Sept. 6, 1960 V. J. MOIR 2,951,427

ROAD WORKING MACHINE

Filed Aug. 31, 1956

Fig.1

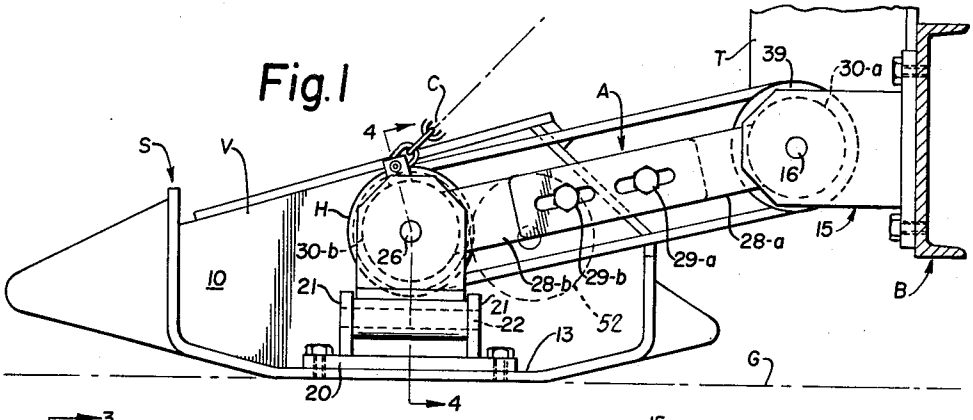


Fig.2

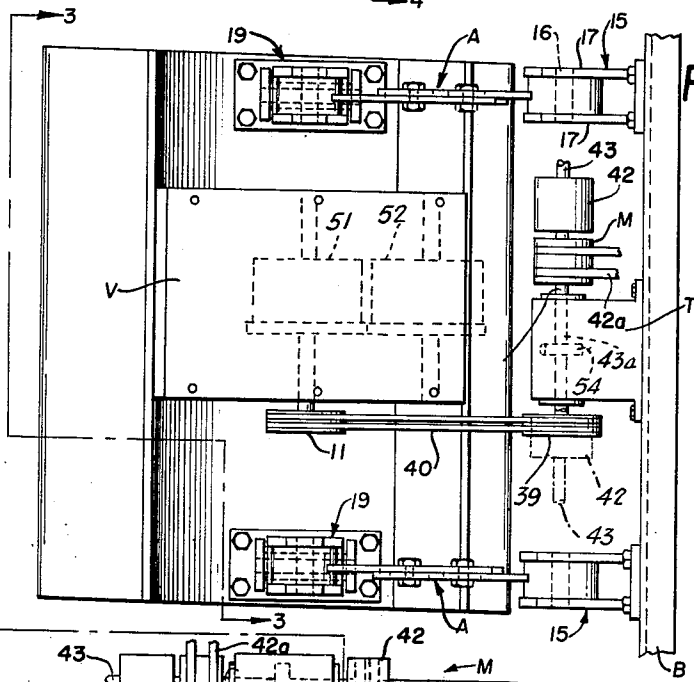


Fig.4

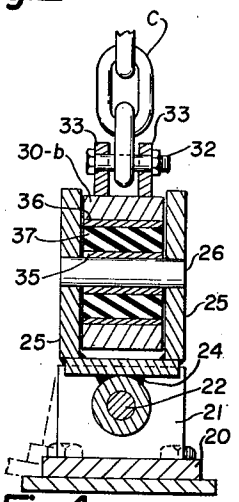


Fig.5

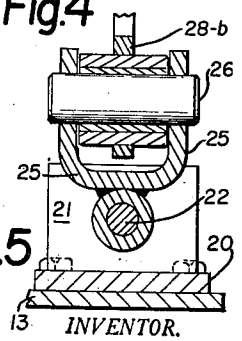
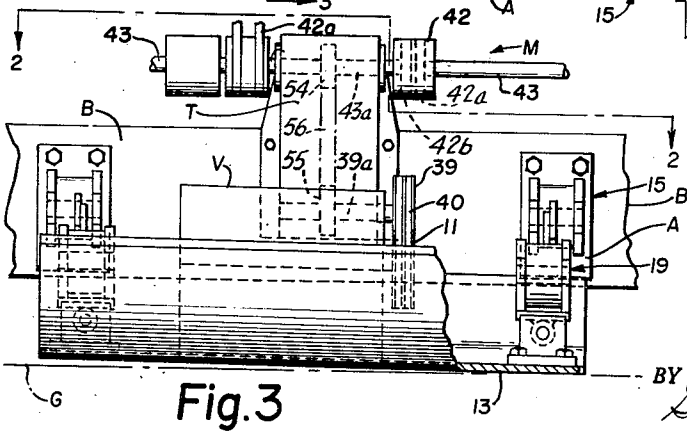


Fig.3



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United States Patent Office 2,951,427
Patented Sept. 6, 1960

2,951,427

ROAD WORKING MACHINE

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Filed Aug. 31, 1956, Ser. No. 607,514

2 Claims. (Cl. 94—48)

The present invention relates to a road working machine or the like, such as those used in settling and compacting coarse gravel and aggregate, sand, earth and the like; and more particularly to a vibratory tamping shoe mounting and driving structure.

In a common type of material compacting or tamping machine, used for compacting layers of materials such as coarse aggregate, for settling a layer of fine granular materials into an underlying coarse layer and compacting the same, and like operations in building roads or similar construction over extensive areas, a crawler or caterpillar type vehicle is provided with a transverse array of individually actuated ground or surface contacting elements suspended across the front of the vehicle. Usually each element is a shoe structure adapted to slide over the ground and mounted to the vehicle by one or more pivoted arms extending forward from the chassis to permit vertical oscillation of the element by an actuating unit developing vertical forces in opposite directions to lift the element and move it downwardly with an impact applied to the underlying material; and also to permit the element to be retracted upwardly from operational contact position when the tractor is driven from one work location to another. As an actuating unit, for example paired simultaneously driven eccentric weights are supported on parallel horizontal shafts mounted on the shoe, and resilient shock absorber elements are included in the arm structure to minimize vibrating shock communication from shoe to vehicle. The vibratory rate, usually on the order of 1000–3000 v.p.m., the amplitude and the overall shoe weight is such that not only is a heavy compacting blow developed, but also vibration of the underlying material is effected which tamps and locks the material together and further is effective to settle an upper layer of fines downwardly into a lower layer of coarse material.

Now in machines of this character, maintenance problems have arisen from excessive deterioration in the shock absorber units; and where belt and pulleys are used to transmit motion from undue belt wear and breakage. The general object of the present invention is then to provide a tamping shoe mounting and driving structure having the advantages of a belt and pulley drive whereby several shoes of the aforementioned character may be driven from a common power source on the vehicle proper, while minimizing such maintenance problems. Another object is the provision of such shoe structure adapted to increased compacting effectiveness over comparable mechanisms. A further object is the provision of a shoe mounting simplified in structure yet minimizing vibration communicated to the vehicle chassis more effectively than comparable structures.

Other objects and advantages of the invention will appear from the following description and the drawings wherein:

Fig. 1 is a side view of a vibratory tamping shoe and means for mounting the same to the chassis of a vehicle, constructed according to this invention;

Fig. 2 is a plan view corresponding to Fig. 1, but in somewhat smaller scale;

Fig. 3 is a front end view corresponding to Fig. 2 with certain portions broken away, taken as indicated by line 3—3 in Fig. 2, the shoe being shown tilted transversely of the vehicle;

Fig. 4 is a detailed view of a shoe mounting bracket in section taken as indicated by line 4—4 in Fig. 1; and

Fig. 5 is a view similar to, and showing a modification of, the structure of Fig. 4.

In the drawings, there appears a single vibratory material tamping or compacting shoe S mounted through a pair of pivoted arm structures A on the channel-shaped front transverse beam member B of a suitable vehicle, whereby the shoe may be swung, from its normal operating position in sliding contact with the top of the ground or other material to be compacted (indicated by dashed horizontal line G), upwardly and rearwardly by retracting force applied through chains C associated with the respective arms. These chains and their end anchors are omitted from Figs. 2 and 3 for clarity in representation of other elements. To the shoe is imparted its vibratory compacting motion by its mechanical vibrating unit V driven by a power source on the vehicle through mechanism including the individual transmission unit T secured on beam B and intermediate input shaft means M.

It is to be understood that the present invention is particularly intended for use where a plurality of similar shoes, mounted across the front of a suitable vehicle (e.g. of the crawler or caterpiller type) are simultaneously driven in compacting operation by one ultimate power source on the vehicle; and are simultaneously raised from and lowered into ground contacting position respectively for travel of the vehicle from one work location to another and for operating traverse of a surface to be compacted. Thus the shoes may each be supported by a pair of arms, pivotally mounted on the vehicle with the chains C reeved on a common power driven shaft for raising and lowering the several shoes simultaneously. The vibrating unit V may be comprised of a pair of parallel-shafted, like meshed unbalanced gear wheels **51**, **52** having shafts suitably bearinged in opposed longitudinal side plates **10** of a unit housing with the shaft of one (**51**) of the wheels extended through the housing to carry a pulley wheel or wheels **11** on its outboard end and with the unbalanced wheels so meshed relative to the annular positioning of their eccentric mass centers that strong vertical forces are developed to vibrate the shoe up and down on the order of 2000 v.p.m. Preferably the plane of the shafts is horizontal in normal disposition on level ground.

As appears in Figs. 1 and 2, the shoe may be of welded plate integral construction and has front and rear bottom portions upwardly inclined away from a main flat bottom **13** for primary working contact with the top surface of material to be compacted with the side plates of the unit V rigidly secured centrally of the shoe, side enclosing plates of the shoe being omitted for clarity. If desired the plan outline of the shoe may be rhomboidal so that with say four shoes ganged in side-by-side disposition, all the material across the overall span of the set of shoes is compacted during forward advance of the vehicle.

The inclined generally parallel arm structures A at opposite sides of the shoe are identical. For each there is a pivot bracket **15** bolted to the forward vertical face of chassis beam B and having a horizontal pivot pin **16** fixed in the spaced forwardly extending bracket legs **17**, the pins of the brackets **15** of each shoe being aligned. Also there is for each arm structure a universal type bracket **19**, the lower portion of which has secured to

the shoe bottom plate **13** a base **20** with a pair of spaced parallel upright legs **21** spanned by a longitudinally extending horizontal pivot pin **22**. On the upper part of bracket **19**, the base **24**, pivotally secured between legs **21** by pin **22**, carries the spaced upwardly extending legs **25** with another pin **26** transversely disposed in upwardly spaced relation to **22**. The pins **26** and the vibrating unit shaft bearing pulley **11** for each shoe are coplanar; and moreover are substantially in alignment when the shoe bottom **13** in transverse aspect is parallel with beam B.

The arm proper is formed by a pair of elongated upper and lower plate elements **28***a*, **28***b* overlapped and secured together for adjustable length by bolt and slot connections **29***a*, **29***b* and at opposite ends having corresponding cylindrical eyes **30***a*, **30***b* pivotally supported on pins **16** and **26** respectively by similar shock absorbing bushings as seen in Fig. 4. At the shoe end of the arm, the lower end of the corresponding chain C is secured by a bolt **32** passed through the last link and between a spaced pair of anchor lugs **33** on eye **30***b*. The aforementioned bushings comprise coaxial inner and outer metal sleeves **35**, **36** to which is bonded the intervening rubber or like apt material **37**; the outer sleeve, and therefore the entire bushing being force-fitted into the arm eye, but the inner sleeve being pivotally free on its corresponding pin.

The pivotal mounting along with provision of a certain end clearance between the eyes and adjacent bracket permits of some degree of lateral tilting of the shoe as indicated by dashed outlines of Fig. 4 exaggerated or in Fig. 3. Accordingly, there is further ability in the shoe to accommodate to surface dispositions of material being compacted and attain more effective operation. As may be noted in the drawings, Fig. 1, the bracket plates **17** and **25** extend in all directions beyond the eye cylinders **30***a*, **30***b*, respectively embraced thereby, which seems, in confining and guiding the non-pivotal motions of the eyes with respect to the pins within the corresponding shock absorber units, to extend markedly the useful life of the units, and to permit development of a greater impacting force than that with comparable units lacking this feature.

In the vibrator unit power transmission system, for each shoe a transmission unit T with housing secured to the beam B provides an output shaft **39***a* carrying a pulley or pulleys **39**, normally radially aligned with pulleys **11** for driving connection therewith by V-belts **40**, and axially aligned with the pins **16** of brackets **15**, whereby oscillatory vertical movement of the shoe during operation is ineffective to vary belt, length or tension. Spaced vertically above the output shaft is an input shaft **43***a*, the two shafts of the unit being connected by suitable gearing or sprockets **54**, **55** with connecting chain **56**.

In the case of end shoes of a gang, one end, for the other intervening shoes, both ends of the input shaft **43***a* of the transmission unit T are connected to the like units of adjacent shoes to form the shaft means M by coupling units **42** and inserted shaft elements **43**, one of the input shafts **43***a* being immediately driven by a prime mover on the vehicle, as through belting on a sheave **42***a* inward of adjacent coupling **42**.

The coupling units, whereby the input shaft of a transmission unit T is connected to the inserted shaft elements **43** and thereby to the input shafts of adjacent transmission units T, are each comprised merely of two similar halves **42***a*, **42***b* or members rigidly secured on the respective connected shafts, and readily removable means for securing the coupling halves together. The use of the described composite shaft means M with the couplings included therein facilitates not only manufacture but also maintenance of the machine, since the entire shoe driving mechanism, even of an array centered shoe, may be dealt with individually by removing the securing means for the couplings at each side of the transmission unit for such shoe, thus freeing the particular transmission input shaft **34***a* from the rest of the shaft means M. The advantages here are clear over use of a solid shaft spanning the entire array and serving as a common input shaft to all transmission units, inasmuch as the latter arrangement would require disturbing several other units T in order to remove one unit from the middle of the array for repair.

In the detail Fig. 5, there is shown a modification of the universal type connection of the lower end of the shoe support arm to the shoe, wherein elements generally similar to these of Fig. 4 bear like reference numerals. It has been found with the double pivoting bracket, that the shock absorber unit of each lower arm end, comprised in Fig. 4 of the bonded metal-rubber-metal sleeves **35**, **36**, **37**, may be omitted; and not only do the corresponding units in the upper eyes of the arms alone attenuate vibrations communicated to the vehicle chassis quite as well as the combination with both upper and lower arm eyes provided with such units, but further even less vibration is communicated, where the structure of Fig. 5 is used for the lower ends of the arms. In Fig. 5, the lower bushed arm eye is pivoted directly on pin **26**; and the pins **26** are again disposed relative to the pulley shaft **11** as previously described.

From the foregoing description, it is readily seen that from the manner of mounting such shoe to the vehicle, not only for physical attachment but also driving connection, not only is there avoided change in belt length, tension and condition due to lifting the shoes into retracted non-operating position, but also the continual change in belt disposition at the relatively high ratio and frequency of operating conditions which give rise to frequent belt failure. Further it has been found that with both ends of the arms freely pivotal, and with some axial clearance of the arms in the brackets, and corresponding radial extension of the bracket legs **25** and **17** beyond the eyes of the arms, shock absorber life is increased; while these features in conjunction with the lateral tiltability of the shoe allows a more ready accommodation of the effective shoe pressure applying area to the surface being worked, yielding greatly improved compaction performance in terms of both speed and density attained.

I claim:

1. In a road working or like material compacting vehicular machine having a plurality of individually suspended tamping shoes each provided with a rotationally driven, vertically vibratory actuator driven from a common power source on the vehicle chassis, each said shoe having a plane base providing a normally horizontal material contacting surface adapted when in operating position to slide over and be supported by material spread over the ground or like area for compaction, the combination comprising: suspension means for each said shoe including a pair of spaced like arms projecting from and having corresponding ends secured to the chassis by pivot structures with pivot axes horizontally coaxially aligned in a direction transverse of the vehicle thereby permitting the arms to swing in vertical planes extending parallel to the vehicle length, a pivot bracket for each arm whereby the other end of each arm is pivotally secured to a corresponding side of said shoe, each pivot bracket having a first unrestrained pivotal connection with the respective arm and including a second unrestrained pivotal connection with the shoe, the axes of the said first pivotal connections in the brackets being parallel to the pivot axes of said pivot structures and normally in alignment with each other, the axes of the second pivotal connections being generally parallel to the shoe base and at right angles to the first pivotal connections, said rotationally driven vibratory actuator on each said shoe having an input pulley normally coaxially aligned with respective said first pivotal connections; and power transmission means secured to the vehicle chassis having for each said shoe an output pulley coaxially aligned with

said pivot structures of the respective shoe arms, the respective output and input pulleys being belt connected and normally coplanar as to rotation; and means actuated from a power source on said chassis for swinging said shoes upward from and down to operating position; said transmission means including for each said shoe a unit having output shaft means carrying said output pulley, input shaft means vertically spaced from the output shaft means and coupled with similar input shaft means for adjacent shoes, and means within the unit drivingly connecting the shaft means thereof.

2. A structure as described in claim 1, wherein each

said arm is adjustable in length for tensioning said driving belt means.

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