the upper rear portion of the rudder. The cylinder is powered by a hydraulic pump or actuator **59** controlled or operated by the hand lever **60**. Hydraulic fluid connections in the form of flexible tubes or hoses **61** provide the hydraulic linkage between the actuator and the cylinder. An operator's seat **62** may be provided at a position convenient to the operating lever **60** and positioned so that the operator may observe the condition of the unspread aggregate before the spreader and the performance of the gravel rudder.

In operation the vehicle is drawn by a tractor unit along the windrow or mound of aggregate material. The flat skids and swivel mounting allow the apparatus to be steered, without lateral skidding or dragging, by the movement of the tractor. As the apparatus advances through the windrowed material the lifting blade **17**, which is spaced slightly above the level of the runners or skids to provide running clearance with the ground, passes beneath the windrowed aggregate, lifting it from the ground and so disturbing and loosening the entire width and depth of the layer so as to eliminate any local compaction caused by vehicles used in previous blading operations. The gravel rudder **56** may be used as needed to deflect the material passing over the spreader blade to one side or the other to compensate for maldistribution of the aggregate into which the apparatus advances, that is, maldistribution from the center line of the road or road width being laid, so that the tractor and road working apparatus may be advanced on a straight line, with little or no need for steering deviations in attempting to overcome deviations in the material distribution. Thus the spreader blade **16** encounters material from which local compaction is eliminated, so that after the blade **16** passes, spreading the aggregate to the desired width and depth, the material is left at substantially uniform thickness and density. When the wheels **11** of the vehicle travel the spread material, any local compaction caused thereby is of no consequence, since the blade **16** has already performed its function of securing final uniform distribution of the aggregate material. Subsequent compacting or tamping operations, therefore, produce both a uniform density and level. In addition to setting the principal operating height of blade **16**, the screw **49** may be utilized to effect any desired running adjustments of blade height.

The blade **16**, being vibrated laterally at rates which may vary from 1000 to 3000 vibrations per minute and with an amplitude of an order of one-eighth inch, quickly moves the material from its windrowed position outwardly towards the ends of the blades, for the oscillatory lateral displacement of the blade imparts energy to the particles of the aggregate giving them a lateral direction of motion, which energy is increased substantially over that which can be advantageously imparted by the mere wedge displacement action of the conventional type blades. The magnitude of this additional energy imparted is indicated by the fact that with a blade having a height of two and one-half feet, a twelve and one-half foot span, arm angle of about 112°, and the above described vibration rates and amplitude, the energy from a twelve horse power vibrator engine may be absorbed in spreading operations. The consequence is that the spreader may be moved at substantially greater forward speeds than would otherwise be permissible. Further, the agitation imparted, in addition to causing more ready flow and spread of material, serves to some degree to settle the material, anticipating somewhat the compacting operation which is subsequent to the spreading.

Obviously changes in the apparatus disclosed—such, for example, as variations in the type of wheel mountings, the blade actuating unit, gravel rudder control, positioning and type of draw bar or linkage adapted for particular tractor units—may be made without departing from the spirit of the invention, the scope of which is defined by the appended claims.

We claim:

1. An apparatus for spreading and leveling gravel and like materials comprising a vehicle frame including elements adapted to support the frame for movement over horizontal surfaces whereon is disposed material to be spread, said frame including a swiveled steering means spanning the operating width of the apparatus and bearing a pair of forward support elements disposed on opposite lateral ends thereof, a material spreading and leveling blade supported on the frame, and a material lifting blade supported by and extending across the said steering means, said lifting blade being disposed to pass under and lift the major part of the depth of material to be spread by the spreader blade, thereby to eliminate localized compaction of material before the passage of the spreader blade thereover.

2. An apparatus as described in claim 1 wherein the spreading blade is disposed obliquely to the length of the vehicle and including means mounting said spreading blade to the frame for horizontal vibrating movement and blade vibrating means for imparting said movement to the spreading blade whereby a force component transverse of the vehicle is applied to material being spread.

3. An apparatus for spreading gravel and like materials comprising a vehicle frame including elements adapted to support the frame for movement over horizontal surfaces whereon is disposed material to be spread, said frame including a swiveled steering means spanning the operating width of the apparatus and bearing a pair of forward support elements disposed on opposite lateral ends thereof, a material spreader blade having a spreading surface disposed obliquely to the direction of movement of the vehicle, means supporting the blade on the frame for vibration relative to the frame with a vibration component transverse to the direction of movement of the frame, a blade vibrating unit connected to the blade to impart vibration thereto with said transverse component, and a transverse material lifting blade supported by and extending across the said steering means, said lifting blade being disposed to pass under and lift the major part of the depth of material to be spread by the spreader blade thereby to eliminate localized compaction of material before the passage of the spreader blade thereover.

4. An apparatus as described in claim 3 wherein the said swivel steering means of the frame is connected to the rest of the frame by a swivel mounting which includes means for raising and lowering the rest of the frame relative thereto and thereby adjusting the height of the said spreader blade.

5. An apparatus for spreading gravel and like materials comprising a vehicle frame having support elements adapted to support the frame for movement over horizontal surfaces whereon is disposed material to be spread, said frame including a swiveled steering means spanning the operating width of the apparatus and bearing a pair of forward support elements disposed on opposite lateral ends thereof, a material spreader blade having a spreading surface disposed obliquely to the direction of movement of the vehicle, means supporting the blade on the frame for vibration laterally relative to the frame, a blade vibrating unit connected to the blade to impart said vibration thereto, a transverse material lifting blade supported by and extending across the said steering means,

said lifting blade being disposed to pass under and lift the major part of the depth of material to be spread by the spreader blade thereby to eliminate localized compaction of material before the passage of the spreader blade thereover, a material deflecting rudder pivotally mounted centrally to the said steering means and comprising a vertical plate pivoting about a vertical axis, and means for controlling the position of said plate whereby material passing over said lifting blade may be deflected toward one side or the other before said spreader blade.

6. An apparatus for spreading gravel and like materials comprising a vehicle frame including forward and rear elements adapted to support the frame for movement over horizontal surfaces whereon is disposed material to be spread, said frame including a centrally swiveled steering means spanning the operating width of the apparatus and bearing a pair of forward support elements disposed on opposite lateral ends thereof, a material spreading blade ahead of said rear elements and composed of two rearwardly divergent blade arm portions disposed substantially symmetrically to the vehicle length, means supporting the blade on the frame for vibration relative to the frame with a vibration component transverse to the direction of movement of the frame, a blade vibrating unit connected to the blade to impart vibration thereto with said transverse component, and a transverse material lifting blade supported by and extending across the said steering means, said lifting blade being disposed to pass under and lift the major part of the depth of material to be spread by the spreader blade thereby to eliminate localized compaction of material before the passage of the spreader blade thereover.

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