Aug. 6, 1968 G. O. GARIS ET AL 3,395,626

SOIL COMPACTING MACHINE

Filed Jan. 13, 1966 3 Sheets-Sheet 1

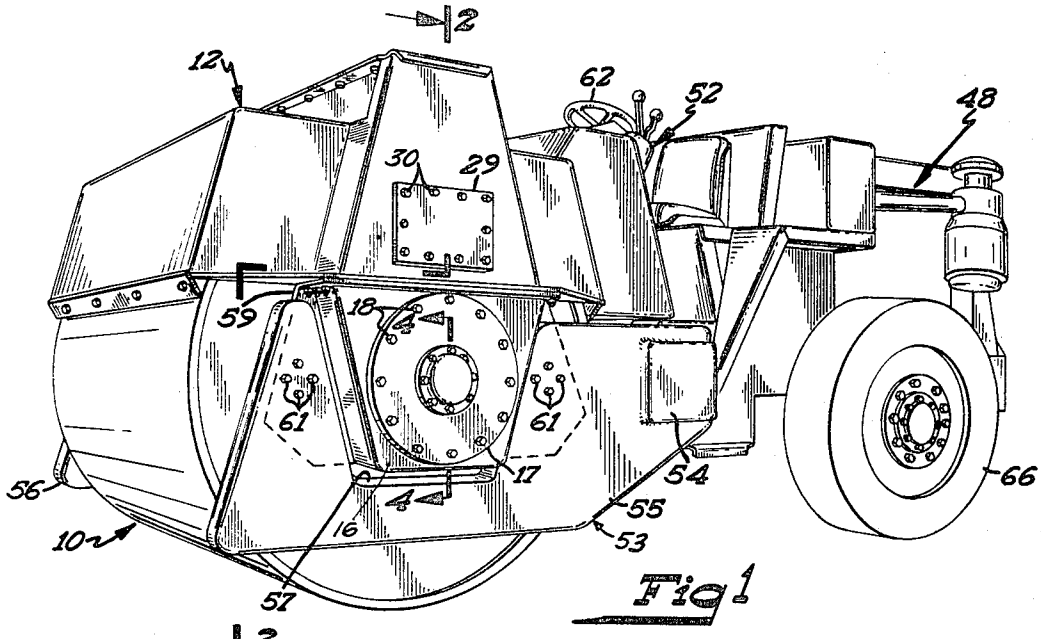


Fig 1

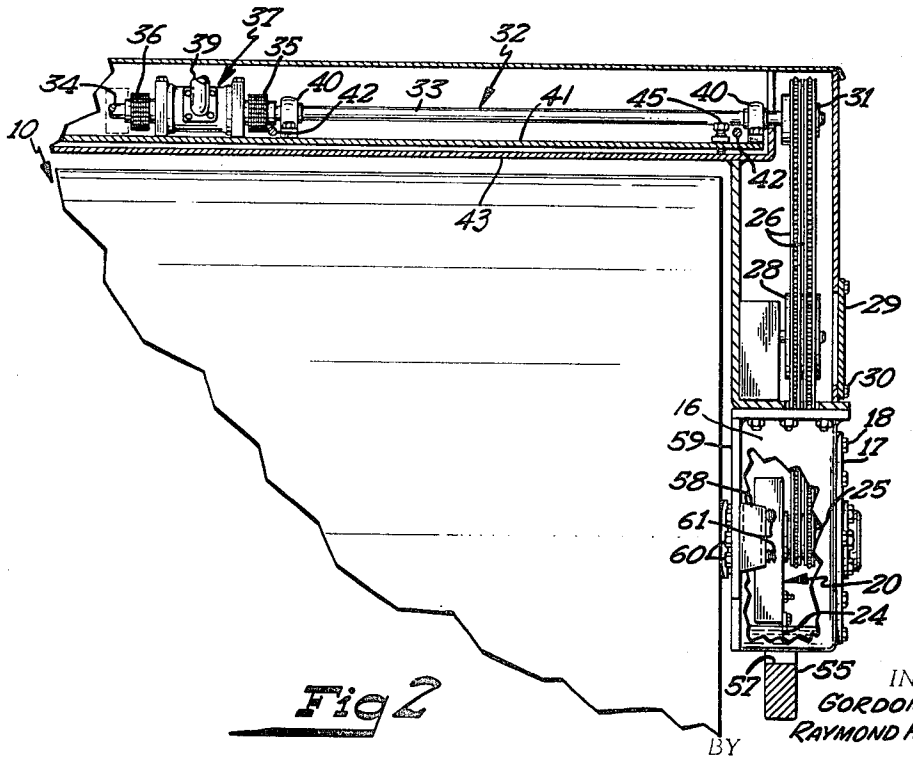


Fig 2

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Filed Jan. 13, 1966 3 Sheets-Sheet 2

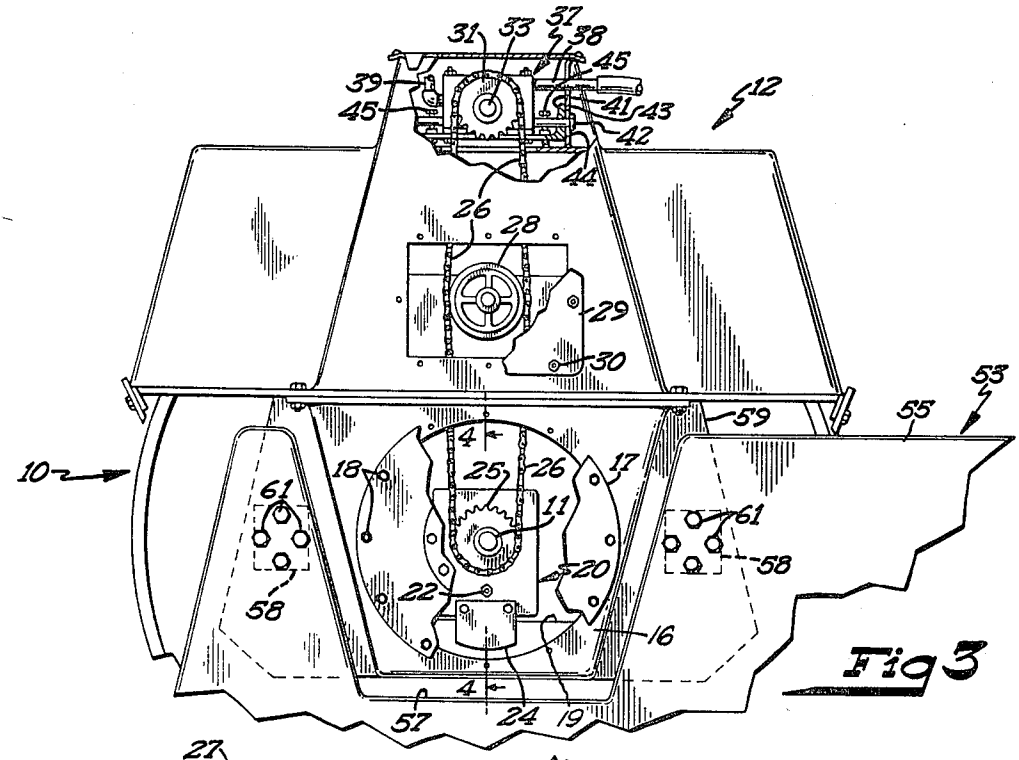


Fig 3

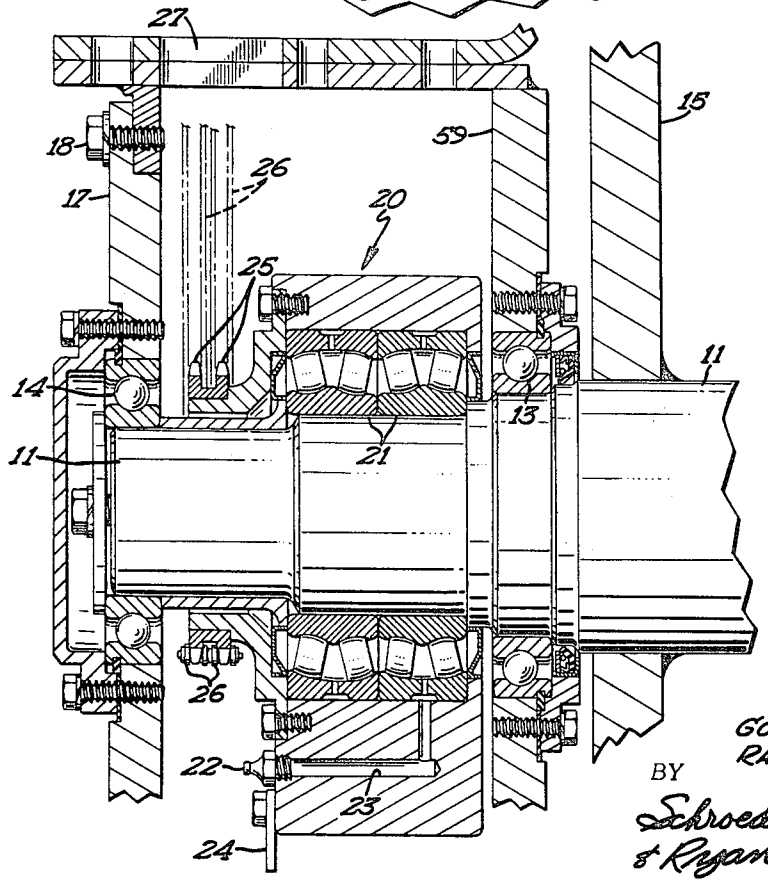


Fig 4

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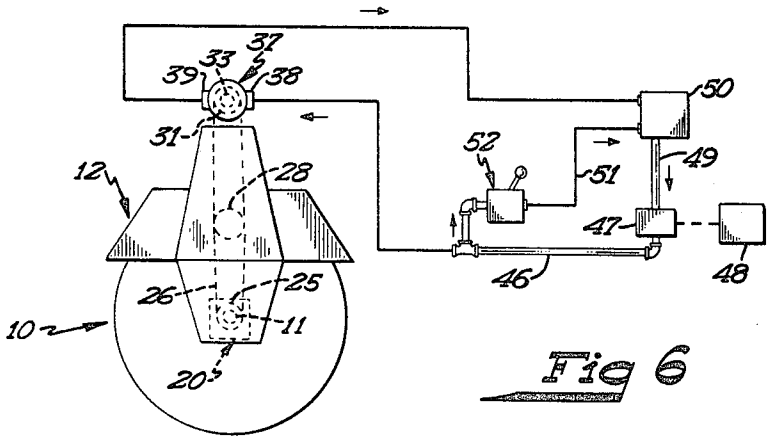


Fig 6

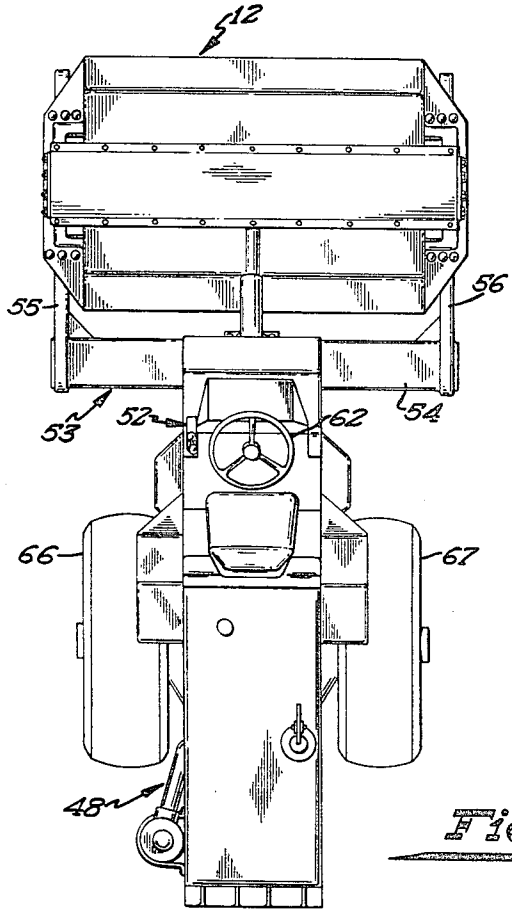


Fig 5

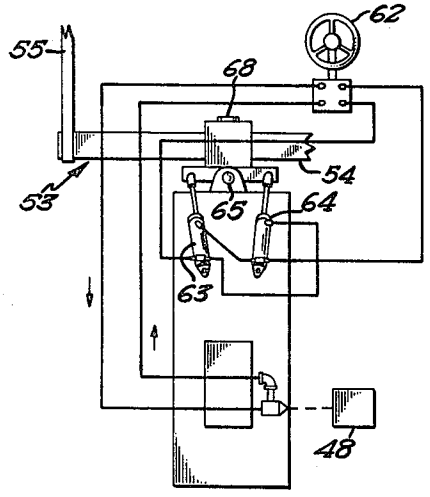


Fig 7

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United States Patent Office

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SOIL COMPACTING MACHINE

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5 Claims. (Cl. 94—50)

ABSTRACT OF THE DISCLOSURE

A ground-engaging roller has coaxial journals at its opposite ends rotating in bearings carried by a frame portion of the machine. Freely rotatably mounted on each of the journals is an eccentric weight, rotation of which imparts vibration to the roller. The eccentric weights are enclosed within housings formed in the frame. Opposite walls of these housings which are transverse to the axis of the journals mount the bearings in which the journals turn. These bearings have open communication with the interior of the housings so that oil contained in the housings and splashed about by rotation of the eccentric weights lubricates the bearings.

The eccentric weights are driven at high speed by a hydraulic motor which is drivingly connected with both of the weights by disconnectible power transmission means, disconnection of which enables the phase relationship of the weights to be altered, and reconnection holds the eccentric weights in selected phase relationship and enables both to be driven in unison by the hydraulic motor in any desired phase relationship.

This invention relates to soil compacting apparatus. More particularly, it relates to self-propelled soil compacting machines of the type in which a single vibrating roller of substantial axial length and of great weight provides the soil compacting action.

In self-propelling vibrating rollers designed for the compaction of soil, as heretofor known, one method utilized to provide additional compacting forces has been to employ a rapidly rotating transversely extending shaft with eccentrically mounted weights thereon. In such a device, the shaft is driven from the power pod which constitutes the prime mover of the machine. Such compacting apparatus, however, has proved unsatisfactory because of a number of disadvantages inherent in its construction. One such disadvantage resides in the fact that these shafts usually weigh as much as 800 pounds and are approximately 8 feet long. As a result the bearings in which the shafts rotate are soon worn to the extent of requiring replacement. To remove such a large and heavy shaft for repair and maintenance work is no easy task. On the contrary it entails considerable time, manpower, and machinery, to say nothing of the expense involved in the replacement of worn parts.

In addition, the power transmitting connection through which the shaft is driven from the power pod must cope with a host of unpredictable variables because of the necessary relative motion between the roller and the power pod. The distance across which the power must be transmitted continually varies. This causes excessive wear, loose, and ineffective driving action and often complete failure of the power transmitting connection. Our invention is directed toward obviating these difficulties, and at the same time providing a more useful and versatile compacting machine, capable of a variety of compacting actions.

Accordingly the overall object of this invention is to provide an improved soil compacting machine of simple and relatively inexpensive construction which, because of its novel design and construction, requires considerably less maintenance than comparable machines heretofor available, and which when necessary can be serviced and maintained more simply and hence more inexpensively than prior machines.

More specifically, it is an object of this invention to provide a vibrating roller type soil compacting machine in which the vibration is produced by rotating eccentric weights driven by a hydraulic motor which derives its power from a pump on the power pod so that the drive for the rotating weights is in nowise affected by relative motion between the roller and the power pod.

Another object of this invention is to provide a novel and improved soil compacting machine of the vibrating roller type which can be simply and quickly adjusted to provide a variety of different soil compacting actions to thereby better adapt the machine to various soil conditions.

With these observations and objects in mind, the manner in which the invention achieves its purpose will be appreciated from the following description and the accompanying drawings. This disclosure is intended merely to exemplify the invention. The invention is not limited to the particular structure disclosed, and changes can be made therein which lie within the scope of the appended claims without departing from the invention.

The drawings illustrate one complete example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a perspective view of a soil compacting machine embodying our invention;

FIG. 2 is a fragmentary vertical sectional view on an enlarged scale taken approximately along line **2—2** in FIG. 1, with portions broken away to better show the construction;

FIG. 3 is a fragmentary side elevational view on an enlarged scale with portions of the frame broken away to show the interior construction and arrangement;

FIG. 4 is a fragmentary sectional view taken on a further enlarged scale approximately along line **4—4** in FIG. 3;

FIG. 5 is a plan view of the machine;

FIG. 6 is a diagrammatic illustration of the hydraulic system which drives the rotating eccentric weights; and

FIG. 7 diagrammatically illustrates the manner in which the machine is steered.

The embodiment of our invention illustrated in the drawings includes a heavy steel drum or roller **10** which is fixedly mounted on a shaft **11**. As best shown in FIG. 4 the ends of shaft **11** extend outwardly beyond the end walls **15** of the drum or roller **10** and are journalled in bearings **13** and **14** which are mounted in the axially spaced walls of a box or housing **16** which constitutes part of a frame **12**. The outer wall of each box **16** is comprised in part of a removable access plate **17** secured in place with retaining lugs **18**. The lower portion of each box **16** is filled with oil or other suitable lubricant preferably to a level indicated in FIG. 3 by the line **19**. The inner wall of each box **16** extends forwardly and rearwardly beyond the box as indicated in broken lines in FIG. 1 for a purpose to be hereinafter described.

Mounted for rotation upon each of the end portions of shaft **11** between its bearings **13** and **14** is an eccentric weight **20**. Each of the weights **20** is supported upon the shaft by bearings **21** which are lubricated through a lubrication fitting **22** and duct **23**. A splash plate **24** is secured to the weight and extends radially outwardly to strike the oil and cause it to splash about and effectively lubricate bearings **13** and **14** as the weight revolves.

Mounted on each of the weights **20** in fixed relation

thereto is a sprocket gear **25** which is driven by a continuous chain **26** which passes upwardly through an opening **27** provided for that purpose in the upper wall of the box **16** and the immediately adjacent wall of the frame. This chain passes on each side of and has guiding engagement with an idler wheel **28** which is comprised of a metal hub and spokes and a polyurethane rim or tire. The idler wheel **28** is mounted for free rotation upon the frame **12** inwardly of a cover or access plate **29** which is secured by lugs **30**.

Each chain **26** extends around a drive sprocket **31** which is fixedly mounted on one end of a drive shaft **32** which in turn is rotatably mounted upon the upper portions of the frame **12** as best shown in FIG. 2 and FIG. 3. As shown in FIG. 2, the drive shaft **32** is divided into two sections **33** and **34**, each of which is connected by one of a pair of flexible couplings **35** and **36** to the drive shaft of a hydraulic motor **37**. The hydraulic motor **37** has a fluid inlet **38** and a fluid outlet **39**. The shaft **32** is rotatably mounted by means of a plurality of bearings **40** upon an elongated channel member **41** which extends transversely of the machine and generally parallel to the shaft **11**.

The channel member **41** is clamped between the flanges of a slightly larger transverse upwardly facing channel **43** formed in the frame **12**, as best shown in FIG. 3 by a plurality of elongated clamping bolts **42** spaced across the width of the machine and passing through vertical slots **44** in the channel **43** so that upon loosening the bolts, the channel **41** may be adjusted vertically. For this purpose a plurality of jack-screws **45** are provided. These screws extend downwardly through the web of the channel member **41** and bear against the web of the channel **43**. Thus, when the clamping bolts **42** are loosened, the drive shaft **32** may be raised or lowered for a purpose to be hereinafter described. It will be appreciated that belt, gear, or even direct drive means could be utilized as power conveying means in lieu of the chains **26** but we have found sprocket chains to be particularly well-suited for this purpose.

FIG. 6 illustrates the manner in which the fixed volume hydraulic motor **37** is driven. The inlet **38** of the motor is connected by a hydraulic line **46** with the discharge outlet of a fixed volume pump **47** which is mounted on a power pod indicated generally by the numeral **48**; and driven by the power source of the pod. This power source may be either a gasoline motor or a diesel engine, as desired, or even a self contained electrical power unit. The inlet of the pump **47** is connected by a hydraulic line **49** to a hydraulic fluid reservoir **50**. The reservoir **50** is also carried by the power pod and is connected by a second hydraulic line **51** to the line **46** through a simple two way valve **52**. The discharge of the motor **37** is, of course, also connected by a hydraulic line to the reservoir **50** so as to return the fluid to the reservoir.

The line **51** and the valve **52** have sufficient flow capacity to handle substantially the entire output of the pump **47** so that when the valve is open the fluid delivered by the pump will bypass the motor and the shaft **32** will remain stationary. When the valve **52** is closed, the entire output of the pump **47** will be delivered to the motor **37** to drive the same at its maximum speed. Adjustment of the speed of the shaft **32** and hence the revolution of the eccentric weights, is accomplished by varying the speed of the power source driving the pump **47**.

If desired, a more complicated flow control valve may be substituted for the valve **52** to enable regulating the speed of the motor **37** independently of the pump. However, one of the advantages of our compacting device is the fact that through this simple hydraulic line system we can utilize a simple and relatively inexpensive two way valve and thus reduce the cost and maintenance substantially. It will be understood, of course, that some other power source may be used in lieu of the hydraulic motor **37** but again, the motor **37** provides an effective and inexpensive way of accomplishing the desired purpose.

The frame **12** includes a yoke indicated generally by the numeral **53** by which it is connected with the power pod **48**. As shown in FIG. 5 the yoke includes a cross-member **54** and a pair of arms **55** and **56** each of which is formed with a large upwardly facing notch or recess **57** of sufficient size to accommodate the adjacent box **16**.

The arms **55** and **56** are connected with and supported by the remainder of the frame **12** through a pair of rubber blocks **58** indicated in dotted lines in FIG. 3. As there shown, one of those rubber blocks is mounted ahead of each box and the other is mounted behind each box upon the portions of the inner wall **59** of the box **16** which extend forwardly and rearwardly of the box as hereinbefore mentioned. Each rubber block **58** has a pair of metal plates imbedded therein, one of which has studs (not shown) fixed thereto and projecting from one side of the block to secure the block to the wall **59**, and the other has studs **61** fixed thereto and projecting from the other side of the block to secure the same to the arms **55–56** of the yoke. The resulting shock absorbing connection between the yoke and the rest of the frame **12**, obviously minimizes the transmission of vibration from the drum to the power pod.

The yoke **53** is connected with the pod **48** through a gimbal joint comprising a vertical pivot pin **65** and a horizontal pin **68**. Relative rotation between the yoke and the power pod about the vertical pivot pin **65** enables the machine to be steered, while relative rotation therebetween about the horizontal pin **68** permits the roller to follow the contour of the ground without hindrance from the power pod.

As diagrammatically illustrated in FIGURE 7, steering is effected by controlling the flow of pressure fluid from a hydraulic power source to a pair of double acting hydraulic cylinders **63** and **64** arranged to react between the yoke and the power pod. A steering wheel **62** which actuates conventional valve structure is provided for this purpose.

The power pod **48** includes a pair of propelling wheels **66** and **67** by means of which the entire machine is propelled forwardly or rearwardly as desired. These wheels are also driven by the gasoline or diesel engine which is mounted on the pod.

In use, the phase relationship between the weights **20** at the opposite ends of the shaft **11** will depend upon the particular compacting action desired. The drum which is about 54 inches in diameter rolls at a relatively slow rotational speed, approximately 5–30 r.p.m. while the weights **20** mounted on the shaft rotate thereabout within a range of 1000–1500 r.p.m. The preferred range of ratio between the rotation of the weights and the drum is between 30:1, respectively, and 60:1, respectively.

If the weights **20** are in phase, the resultant force applied on the drum **10** through the shaft **11** is one of constant amplitude. However, if the weights are displaced 180 degrees from each other, rotating forces of equal magnitude but displaced in time operate on opposite ends of the drum. This produces an elliptical force in the drum end planes and a twisting movement about the center of mass of the drum. The ground in the vicinity of the drum is thus subjected to horizontal, vertical, and twisting and impacting modes of vibration.

Since both weights are driven by the hydraulic motor **37**, the motion transmitting connection between the motor and at least one of the weights must be disconnectible to enable changing the phase relationship of the weights. One way this can be done is by simply loosening the clamping bolts **42** and turning the jack screws **45** to permit the channel member **41** to lower. This reduces the center-to-center distance between the sprockets **25** and **31** and permits the relative rotational positions of the weights **20** to be altered as desired, whereupon the slack in the

chains is taken up by turning down the jack screws and tightening the clamping bolts.

If the weights are displaced anywhere from zero degrees to 180 degrees the action effect is partway between that described for zero degrees displacement and 180 degrees displacement. If the weights are driven in opposite directions and displaced 180 degrees, the action will be one of horizontal twisting and vertical impact. Such counter rotation can be obtained by substituting crossed belt and appropriate pulleys for one of the chains and its sprockets or through the use of conventional bevel gears.

If two weights are placed at each drum end (a total of four) and the weights of each end pair counter-rotate and the weights are properly phased the result is vertical force only or so called impactor action.

Thus it can be seen that we have provided a versatile and yet simply and inexpensively constructed ground compacting machine which can be easily and inexpensively serviced and maintained. The shaft **11** being fixed with respect to the drum **10**, and the eccentric weights **20** being rotatably mounted on the shaft, the wear resulting from prolonged use is relatively slight since the bearings which support the extremely heavy shaft are not subjected to rapid rotation. Moreover, it is much easier, less time consuming, requires much less machinery, and is far safer to service the bearings of an eccentric weight such as the weights **20** than to remove and replace an eight foot long, 800 pound shaft characteristic of compacting machines heretofore available.

Another advantage of our soil compacting machine is that it obviates the many variables and the resulting difficulties attendant to the usual construction wherein the eccentric weights are driven from the power source of the pod through mechanical motion transmitting connections.

What is claimed is:

1. A vibratory compacting machine comprising:

(A) a frame;

(B) a ground-engaging roller unit having a cylindrical drum;

(C) bearing means at the ends of the drum freely rotatably connecting the roller unit with the frame;

(D) a plurality of rotary eccentric weights mounted on the roller unit at axially spaced locations for free rotation about the axis of the roller unit, the free rotation of said eccentric weights about the axis of the roller unit enabling the eccentric weights to be disposed in any desired phase relationship and secured in said relationship;

(E) drive means for said eccentric weights;

(F) power transmission means drivingly connecting the eccentric weights with the drive means; and

(G) propelling means connected with said frame for propelling the machine across the ground.

2. The vibratory compacting machine of claim **1**, wherein said bearing means include journals formed by the end portions of a shaft extending axially through the drum,

and wherein there are two of said eccentric weights, on mounted on one of the journals and the other mounted on the other journal.

3. A vibratory compacting machine comprising:

(A) a frame;

(B) a ground-engaging roller unit having a cylindrical drum and coaxial journals at the opposite ends of the drum;

(C) bearing means for the journals carried by the frame;

(D) a plurality of rotary eccentric weights mounted on the roller unit at axially spaced locations for free rotation about the axis of the roller unit,

the free rotation of said eccentric weights about the axis of the roller unit enabling the eccentric weights to be disposed in any desired phase relationship;

(E) common drive means for said eccentric weights;

(F) disconnectible power transmission means drivingly connecting each of the eccentric weights with said common drive means,

said power transmission means when connected holding the eccentric weights in selected phase relationship; and

(G) propelling means connected with said frame for propelling the machine across the ground.

4. The vibratory compacting machine of claim **3**, wherein said common drive means is a hydraulic motor, and wherein said disconnectible power transmission means comprises a shaft for each of said eccentric weights, both driven by the motor, and chain and sprocket means connecting each shaft with its respective eccentric weight,

the center-to-center distance between the shafts and the axis of the journals being adjustable to enable disconnection of the power transmission means.

5. A vibratory compacting machine comprising:

(A) a ground-engaging roller unit having a cylindrical drum and coaxial journals at the opposite ends of the drum;

(B) a frame having a hollow portion adjacent to each end of the roller unit,

each of said housings having opposite walls spaced axially of the journals and the journals spanning the distance between said walls;

(C) bearing means for each journal mounted in said opposite walls of its associated housing;

(D) rotary weight means surrounding each journal within its associated housing,

each of said rotary weight means having its center of gravity radially spaced from its axis of rotation;

(E) bearing means on each journal rotatably supporting its associated rotary weight means for free rotation about the journal;

(F) drive means on the frame drivingly connected with said rotary weight means to rotate the same relative to the frame and the ground-engaging roller unit, said drive means including a common power source for said two rotary weight means; and

(G) disconnectible power transmitting means connecting each of said rotary weight means with said common power source, disconnection of either one of said power transmitting means enabling the rotary weight means to be disposed in any desired phase relationship and reconnection thereof holding the rotary weight means in the selected phase relationship,

so that said two rotary weight means may be driven in unison but in any predetermined phase relationship.

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