May 31, 1966 H. R. PIPER 3,253,522

COMPACTING MACHINE

Filed Jan. 28, 1963 2 Sheets-Sheet 1

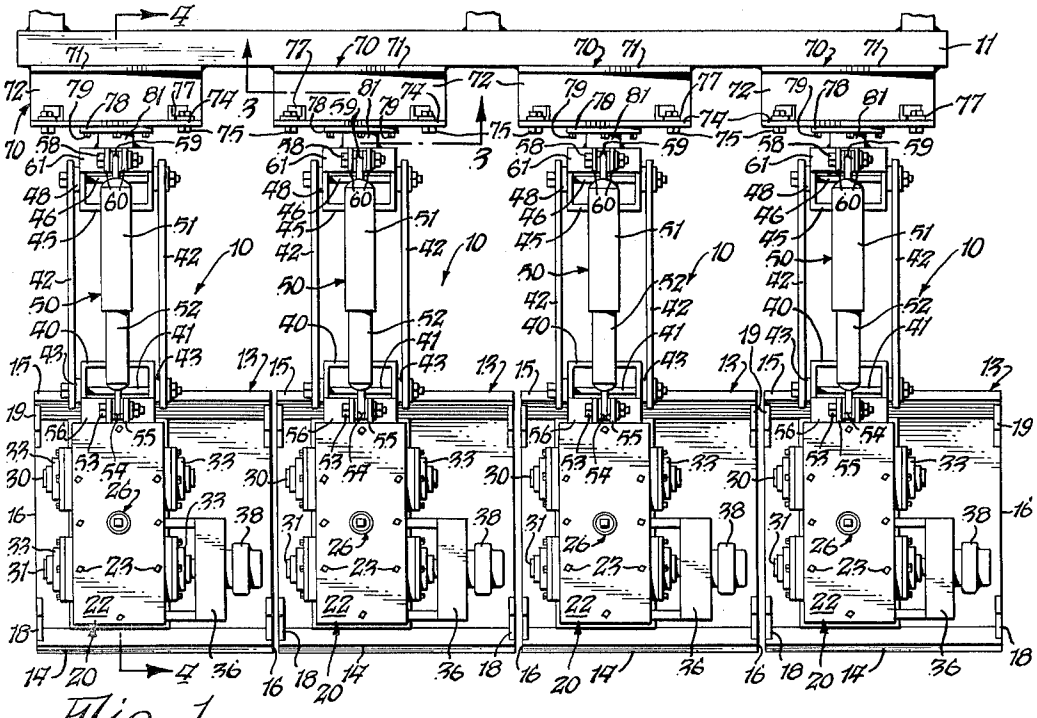


Fig. 1.

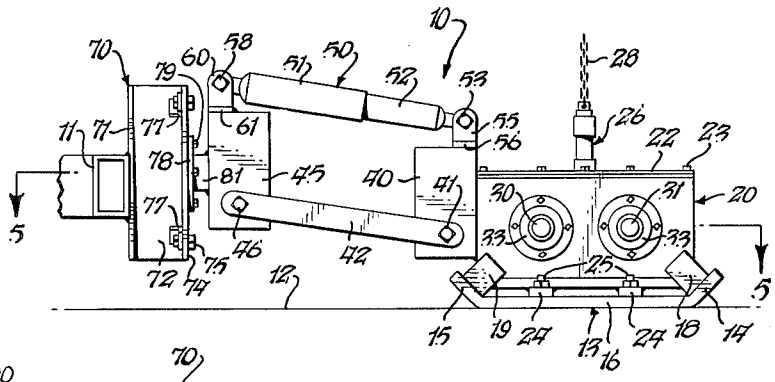


Fig. 2.

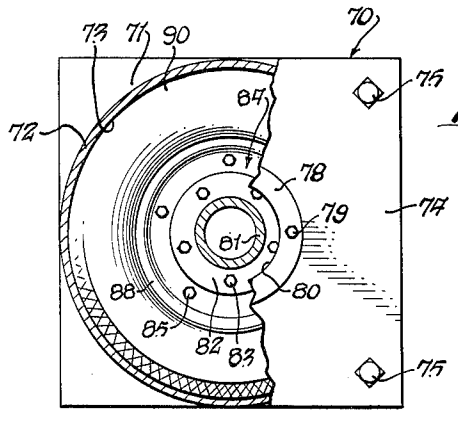


Fig. 3.

Harold R. Piper INVENTOR.

BY Popp and Sommer

Attorneys

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COMPACTING MACHINE

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Fig. 4.

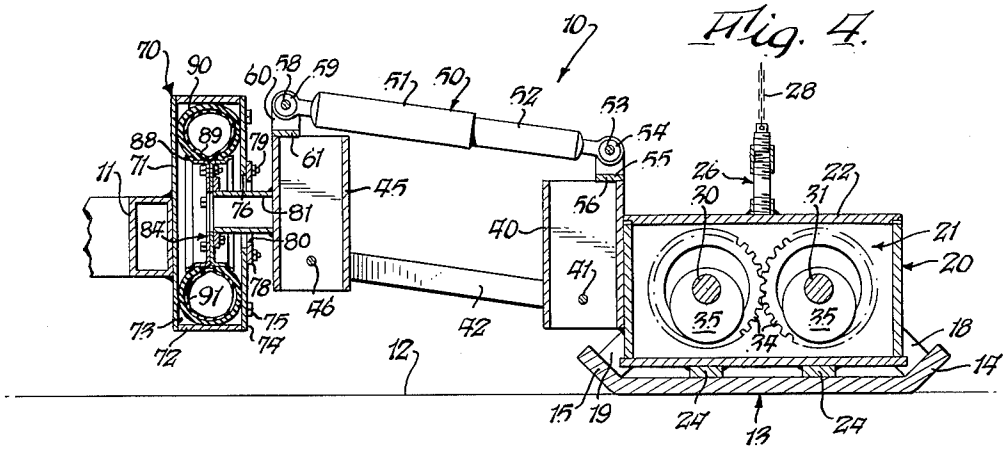


Fig. 5.

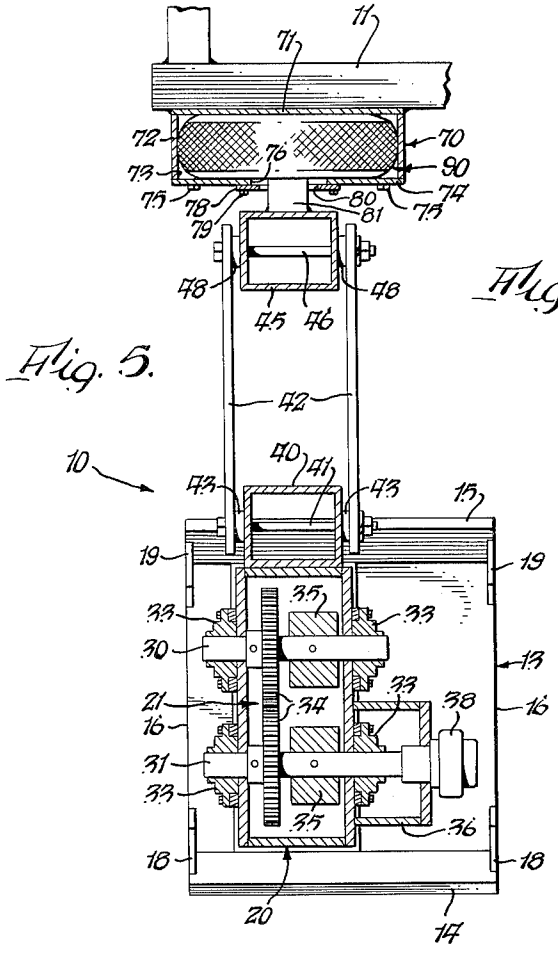
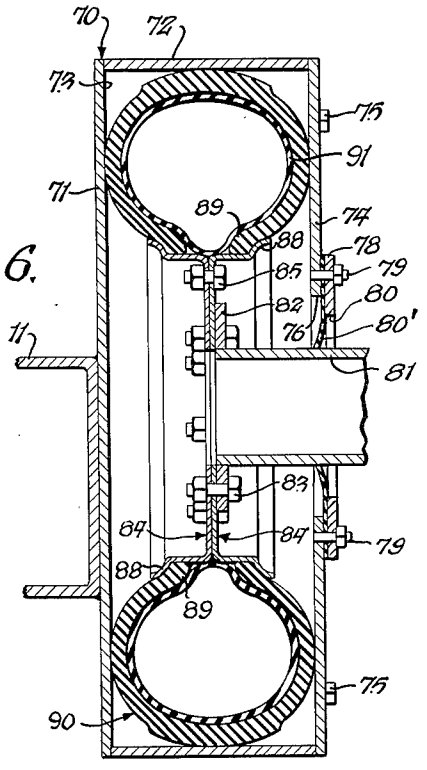


Fig. 6.



INVENTOR.
Harold R. Piper
BY Popp and Sommer
attorneys

United States Patent Office 3,253,522 Patented May 31, 1966

3,253,522

COMPACTING MACHINE

Harold R. Piper, Nunda, N.Y., assignor to Trac-Machinery Corporation, Nunda, N.Y., a corporation of New York

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12 Claims. (Cl. 94—48)

This machine relates to a machine for compacting the loose granular material, such as stone, gravel, soil or the like forming a layer of a roadway, dam, bridge approach or other surface, and is of the type comprising a row of broad metal shoes which row is moved along the surface to be compacted with the shoes severally subjected to the action of an eccentrically weighted rotary compactor carried by each shoe, the vertical vibratory or oscillatory forces being transmitted through each shoe to compact the surface on which the shoes are riding.

One of the principal objects of the invention is to effectively isolate the propelling vehicle from vibrations escaping from the eccentrically weighted rotary compactors associated with the row of shoes, such escaping vibrations being detrimental to the propelling vehicle.

Another object of the invention is to provide such a compactor which can be used for heavy duty service to compact rough and irregular surfaces composed of large stones or other granular material and having irregular humps.

Another object is to provide such a compactor which is equally effective in travelling forwardly or backwardly, the normal use of the compactor involving moving it back and forth over the area to be compacted.

Another object is to provide such a compactor in which the row of shoes is moved forwardly and backwardly along the surface to be compacted by a mechanism which will keep the row of shoes in line regardlless of what obstacles these shoes may individually encounter.

Another object of the invention is to maintain each shoe flat and horizontal but at the same time yieldingly permit each shoe to rock fore-and-aft about a generally horizontal axis, the fore-and-aft rocking permitting the shoe to adapt itself to sharp rises and depressions encountered in the terrain.

Another object is to provide such a road compactor which is of rugged and sturdy construction and will rapidly and uniformly compact the surface and which will stand up under conditions of severe and constant use without getting out of order or requiring repairs.

Another object is to provide such a compactor which can readily be driven from place to place, provision being made to facilitate such movement.

Another object is to provide such a compactor which is low in cost, principal elements of the compactor being available as large production components of standard road vehicles.

Another object is to provide such a compactor in which the opposing edges of the several shoes of the row are prevented from riding up on one another.

Other objects and advantages of the invention will be apparent from the following description and drawings in which:

FIG. 1 is a top plan view of a compactor embodying the present invention showing the same attached to the horizontal front push-pull bar of a propelling vehicle which moves the compactor back and forth horizontally along the surface to be compacted.

FIG. 2 is a side elevational view thereof.

FIG. 3 is an enlarged fragmentary vertical sectional view taken generally on line 3—3, FIG. 1.

FIG. 4 is a vertical section taken generally on line 4—4, FIG. 1.

FIG. 5 is an enlarged horizontal section taken generally on line 5—5, FIG. 2.

FIG. 6 is a greatly enlarged fragmentary view similar to FIG. 4.

On the following description for simplicity, it will be assumed that the compactor is being used in compacting a base layer of stone or gravel of a roadway although it is useful for compacting dirt or other granular material and is also useful in compacting fill or other granular material in making dams, roadway fill section or approaches or elsewhere where compacting of a granular material by a mobile unit is desirable.

While the compactor of the present invention can have any number of compactor units, it is shown as having four identical units **10** arranged side by side and attached to the front face of a horizontal push-pull bar **11** of a propelling vehicle (not otherwise shown), this horizontal push-pull bar extending transversely of the line of movement of the propelling vehicle and the several units **10** being arranged in line transversely of this line of movement so that each unit operates on a narrow strip of the roadway **12** and the combined action of the group of units is to compact a wide strip of the roadway. Inasmuch as the units **10** are identical in construction and operation, a description of one will be deemed to apply to all of them.

The numeral **13** represents a metal shoe which is of rectangular shape in plan and of substantial thickness and weight, the forward ends **14** of each of these shoes inclining upwardly and forwardly to ride up on the stones of the surface **12** being compacted and the rear ends **15** of these shoes inclining upwardly and rearwardly to permit the shoes similarly to ride up on the stones of the roadway **12** when the propelling vehicle is put in reverse. The side edges **16** of the inboard shoes **13** are in closely spaced parallel relation with each other and with the inside edges **16** of the outboard shoes **13** so that the several shoes act in conjunction with one another to compact a broad strip of the roadway being compacted. However, to keep these closely spaced side edges **16** from riding up on one another, each shoe **13** is provided at each of its forward corners with an upstanding lug or flange **18** and at each of its rear corners with an upstanding lug or flange **19**, these lugs or flanges being arranged with their outer faces forming a continuation of the side edges **16** so as to come into contact with one another when the displacement of the units **10** is sufficient to bring the shoe **13** into contact with one another.

To the upper face of each shoe **13** is fixed the casing **20** for an eccentrically weighted rotary compactor or compactor unit indicated generally at **21** and which serves to impart vertical reciprocatory or vibratory forces of substantial amplitude and value to each shoe **13** so as to compact the stones of the roadway **12** supporting the shoes and along which the row of shoes is moved. The casing **20** is in the form of a rectangular metal box having an open top enclosed by a removable cover **22** which can be secured in position by stud bolts **23** or in any other suitable manner. To the bottom of each box **20** is secured, as by welding, a pair of horizontal bars **24** extending transversely of the line of movement of the propelling vehicle and these bars preferably project beyond the sides of the boxes and are removably secured to the top faces of the shoes **13** as by stud bolts **25**.

An upstanding fitting, indicated generally at **26**, can be secured to the top face of each box cover **22** at its center, the purpose of this fitting being to permit connection of each compactor unit **21** to a lifting chain **28**. The several lifting chains are connected to any suitable lifting device (not shown) carried by the propelling vehicle, the purpose of these lifting chains being to enable the pro-

pelling vehicle, with the elevated compactor units **21**, to be driven from place to place.

The eccentrically weighted compacting device or unit **21** is of conventional construction and is shown as comprising a pair of parallel horizontal shafts **30**, **31** arranged in the same horizontal plane to extend transversely with reference to the line of movement of the propelling vehicle and extending through the side walls of the companion casing **20** and journalled therein by means of suitable bearings **33**. These shafts **30**, **31** are geared to rotate together by means of intermeshing gears **34** of the same size and each shaft carries an eccentric weight **35**. These eccentric weights are connected to the shafts **30**, **31** in such phase relationship that the salients of both are in their extreme downward position at the same time and in their extreme upward position at the same time. By this means, as the two shafts **30**, **31** rotate in unison the full force of all the weights is effective in a vertical direction so as to provide maximum vertical compacting of the granular material of the roadway **12**, whereas these weights tend to cancel each other as their salients approach horizontal so as to minimize undesirable horizontal reciprocatory forces. It will also be noted that these horizontal forces are parallel with the direction of movement of the propelling vehicle and shoes **13**.

The shaft **31** is shown as extending through an outboard bracket **36** fixed to one of the side walls of the casing **20** and supporting a motor **38** which drives the shaft. Each motor is shown as being a hydraulic motor.

A bracket in the form of a vertical tube **40** which is rectangular in horizontal cross section is secured to the exterior of the rear wall of each casing **20** in any suitable manner, as by welding. A horizontal pivot bolt **41** extends through the lower ends of the side walls of this bracket **40** to project outwardly therefrom and support the forward ends of a pair of parallel links **42** which are in the form of solid bars which are of substantially the same effective length extending fore-and-aft with reference to the line of movement of the propelling vehicle between the propelling vehicle push-pull bar **11** and each shoe **13**. A rubber bushing **43** is preferably interposed between each link **42** and the bracket **40** so as to provide a limited universal joint action in each pivot joint.

The rear ends of each pair of links **42** are arranged along the exterior of the lower ends of the side walls of a bracket **45** shown as being in the form of a vertical tube of rectangular form in horizontal cross section. These rear ends of each pair of links **42** are pivotally connected to this bracket **45** by a pivot bolt **46** extending through the side walls of the bracket **45** and through the rear of the links **42**. A rubber bushing **48** is preferably interposed between each link **40** and the bracket **45** so as to permit a limited universal joint action in each pivot joint, the movement of the propelling vehicle being transmitted to each shoe through this rubber bushing as with the rubber bushing **43**.

A feature of the invention resides in the provision of a hydraulic telescopic shock absorber **50** between the upper ends of the brackets **40**, **45** and which act in a manner of a dash pot to provide a longitudinally yielding strut. Each shock absorber can be of any suitable construction to have orifice-restricted oil flow between the two telescopic parts **51**, **52** so as to yieldingly resist both contracting or extending telescoping movement of these parts, there being no spring bias of these parts in either direction.

The forward end of the forward part **52** of the shock absorber is pivotally secured, preferably by means of a pivot bolt **53** and rubber bushings **54**, between a pair of ears **55** projecting upwardly from a base plate **56** which in turn is secured, as by welding, to the top of the tubular bracket **40**. The rear end of the rear part **51** of the shock absorber is pivotally secured, preferably by a pivot bolt **58** and rubber bushing **59**, between a pair of ears **60** projecting upwardly from a base plate **61** which in turn is secured, as by welding, to the top of the tubular bracket **45**. The movement of the propelling vehicle is transmitted to each shoe **13** through the rubber bushings **54** and **59** which imparts limited universal joint action to the pivot joints.

It will be seen that the pair of solid bar bottom links **42** in combination with the shock absorber **50** provide three parallel struts.

A pneumatic cushion structure, indicated generally at **70**, is interposed between each tubular bracket **45** and the front push-pull bar **11** of the propelling vehicle, the primary purpose of this cushion structure being to prevent vibrations of the several eccentrically weighted rotary compactor units **21** from being transmitted to the propelling vehicle.

To this end a vertical rectangular metal plate **71** is secured, as by welding, to the forward face of the propelling vehicle push-pull bar **11** in rear of each of the shoes **13**. To the forward face of each of these plates **71** is welded a forwardly projecting cylinder **72** forming a box which is open at its front and forms a cylindrical chamber **73**. This chamber is enclosed by a front cover plate **74** secured by bolts **75** which extend through this cover and through ears **77** welded to the periphery of the cylinder **72**. This cover is provided with a large circular opening **76** which is partly closed by a concentric ring **78** removably secured to the front or exterior face of the cover **74** by stud bolts **79** or in any other suitable manner. This ring has a central circular opening **80** substantially larger than a cylindrical hub **81** welded to and projecting rearwardly from the vertical tubular bracket **45** through this opening **80**. The ring **78** serves to secure a ring-shaped rubber dust seal **80'** across the opening **80**, the inner edge of this dust seal engaging the hub **81**.

To the rear end of the hub **81** is welded a radially outwardly projecting ring **82** which forms a flange at the rear end thereof. To this flange is secured, as by an annular series of bolts **83**, a pair of tire rim plates **84** which are arranged in face-to-face relationship and are preferably secured together by another annular series of bolts **85**. These tire rim plates **84** are identical in construction and the outer perimeter of each is formed to provide a half rim **88** engaging and holding the beads **89** of a pneumatic rubber tire **90**.

The tire **90** and rim plates **84** are of the type which are commercially available and are made in mass production and used primarily for ground engaging vehicle wheels, the tire **90** having a conventional tube **91** and being inflated by means of a conventional filling nipple (not shown) so that the front and rear side walls of each tire are in compressive relationship, respectively, with the cover plate **74** and the plate **71** and so that the tread of the tire is in compressive relation with the cylinder **72** as best illustrated in FIGS. 3 and 6.

In the operation of the compactor forming the subject of the present invention the propelling vehicle push-pull bar **11** is being propleled along the road **12** to be compacted, thereby to impart similar movement to the several compacting units **10** which are shown as being four in number and arranged transversely of the line of movement of the propelling vehicle. In usual practice, the propelling vehicle is moved back and forth along the roadway until the desired degree of compacting and smoothing of the granular material thereon is achieved. This forward and backward movement of the front push-pull bar **11** of the propelling vehicle is transmitted to the shoe **13** of each unit, via the corresponding vertical plate **71** welded to the push-pull bar **11**, rubber tire **90**, rim plates **84** of this tire, flange **82** and hub **81**, to the corresponding vertical tubular bracket **45**, and thence via the three push-pull struts formed by the corresponding pair of lower links **42** and shock absorber **50** to the companion vertical tubular bracket **40**, casing **20** for the correpsonding eccentrically

weighted rotary compactor 21, and through the bars 24, and stud bolts 25 to the corresponding shoe 13.

The operator of the propelling vehicle energizes the several motors 38, thereby, through the shaft 31, gears 34 and shaft 30 associated with each motor, to rotate the companion pair of eccentric weights 35. These weights are in such phase relationship as to exert their full force additively in a vertical direction and to cancel each other out in a horizontal direction. The primary vertical vibration or oscillation forces so produced by each pair of eccentric weights 35 is transmitted through the bearings 33 to the casing 20 for each pair of weights and through the bottom bars 24 and stud bolts 25 to the companion shoe 13. Accordingly each shoe 13 is subjected to vertical oscillations or vibrations of substantial magnitude and force thereby to compact loose stones or like granular material forming the surface 12 to be compacted. Since the several shoes 13 are in closely spaced face-to-face relationship, they jointly compact a broad strip of the surface 12 to be compacted as they are moved along by the push-pull bar 11 of the propelling vehicle.

In the event it is desired to drive the propelling vehicle and compactor units 21 to a different location the compactor units can be held in elevated position by means of the chains 28 and a suitable lifting mechanism (not shown).

The several pairs of solid lower bars or links 42 transmit the necessary positive forward and backward force to keep all of the shoes 13 in line, transversely of the line of movement of the propelling vehicle, regardless of the obstacle which any one of these shoes encounters. In combination with these pairs of solid lower links or bars 42, the telescopic shock absorbers 50 have a number of important functions.

Thus it will be noted that each shock absorber 50 is in parallelogram relation to its pair of solid bars or links 42 thereby to provide a three strut parallelogram permitting vertical movement of the companion shoe 13 and the rotary compactor 21 associated with this shoe while at the same time tending to hold this shoe in any assumed position. Also the telescopic shock absorber is of the dash pot type which, through restricted internal oil flow resists but permits inward and outward movement of the telescoping parts 51, 52. This permits the shoe 13 associated with each shock absorber to tilt and ride up and down any sharp rise, such as a stone or hump encountered by it in moving along the surface 12 to be compacted. Thus, when a sharp rise or hump is encountered by the inclined forward end 14 of a shoe 13, the back pressure of the hump against this forward end is transmitted to the three struts 42 and 50 and since the upper strut 50 is in the form of a telescopic shock absorber of the dash pot type it contracts or collapses to permit the shoe 13 to tilt and its forward end 14 to rise and ride up on the obstacle. Conversely on encountering such a hump during rearward movement of the propelling vehicle the shock absorber strut 50 is forced to contract to permit the rounding rear end 15 to rise and ride up on the vehicle.

The rubber cushions 90 serve the important function of substantially completely isolating the push-pull bar 11 of the propelling vehicle from all vibrations escaping from the several eccentric weight rotary compacting units 21. Thus such escaping vibrations reaching each vertical tubular bracket 45 is transmitted via the hub 81 to the rim plates 84 for the pneumatic rubber tire 90. Such fore-and-aft vibrations of the hub 81 are then transmitted through the side walls of this tire to the casing 71, 72, 74 for this tire and hence are substantially completely absorbed by the pneumatic tire. Such escaping vibrations of the hub 81 in a direction perpendicular to its axis are absorbed by the tread of the tire 90. Accordingly, the several tires 90 substantially completely isolate the front push-pull bar 11 of the propelling vehicle from all vibrations escaping from the several eccentrically weighted compactors 21.

It will be noted that such escaping vibrations from the eccentric weight 35 are in the direction of the line of movement of the shoes 13 and propelling vehicle due to their axes being perpendicular to this line of movement.

From the foregoing it will be seen that the present invention provides a compactor which can be designed for very heavy duty service over a very irregular surface and in which the several compactor units will adapt themselves to such highly irregular surface and act to compact the surface with a high degree of effectiveness. It will also particularly be noted that the front push-pull bar 11 of the propelling vehicle is substantially completely isolated from vibrations escaping from the eccentrically weighted rotary compactors 21 by the air cushions formed by the rubber tires 90.

I claim:

1. A road compactor for attachment to a push-pull member of a propelling vehicle, comprising a compacting shoe adapted to be supported on the surface to be compacted, means vibrating said shoe, a pair of parallel links of substantially the same effective length extending fore-and-aft with reference to the line of movement of said propelling vehicle, means including pivots each arranged on a generally horizontal axis extending transversely of said links pivotally connecting the forward ends of said links with said shoe, means including pivots each arranged on an axis generally parallel with said first mentioned axes pivotally connecting the rear ends of said links with said push-pull member, and a shock absorber having front and rear operating parts movable against resistance toward and from each other, said shock absorber being arranged substantially parallel and in vertically spaced relation to said links and means including a pivot arranged on axis generally parallel with said first named axes pivotally connecting said front operating part of said shock absorber to said shoe, means including a pivot arranged on an axis generally parallel with said first named axes pivotally connecting said rear part of said shock absorber to said push-pull member, said pivots connecting said shock absorber at points which are vertically spaced from said first named axes, said operating parts of said shock absorber acting in combination with said links to permit said shoe to tilt about a generally horizontal axis extending transversely of the line of movement of said shoe, whereby said shoe may adapt itself to rises and drops in the terrain.

2. A road compactor as set forth in claim 1 wherein said shock absorber is arranged in a vertical plane substantially midway between the vertical planes of said links.

3. A road compactor as set forth in claim 1 wherein said shock absorber is arranged above said links.

4. A road compactor as set forth in claim 1 wherein said shock absorber is of the telescopic type arranged in a plane substantially midway between the vertical planes of said links whereby said links and shock absorber act as three struts to propel said shoe.

5. A road compactor as set forth in claim 1 wherein said shock absorber is of the telescopic type to form, with said links, three struts and wherein said means connecting said front operating part of said shock absorber with said shoe includes a bracket fixed to and rising from the rear end of said shoe and to the upper end of which bracket said front operating part of said shock absorber is so pivotally connected.

6. A road compactor as set forth in claim 5 wherein each of said pivotally connecting means includes a rubber bushing through which the movement of said propelling vehicle is transmitted through said links and shock absorber to said shoe.

7. A road compactor as set forth in claim 1 wherein a plurality of said compactors are connected to said propelling vehicle member with said shoes in edge-to-edge

relation to one another in a row extending transversely of the line of movement of said propelling vehicle and wherein an upstanding, vertical flange is fixed to the upper face of and at each of said opposing edges of said shoes, with its outer vertical face substantially co-planar with the corresponding opposing edge to prevent said shoes from riding up over one another at said opposing edges.

8. A road compactor as set forth in claim **1** wherein the means connecting the rear ends of said links and the rear operating part of said shock absorber to said push-pull member includes a bracket to which the rear ends of said links and the rear operating part of said shock absorbers are so pivotally connected and a yielding cushion interposed between said bracket and push-pull member and retarding the transmission of the vibration of said shoes, links and shock absorber to said push-pull member.

9. A road compactor as set forth in claim **8** wherein said yielding cushion is a resilient pneumatic tire.

10. A road compactor for attachment to a push-pull member of a propelling vehicle, comprising a compacting shoe adapted to be supported on the surface to be compacted, a bracket member arranged in advance of said push-pull member, a yielding cushion including a pneumatic tire operatively interposed between said bracket member and push-pull member with its axis in the direction of the line of movement of the propelling vehicle, generally horizontal struts, means including pivots each arranged on a generally horizontal axis extending transversely of said struts pivotally connecting the rear ends of said struts with said bracket member, and mean including pivots each arranged on a generally horizontal axis extending transversely of said struts pivotally connecting the front ends of said struts with said shoe.

11. A road compactor as set forth in claim **10** wherein said yielding cushion additionally comprises a box structure fixed to one of said members and having an opening opposing the other of said members, a hub on said other of said members projecting through said opening, and a tire rim in said box structure fixed to said hub, said pneumatic tire being fixed to said tire rim and having its side walls in compressive relation with said box structure.

12. A road compactor as set forth in claim **11** wherein the tread of said pneumatic tire is in compressive relation with said box structure.

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CHARLES E. O'CONNELL, *Primary Examiner.*

JACOB L. NACKENOFF, *Examiner.*

N. C. BYERS, *Assistant Examiner.*