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Domenighetti

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[54] **MULTI-COMPACTING MACHINE COMPRISING THREE OR MORE INTERARTICULATED UNITS FOR SOIL TAMPING**

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[52] **U.S. Cl.** **404/123;** 404/128; 280/400

[51] **Int. Cl.**[2] **E01C 19/26**

[58] **Field of Search** 404/123, 128; 280/419, 280/442, 492, 400, 408

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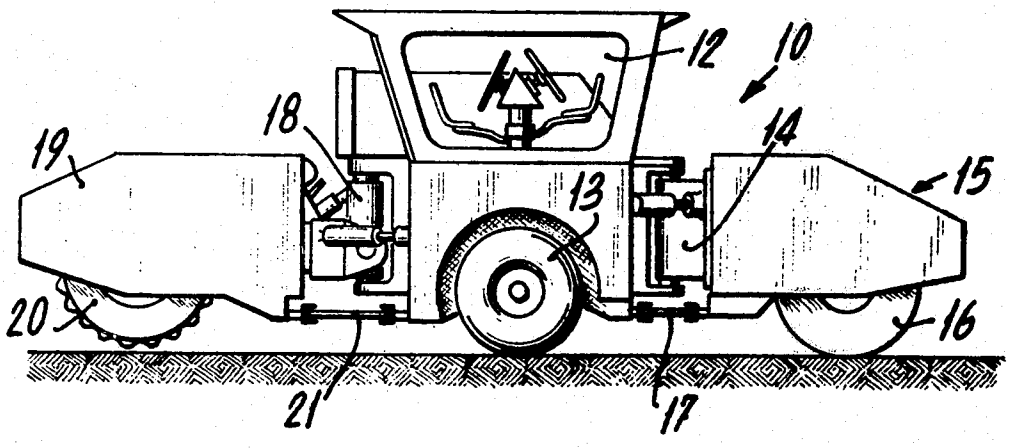
[57] **ABSTRACT**

A soil compacting machine comprising three interarticulated units, two of which are interconnected for universal relative swinging movement about three orthogonal axes, with hydraulic power means for effecting the swinging about at least two of these axes. The swinging between the other two units is also powered, the drive to the connections between the units being alternative so that when one pair of units is being swung relative to each other the other pair will idle, and vice versa.

7 Claims, 5 Drawing Figures



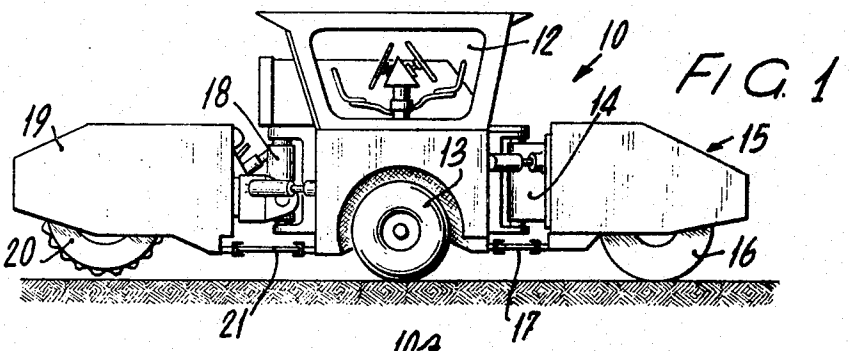


FIG. 1

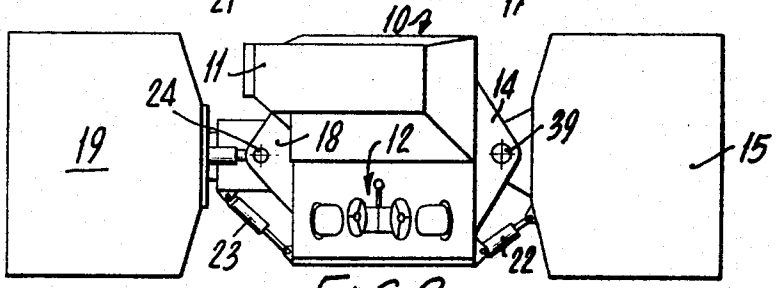


FIG. 2

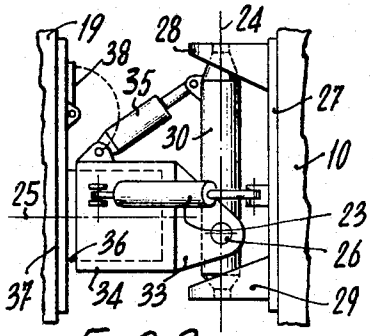


FIG. 3

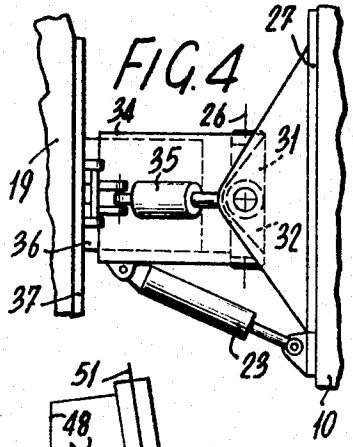


FIG. 4

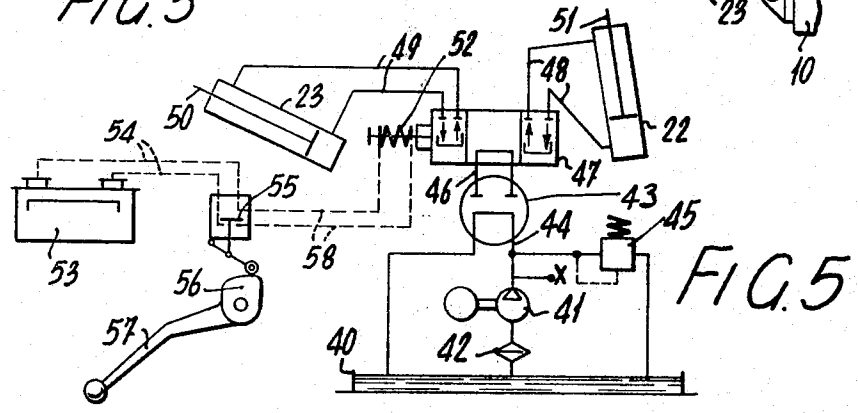


FIG. 5

MULTI-COMPACTING MACHINE COMPRISING THREE OR MORE INTERARTICULATED UNITS FOR SOIL TAMPING

Machines provided with a central articulation type of steering are known and as compared to conventional steering self-propelled machines have substantial advantages, among which are an accurate covering of the tracks being made on the soil by the machine wheels, a high handiness and adaptability to various types of soil.

It is the object of the present invention to make use of the above advantages in a machine having not two, but three or more units that are interarticulated and interconnected by articulated steering systems, such as those used on the most modern machines provided with centrally articulated steering.

According to the provided arrangements, a multi-unit machine is "caterpillar" configurated, capable of forward and rearward operation, insuring track covering, and can be driven by a single operator, whose driving position can be selected, as desired, on any of the several units comprising the machine.

A use of particular interest for this machine is in self-propelled tamping means.

Thus, it is desirable in such apparatus that the soil should be concurrently subjected to the action of different tamping systems which, by simultaneously acting upon the same soil portion, will mutually enhance the effect thereof. It is already known, for example, that there is an advantageous effect obtained by combining the action of a vibrating metal drum and that of a set of highly loaded tired wheels.

According to the present invention, since three or more tamping units can be interconnected, still more satisfactory results can be provided, that is adding to the action of the two above mentioned means, also the action of more or less vibrating sheepfoot or "grid" drums and the like.

An embodiment of the invention includes a centrally articulated combined roller comprising a set of vibrating metal drums and a set of multiple tired wheels, and a unit very similar to that provided with vibrating metal drum and connected to the tired-wheel unit by a universal joint type of steering, enabling the latter unit to rotate also about a transverse horizontal axis relative to the forward movement direction of the machine.

To enable a machine to enter a curve, such machines fitted with central articulated steering, normally use an actuator (hydraulic piston) which, by extending or retracting, causes the two units comprising the machine to rotate about the vertical axis of the steering articulation or joint.

Such an actuator is provided in multi-unit machines for each of the connecting steering articulated joints; however, for accurate both forward and rearward drive, these actuators are operated one at a time by the control zone, while the other are not, thus remaining idle,

More particularly, when the entire machine is to be moved in a given direction, the only actuator being driven is that at the first steering articulated joint in the movement direction. The other actuators are idle and therefore the third unit as well as the succeeding units behave as actual mere trailers (this even if the (soil loading) rolling elements thereof which are in contact with the soil transmit a tangential thurst force thereto).

When having to reverse the machine forward motion (which is very often necessary in machines of this design), all of the actuators are idle, except that of the steering articulated joint, formerly at the column "tail", but now at the column "head" because of the motion reversal.

To provide for connecting and disconnecting the several actuators, a distributing valve is inserted in the oleostatic control system and is controlled through the main lever used by the operator for motion reversal.

When this lever is in forward running position, the forward first actuator will be operated and the oil for all of the other actuators is shorted or shut off. Conversely, when the running reversal lever is moved to reverse movement position, the distributing valve connected thereto will comunicate the steering drive with the actuator formerly at the tail and concurrently idle all of the other actuators.

The accompanying drawing shows by mere way of example an embodiment according to the present invention, and more particularly:

FIG. **1** is an elevational view showing a triple-drive self-propelled tamping roller comprising three interarticulated units, as hereinafter described;

FIG. **2** is a plan view of the same machine;

FIG. **3** is a diagrammatic elevational view showing the steering articulated joint also enabling a rotation about a longitudinal horizontal axis, as well as about a transverse horizontal axis;

FIG. **4** is a plan view of the articulated joint shown in FIG. **3**; and

FIG. **5** shows the oleostatic system diagram for alternately operating the two actuators.

As it will be seen from the drawing, a tamping machine shown in FIGS. **1** and **2** comprises a main unit **10** provided with an engine **11** and driving position **12** and bearing on the soil by a plurality of tired wheels **13.** Instead of these multiple tired wheels, also a metal drum or other rolling system could be used. This unit **10** is connected by a conventional steering articulated joint **14** to a unit **15** provided with a vibrating metal drum **16** or other tamping means, the rotary movement of which is provided by a power transmission system comprising a cardan shaft **17.** When coupled to each other, as shown, the units **10** and **15** herein described will appear as and perform the functions of a combined tamping roller commercially known as "Compact-O-Go". However, unlike the prior art combined tampers, the main unit also includes a second steering articulated joint **18** located at the free opposite side, by which a third tamping unit **19** can be held connected, which third unit **19** is in turn provided with a rolling tamping means **20,** preferably also vibrating, and also rotatably driven by a motion transmission system comprising a cardan shaft **21.** Both of the two steering articulated joints **14** and **18** are provided inter alia with horizontal actuators **22,** 23, serving the purpose of controlling and adjusting the mutual angle in the horizontal plane for the three tamping units **10, 15** and **19.**

While the steering articulated joint **14** is of conventional design and is thus not described herein, the articulated joint **18** is made to enable the two units **10** and **19,** as connected thereby, to rotate not only about a vertical axis **24** (FIG. **3**), but also about a longitudinal axis **25** and about a transverse horizontal axis **26.** Moreover, all of these three freedoms of rotation must continuously controlled by the operator, so as to adjust

these capabilities of rotation and to stop the same. To this end, this joint could be made as shown in FIGS. 3 and 4, that is applying a plate 27 to the free surface of unit 10, two identical opposite rigid bearings 28 and 29 being carried thereon and supporting an element 30 rotatably carried about the vertical axis 24. Two horizontal arms 32, 32 are mounted on said body or element 30, extending about the transverse horizontal axis 26 and at the ends thereof engaging the element 33 comprising a cylindrical portion 34. Thus, this body or element 33 is capable of rocking about the transverse horizontal axis 26, but this rocking movement thereof is controlled by the actuator 35, the cylinder of which is rotatably mounted on said body 33, while the associated piston is rotatably mounted on said element 30.

The cylindrical body or portion 34 has a coaxial cylindrical internal cavity, the axis 25 of which is longitudinally horizontal. A cylindrical body 36 engages in said cavity and in turn is fast with the plate 37 which is carried on the surface of the free wall of the tamping unit 19. In order to control the rotary movement for the two units 10 and 19 about the longitudinal horizontal axis 25, use is made of a latching device 38 capable of stopping the relative movement.

The actuator 23 is used for controlling the rotation of the two units 10 and 19 about the vertical axis 24.

As to the actuators 22 and 23, having the purpose of driving the rotary movements for the tamping units 10, 15 and 19 about the vertical axes 24 and 39 of the steering articulated joints 18 and 14, these actuators may comprise oleostatic pistons operable by admitting high pressure oil from a conventional servo-steering system.

However, according to the invention, these pistons will be alternately operated in order to avoid undue slidings on the soil as would be caused by a concurrent drive of the two pistons.

According to the invention, only the first piston in the machine running direction will always be operated. In the case of two steering actuators, such as in the embodiment shown in FIGS. 1–4, the actuator 22 will be operated when the compactor is moving having the unit 15 as its front part, and at the same time the actuator 23 will be disconnected. Conversely, still in the same embodiment, when the machine is operating in the opposite direction (and hence its front part is the tamper 19), it is the actuator 23 that should be operated, while at the same time the actuator 22 will be disconnected.

FIG. 5 diagrammatically shows an oleostatic system according to the invention, wherein reference numeral 40 designates the main oil tank, from which the oil is drawn by a pump 41 through a filter 42 and delivered under pressure to a rotating distributor 43 operated by the machine steering wheel. Pressure oil reaches the distributor 43 through a piping 44 having a limiting valve 45 inserted therein. Normally, two pipings 46 branch off from the distributor 43 (of which one is a delivery piping and the other a return piping), directly leading to the steering actuator.

According to the present invention, said pipings 46 enter a two-position electro-distributor 47. At one of these positions, oil in pipings 46 is directly supplied to the pipings 48 of actuator 24 and the pipings 49 of actuator 23 are shut off, whereby the piston stem 50 can freely move without providing any resistance. When the distributor 47 takes its other position, then the pipings 46 are directly connected with the pipings 49, while the pipings 48 are shut off within the distributor 47, so that the piston stem 52 for the actuator 24 can freely move without providing any resistance.

The electro-distributor 47 takes either of the said two positions depending on whether the electromagnet 52 is energized or not by electric power. To this end, the electrical current from a power supply 53 is supplied through electrical conductors 54 until reaching a switch 55 controlled by a cam 56, the latter being connected to a lever on the pilot bridge.

This lever 57 is for imparting forward and rearward movement to the machine and hence determines the running reversal.

From the switch 55 the electrical current passes through the conductors 58 to the electromagnet 52.

By this system, the alternate energization for the two actuators is provided according to the movement direction.

In this description, an exemplary operating mode for the actuators has been explained, in which for the actuator control the position of the control lever for running reversal is used, thereby providing a sort of automatic control.

However, it will be appreciated that this sort of automation could be also otherwise obtained, as easily understood those skilled in the art.

What I claim is:

1. A multiple machine for compacting soil and the like, comprising three compacting units interconnected by steering articulated joints, at least one of said joints interconnecting the two adjacent units for rotation relative to each other about three orthogonal axes, and power means for selectively controlling the swinging of said two units relative to each other about at least two of said three orthogonal axes thereby to permit control by an operator of the position of said two adjacent units relative to each other.

2. A machine as claimed in clah4 1, and power means for swinging the other two units relative to each other about at least a vertical axis, and means for selectively actuating the power means associated with only one pair of said units at a time.

3. A machine as claimed in claim 1, said power means comprising means for selectively swinging said two units relative to each other about a vertical axis and about a horizontal axis transverse to the path of moveent of said machine.

4. A machine as claimed in claim 1, the connection of said two units for rotation about said three orthogonal axes comprising an upright body mounted for rotation about a vertical axis on one of said units, a cylindrical body mounted on said upright body for vertical swinging movement about a first horizontal axis passing through said vertical axis, and means secured to the other said unit of said two units and rotatable on and relative to said cylindrical body about a second horizontal axis coaxial with said cylindrical body and perpendicular to said first horizontal axis and perpendicular to and passing through said vertical axis.

5. A machine as claimed in claim 4, said second horizontal axis being disposed above said first horizontal axis.

6. A machine as claimed in claim 4, said cylindrical body encompassing said means on said other unit, a hydraulic jack interconnecting said cylindrical body and said one unit to swing said two units relative to each other about said vertical axis, and a hydraulic jack in-

terconnecting said cylindrical body and said upright body to swing said units relative to each other about said first horizontal axis.

7. A machine as claimed in claim 4, and latch means selectively engageable between said cylindrical body and said other unit to prevent rotation of said units relative to each other about said second horizontal axis.

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