March 26, 1963 C. G. MATSON 3,082,668

SURFACE-TREATING MACHINE

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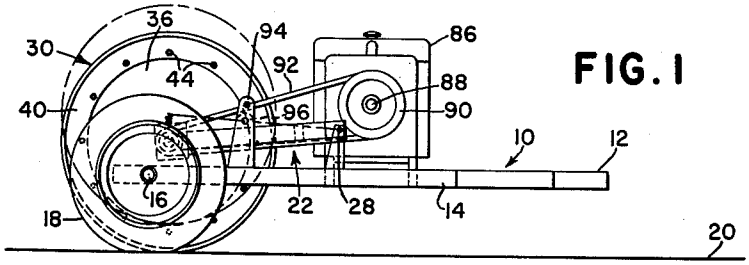


FIG. 1

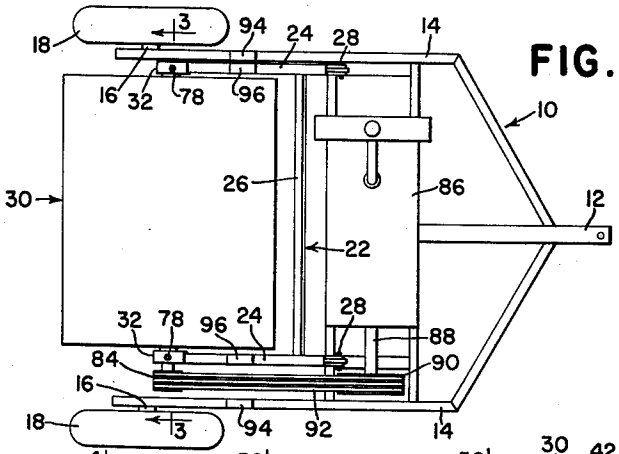


FIG. 2

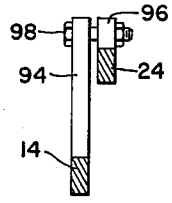


FIG. 6

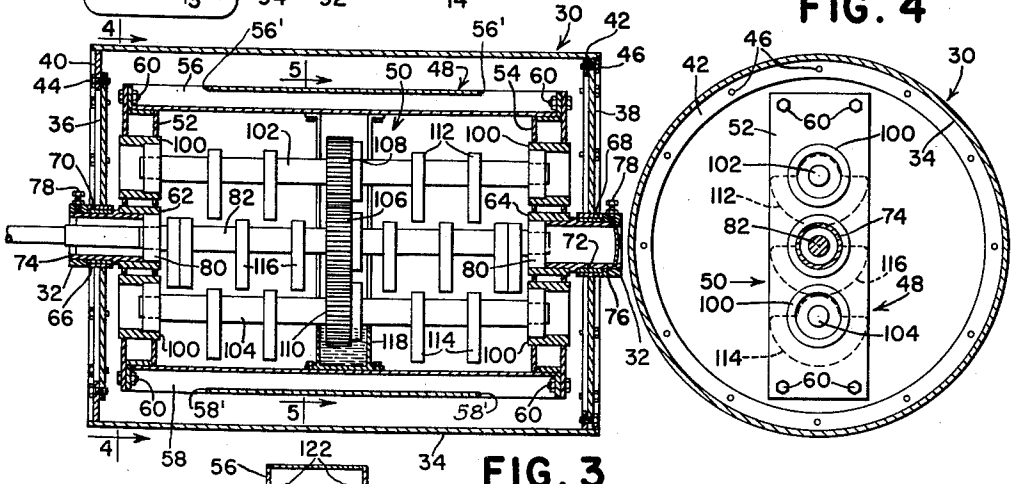


FIG. 3

FIG. 4

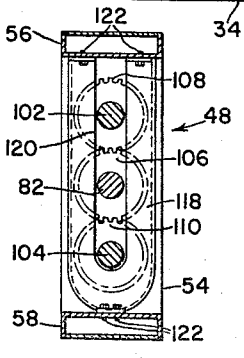


FIG. 5

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1

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SURFACE-TREATING MACHINE

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This invention relates to a surface-treating machine and more particularly to a machine such as a roller for use in compacting or otherwise treating such surfaces as roads, highways, airstrips and the like.

It is a principal object of the invention to provide an improved machine of the character referred to which combines the action of a roller or equivalent means with additional means for generating forces augmenting the action of the roller or the like. Specifically, the machine comprises a mobile main frame advanceable over the surface to be treated and propelling therewith a roller or equivalent element which rides over the surface. In the past, surfaces of this character were treated by rollers or equivalent means possessing substantial weight so that the necessary compaction of the surface could be achieved. According to the present invention, the roller or equivalent means may be made relatively lighter by augmenting the action thereof with vibrator means operative to create forces radially of the axis of the roller or otherwise generally perpendicular to the surface to be treated. Primarily, the generation of forces should be such as to be substantially vertically so that the vertical compacting action of the roller is augmented by the additional forces generated by the vibrator means.

It is a significant object of the invention to provide the machine in the form of a mobile main frame having wheels carrying the main frame over the surface, together with a sub-frame which serves to connect the roller to the main frame. The power plant for driving the vibrator means is located on the main frame and the vibrator means is carried by the sub-frame. It is a further object to locate the vibrator means within the roller, which is hollow for that purpose. Specific objects of the invention reside in improved means for driving the roller-housed vibrator means; means for mounting the roller on the main frame; means for locking the roller and sub- or secondary frame in a transport position; a novel arrangement of weights and shafts, geared together in the vibrator means; a novel arrangement of drum or roller components whereby the drum or roller may be readily assembled and disassembled; and an improved overall construction in which the roller is simply constructed yet readily excludes dirt and other foreign matter while the vibrator means is thus protected and contains, at least to a large extent, its own lubrication system whereby lubricant used in the vibrator means is prevented from escaping exteriorly of the roller.

The foregoing and other important objects and desirable features inherent in and encompassed by the invention will become apparent as a preferred embodiment thereof is disclosed, by way of example, in the ensuing description and accompanying sheet of drawings, the several figures of which are described below.

FIGURE 1 is a side elevational view of a preferred type of machine.

FIGURE 2 is a plan view of the same.

FIGURE 3 is an enlarged transverse section, with portions broken away, as seen generally along the line 3—3 of FIGURE 2.

FIGURE 4 is a section on the line 4—4 of FIGURE 3.

FIGURE 5 is a section on the line 5—5 of FIGURE 3.

FIGURE 6 is a fragmentary sectional view of representative means for securing the transport position of the roller and sub-frame.

2

As best seen in FIGURES 1 and 2, the machine comprises a mobile main frame indicated in its entirety by the numeral 10. This frame has a forward centrally located draw bar or tongue 12 and opposite side bars or frame members 14. Each of the bars 14 carries a stub axle 16 on which is journaled a ground, or surface-engaging wheel 18. The wheels are coaxially arranged and support the frame 10 for advance over whatever surface is to be treated, a representation of which is suggested by the line 20 in FIGURE 1. The frame may be connected to a tractor, truck or other draft vehicle and it is normally intended to be drawn forwardly by the tongue 12. However, this is a mere detail, since the machine may be moved, if desired, in the opposite direction.

Associated with the main frame 10 is a sub- or secondary frame 22, made up of a pair of side bars 24 and a transverse or cross bar 26 which rigidly interconnects the side bars short of their forward ends, leaving the forward ends projecting for pivotal connection at 28, 28 to the proximate portions of the main frame 10. The pivots 28, 28 are coaxial and connect the sub-frame 22 to the main frame 10 so that the two frames normally advance together, but the sub-frame is capable of vertical movement relative to the main frame about the axis through 28, 28. In other words, the means 28, 28 is a flexible or articulate connection. The bars 24 lie respectively closely inwardly of the main frame bars 14 and carry therebetween a ground- or surface-contacting element in the form of a hollow drum or roller 30. The details of construction of the drum will be set forth later. For the present, suffice it to say that the drum is journaled on the secondary frame 24 to rotate about a transverse horizontal axis established at or by supporting connections 32, 32 at opposite ends of the drum.

From the description thus far, it will be seen that the main frame 10 is supported on its wheels 18 and on whatever draft vehicle or appliance is utilized, and that the sub-frame, journaling the roller 30, has vertical relative movement about the axis 28, 28, the roller 30, of course, riding on or rolling over the surface 20 as the machine advances. If the weight of the roller is sufficient to achieve the necessary compaction or other treatment, the machine may be regarded as satisfactory. However, the addition of weight to the roller creates problems entailing increased cost, lower operating efficiency and the like. Accordingly, the present invention has been provided to overcome these problems in a simple and economical manner and at the same time in such way as to achieve more highly desirable results.

The drum or roller 30, as best shown in FIGURES 3 and 4, comprises a cylindrical casing 34 and opposite end walls 36 and 38. The end of the drum at which the wall 36 is located carries rigidly thereon a circular ring 40, which is welded or otherwise rigidly secured to the inner surface of the casing or annular wall 34. The opposite end of the drum carries a similar ring 42, which is likewise rigidly associated with the casing or annular wall at that end. The end wall 36 is removably secured to the inside of the ring 40, as by a plurality of cap screws 44; and the end wall 38 is secured to the outside of the other ring 42 as by a plurality of cap screws 46. The inside diameter of the ring 42 is larger than that of the ring 40; or, stated otherwise, the inside diameter of the ring 42 is large enough to pass the end wall 36 but is smaller than the outside diameter of the end wall 38. The reason for this is that the two end walls are normally preliminarily assembled to a support 48 which carries vibrator means 50, and the casing 34 is then assembled over the unit 48—50, being moved axially onto the unit from left to right as seen in FIG. 3. Hence, the vibrator means 50

is associated with the secondary frame 22 by being located interiorly of or housed by the hollow roller or drum 30. The construction of the support means 48 and vibrator means 50 will be described below.

The support 48 has opposite side members or parts 52 and 54, located respectively adjacent to and inwardly of the drum and walls 36 and 38. The end parts 52 and 54 are substantially identical, although symmetrically arranged, and are rigidly cross-connected by upper and lower transverse members 56 and 58. Each of these members is preferably of box section as shown in FIGURE 5; although, they may be otherwise constructed. The cross members are rigidly but removably secured to the end members, as by bolts 60 which are accessible through cut-outs 56', 58', respectively in the cross members (FIGURE 4). The end member or part 52 is preferably formed of a pair of steel plates welded together by appropriate spacers, and each plate is centrally apertured to coaxially receive therein a collar or ring 62, welded therein or otherwise rigidly secured thereto. A similar construction, repeated in the end member or part 54, includes, welded thereto, a similar collar or ring 64. The end walls 36 and 38 of the drum respectively have coaxial apertures therein, respectively fitted with collars or rings 66 and 68, welded thereto. Each of the rings 66 and 68 carries internally thereof a bearing or bushing as at 70 and 72, and shouldered sleeves 74 and 76, coaxial with and rigidly secured respectively to the rings 62 and 64, and thus in effect parts of the end members 52 and 54, are received respectively in the bushings or bearings 70 and 72, being normally fixed by set screws 78 whereby the support means 48 is carried by the end walls of the drum 30 in a selected fixed position so that the drum may rotate as it rolls over the ground while the support means remains fixed as to its position within the drum, since it is connected to the subframe 22 and normally occupies a generally upright position as shown in FIGURES 4 and 5; although, as will be brought out below, the position of the support means may be changed within the drum. For this purpose, the portions of the shouldered sleeves 74 and 76, which are fixed respectively to the rings 62 and 64 and which extend outwardly through the end walls 36 and 38 of the drum, are received respectively by the previously described connections 32 on the rear ends of the frame bars 24 of the sub-frame 22. Each of these connections includes lock means, here in the form of a set screw 78 by means of which the support means 48 may be locked to the sub-frame bars 24 so as to prevent rotation of the support means 48 while permitting the roller to roll along the surface 20. This connects the support and vibrator means unit 50 to the subframe, since the sleeves 74 and 76 are fixed to the rings 62 and 64 and these rings are in turn fixed to the ends 52 and 54 of the support 48. If it is desired to change the angular position of the support means about the axis of the drum, the set screws 78 may be loosened and the new position achieved, after which the set screws may be tightened. As indicated, the set screws may be provided with lock nuts to improve the securing action.

The support means rings or collars 62 and 64 carry appropriate anti-friction bearings 80 for journaling a central shaft 82, one end of which projects axially outwardly through the hollow sleeve 74 to carry a multiple-belt sheave 84. Drive means, here in the form of an internal combustion engine 86, is carried on the main frame 10 exclusively of the sub-frame 22. This drive means has an output or drive shaft 88 to which is keyed or otherwise fixed a multiple-belt sheave 90. A plurality of drive belts 92 afford means for drivingly interconnecting the sheaves 90 and 84, whereby the shaft 82 is driven from the power plant or drive means 86. It will be noted that the pivot axis 28, 28 is sufficiently close to the center of the drive shaft 88 as to enable vertical movement of the sub-frame and roller relative to the main frame 10 without seriously affecting the drive. Consequently, the sub-frame and roller may have substantial vertical movement relative to the main frame. As a matter of fact, the sub-frame and roller may be locked in a transport position (broken lines, FIGURE 1) in which the sub-frame is raised sufficiently to clear the roller from the surface 20. For this purpose, the main frame and sub-frame have cooperative means, here in the form of apertured ears or members 94 and 96, welded or otherwise mounted respectively on the parts 14 and 24 and through which releasable locking means, such as bolts 98 (FIGURE 6), may be passed to achieve the transport position. This is merely representative of any form of means that could be used in obtaining the transport position indicated. In any event, the transport position of the roller facilitates rapid travel of the machine over highways and the like when the roller is not in use.

In addition to the welded-end collars 62 and 64, the end members 52 and 54 respectively carry other and similar collars 100. Having reference to FIGURE 3, it will be noted that the upper pair of collars 100 are coaxially alined on an axis parallel to the axis of the central shaft 82 and spaced a certain distance therefrom. These upper collars respectively carry suitable anti-friction bearings for journaling a second shaft 102. The lower coaxially alined collars 100 are also established on an axis parallel to the axis of the shaft 82 and carry suitable anti-friction bearings, as indicated, for supporting a third shaft 104. The axis of the shaft 104 is diametrically opposed to that of the shaft 102 as respects the axis of the central shaft 82. In other words, as best seen in FIGURE 4, the three shafts 82, 102 and 104 are located on a common diameter. The three shafts, bearings, etc., are all assembled in the support means 48 before the support means is assembled into the drum. The prior assembly carries the end wall 36 and 38 of the drum so that the assembly just described can be inserted axially into the drum from the right as seen in FIGURE 3. It is for this reason that the interior diameter of the ring 42 at the right hand end of the drum is large enough to pass the end wall 36, which is ultimately secured, as previously described, to the opposite ring 40 by the cap screws 44. The larger diameter of the end wall 38 enables it to stop at and outside of the ring 42 to be secured thereto by the previously described cap screws 46.

The shaft 82 is an input shaft, driven by the drive means previously described, and the input is transmitted to the shafts 102 and 104 by gear means including gears 106, 108 and 110, keyed respectively to the shafts 82, 102 and 104. Since the gear 106 is in constant mesh with both gears 108 and 110, and since the gears are all of the same size, the shafts 102 and 104 will be driven by the shaft 82 but in a direction opposite to the direction of rotation of the shaft 82. All shafts will, of course, rotate at the same speed. For example, if it is assumed (FIGURE 4) that the shaft 82 rotates clockwise, then both shafts 102 and 104 will rotate counterclockwise but at the same speed.

The shaft 102 carries a plurality of weight means at 112, here four in number. A set of similar weights, as to size and number, is carried by the shaft 104 at 114. A double set of similar weights 116 is carried by the central shaft 82. In other words, the central shaft 82 carries eight weights 116, and each of the shafts 102 and 104 carries four weights at 112 and 114, which, added together, equal the number of weights on the shaft 82. Since all weights are of the same size and are timed and located as indicated in FIGURE 4, operation of the vibrator means 50 will create forces effective only along the diameter on which the shafts lie. Thus, as seen in FIGURE 4, all weights 112, 114 and 116 are in pendant positions. Consequently, as the shafts rotate and the weights 116 swing, say, to the left, the weights 112 and 114 will swing to the right. Since the number of weights on the shaft 82 is equal to the combined number of weights on the shafts 102 and 104, the weights and forces

will balance each other so that there will be no forces transmitted along a horizontal line. The same is true as respects any other diameters of the drum until the phase of the weights is 180° past that shown in FIGURE 4, in which case all weights will "throw" upwardly. As the weights continue to move to the position shown in FIGURE 4, they will again counterbalance each other and eliminate any fore-and-aft forces, until the weights attain the positions of FIGURE 4, in which case the combined force will be downwardly, or in opposition to the previously described upward force. Consequently, the effective forces are confined to the diameter on which all shafts lie. In a selected case in which the support means **48** is set upright as shown in FIGURE 4, these forces will augment those created by the roller as the roller is drawn over the surface **20**. That is to say, the upward forces will tend to lift the roller and the downward forces will tend to increase the downward effect of the roller on the surface, thus improving compaction of the surface by the machine. As best shown in FIGURES 3 and 5, the vibrator may include means containing a reservoir of lubricant for the gearing **106—108—110**. In the present case, this means may take the form of an appropriate shield **118** having a slot **120** therein for accommodating the assembly thereof in the support by receiving the several shafts **82, 102** and **104**. The shield means may be appropriately secured to the upper and lower members **56** and **58**, as by removable fasteners **122**. A sufficient quantity of lubricant, as indicated, is contained in the bottom of the shield so that the lowermost gear **110** may dip into the lubricant and thus transfer this lubricant to the other gears. The shield substantially encloses the gearing so that the oil is not thrown off into the interior of the roller. Although expensive seals are not provided at the junctions of the end walls **36** and **38** with their associated rings **40** and **42**, it is nevertheless desirable to keep the roller as water-tight and dirt-tight as possible. Likewise, it is desired to prevent lubricant escaping from the vibrator means externally of the roller.

The machine provided according to the present inventive design is compact, may be inexpensively constructed, and may be efficiently operated. Its travel over the surface to be treated may be relatively high, compared with heavy surface-treating machines heretofore known. For example, the forward travel may be in the range of three to five miles per hour; although, this is not intended to limit the machine to speeds in this range. It is desired that the vibration run about two hundred cycles per minute, which is a relatively low frequency but one which has proven acceptable. Again, these figures should not be construed as limiting the invention. As previously indicated, the present arrangement eliminates the substantial weight of prior devices but the vibrator means enables the production of greater forces in foot-pounds and velocity. The transport position of the roller may be readily achieved by placing a block, for example, ahead of the roller, and then drawing the machine ahead, whereby the roller will climb the block to bring the lug apertures in the members **94—96** into alinement for receipt of the bolts **98**.

Features of the invention other than those enumerated will readily occur to those versed in the art, as will many modifications and alterations in the preferred embodiment disclosed, all of which may be achieved without departure from the spirit and scope of the invention.

What is claimed is:

1. In a surface-treating machine, the combination of: a roller adapted to roll over a surface and including a cylindrical casing and opposite end walls; support means within the roller and having opposite sides respectively proximate to said end walls; means mounting the support means at said sides respectively on the end walls on the axis of the roller for rotation of the roller relative to the support means; one of the support means sides and the proximate one of said end walls being coaxially apertured; a central coaxial shaft journaled in the support means sides and having one end projecting axially outwardly through said one apertured side and said one apertured end wall; a second shaft parallel to the central shaft and journaled in the support means in radially spaced relation to the central shaft; a third shaft parallel to the central shaft and journaled in the support means diametrically opposite the second shaft and at the same radial spacing from the central shaft; gear means on the shafts operative to drive the second and third shafts from and oppositely to the central shaft; weight means on the shafts proportioned as to weight, location and timing so as to develop effective forces only along the diameter on which the three shafts are located and means for selectively securing the support means in angularly adjusted positions about the axis of the central shaft so as to change the angular position of said diameter on which the three shafts are located.

2. In a surface-treating machine, the combination of: a roller adapted to roll over a surface and including a cylindrical casing and opposite end walls; support means within the roller; means mounting the support means in the roller for rotation of the roller relative to the support means; a central coaxial shaft journaled in the support means; a second shaft parallel to the central shaft and journaled in the support means in radially spaced relation to the central shaft; a third shaft parallel to the central shaft and journaled in the support means diametrically opposite the second shaft and at the same radial spacing from the central shaft; gear means on the shafts operative to drive the second and third shafts from and oppositely to the central shaft; weight means on the shafts proportioned as to weight, location and timing so as to develop effective forces only along the diameter on which the three shafts are located; and means for selectively securing the support means in angularly adjusted positions about the axis of the central shaft so as to change the angular position of said diameter on which the three shafts are located.

3. A surface-treating machine, comprising: a main frame having wheels for carrying said frame over a surface to be treated; a secondary frame having front and rear ends and articulately connected to said main frame for advance therewith and for vertical movement of one end of said secondary frame relative to said main frame; a surface-contacting roller having means coaxially journalling same on said secondary frame adjacent to said one end to rise and fall with said one end and adapted to roll over the surface as said frames advance, said journaling means being axially hollow; vibrator means carried by and within the roller and including a support part and a movable part rotatable on said support part on an axis parallel to the roller axis to create forces acting along a diameter of said roller which includes the roller axis and the axis of said movable part to augment the action of said roller on the surface; means adjustably interconnecting the secondary frame and said support part for selectively fixing said support part in various angular positions about the axis of said roller so as to vary the angular position of the aforesaid diameter through which said forces act; drive means on the main frame; and means extending through said hollow journaling means and drivingly interconnecting said drive means and said movable part.

4. A surface-treating machine, comprising: a mobile frame; a surface-engaging element connected to the frame for advance therewith and comprising a hollow drum having a cylindrical casing and opposite end walls, one of said walls being axially apertured; coaxial means respectively on said end walls and journaling the drum on the frame, one of said coaxial means being axially hollow and disposed coaxially adjacent to said apertured wall; vibrator means contained within the drum and including a support and drivable means mounted on said support for rotation about an axis eccentric and parallel to the drum

axis for creating forces acting along a diameter passing through said axes, said support having members thereon coaxial with and respectively proximate to and journaled on the coaxial means to carry the support within the drum for rotation of the drum relative to the support, one of said members being hollow and projecting axially outwardly of the drum through the hollow coaxial means; adjustable means cooperative between the frame and the hollow member for selectively securing the support in various angular positions about the drum axis so as to vary the angular position of the diameter along which said forces act; drive means on the frame; and a drive shaft connected to the drivable means within the drum and extending outwardly through said hollow member and connected to the drive means.

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