July 6, 1965 A. G. COOK 3,192,838

LAND PACKER

Filed Jan. 2, 1962 3 Sheets-Sheet 1

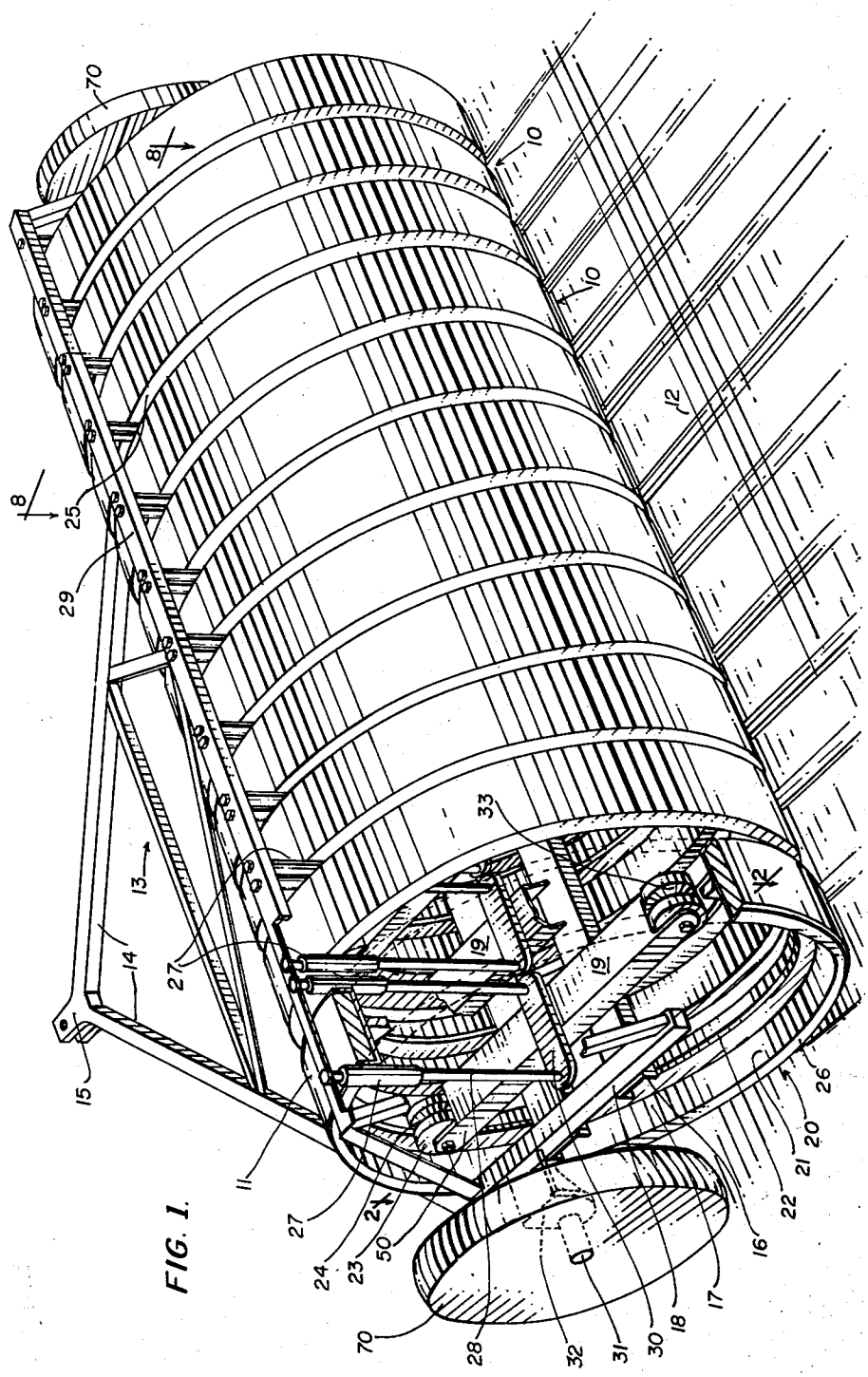


FIG. 1.

July 6, 1965 A. G. COOK 3,192,838

LAND PACKER

Filed Jan. 2, 1962 3 Sheets-Sheet 2

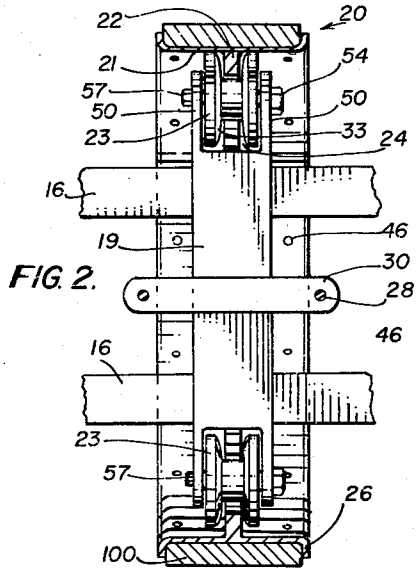


FIG. 2.

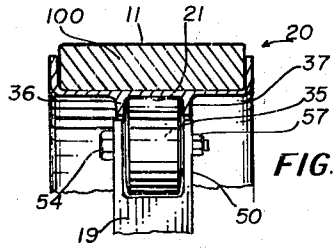


FIG. 3.

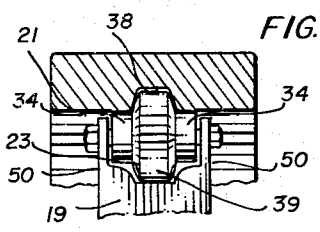


FIG. 4.

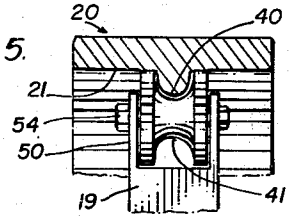


FIG. 5.

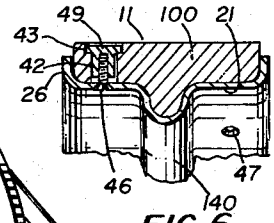


FIG. 6.

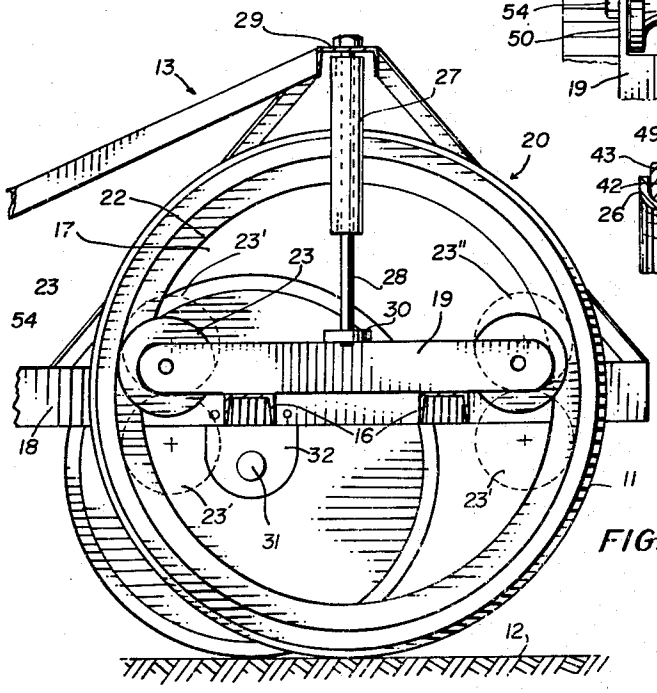


FIG. 8.

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July 6, 1965 A. G. COOK 3,192,838

LAND PACKER

Filed Jan. 2, 1962 3 Sheets-Sheet 3

FIG. 7.

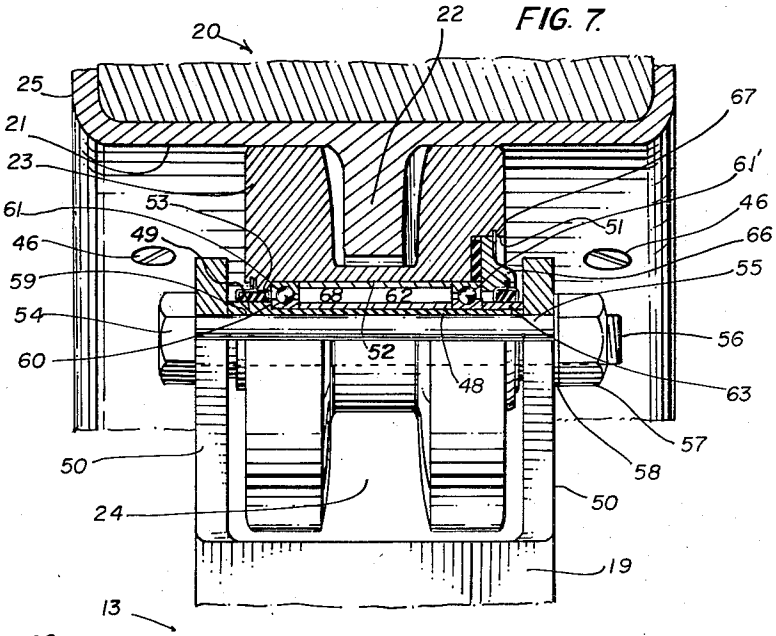


FIG. 9.

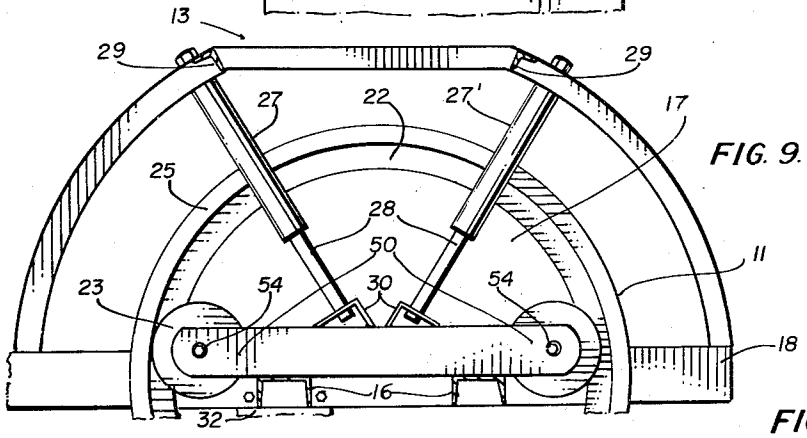
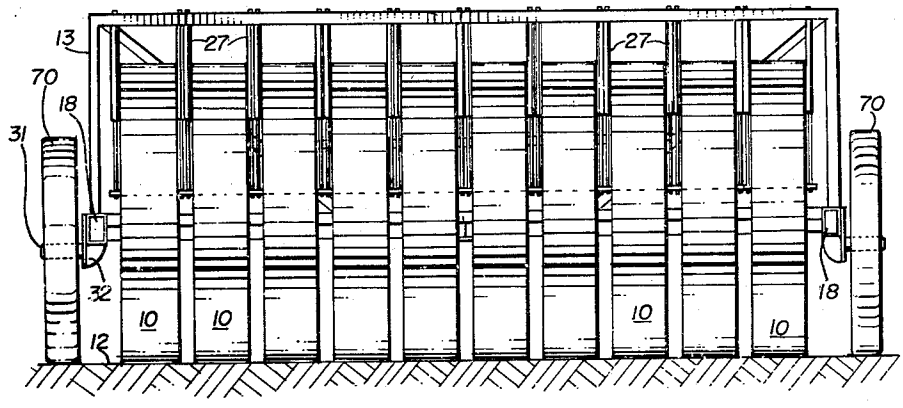


FIG. 10.



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3,192,838

LAND PACKER

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7 Claims. (Cl. 94—50)

This invention concerns land packers, and in greater particularity concerns improved support arrangements in a towable land packer for guiding an axially ganged array of annular packer wheels.

The compaction of soil as in road building and agricultural tillage requires relatively uniform application of pressure over all areas of the ground surface, and prior art packing implements have sought to achieve this objective by employing axially ganged annular packer wheels having a common axle passed through a large central bore in each annulus, to provide horizontal and vertical freedom of relative motions between adjacent wheels. Since adjacent annuli require to be mutually axially restrained and in rubbing contact, such arrangements produce a relatively high friction force and increase the towing load, especially over uneven ground.

Other systems have employed independent axles on swinging or pivoting sub-frames connected with a main towing frame, which arrangement has the disadvantage that such frames are subjected to both axial displacements and considerable twisting forces, often causing adjacent wheels to come into contact and decreasing useful life of support elements.

I am aware that it has been proposed heretofore to arrange annular packer wheels in axially ganged contacting relation between ground-engaging frame-supported end wheels, and to employ a transverse frame equipped with sets of spring-loaded rollers engaging the annular bores of each packer wheel to permit towage while allowing some freedom of relative vertical movement. Such structure imposes higher towing loads with increased wear rates, by failing to guide each packer wheel positively for independent motion.

I provide, according to the invention, an improved land packer which avoids the disadvantages of prior art machines, by a construction which comprises a towable wheeled frame, carrying a transverse horizontal framework in which are fixed a plurality of longitudinal subframes, each terminating at its forward and rearward ends in a transverse axle journalling a roller that guidedly engages the bore in an annular packer wheel, to maintain the latter in fore-and-aft direction, the framework also supporting a plurality of elongate rollers journalled to rotate at right angles to the packer wheel rolling axes and arranged to engage peripheral side margins thereof to maintain verticality of the packer wheels.

By the provision of the support and towing structures outlined, a low draft implement may be realized in which each packer wheel is positively guided and stably supported for limited independent vetrical movement so that adjacent wheels do not slide or rub upon each other. The towability of the implement on rough ground and on side hills is improved, while the thrust rollers operate with relative freedom from obstruction by trash, earth, and stones.

It is accordingly a primary object of the invention to provide a land packer construction wherein annular disc packer wheels are independently journalled for rotation about an axis which is restrained from movement in the support frame either axially or in the horizontal fore-and-aft direction, but which is free to move vertically in the frame as the wheel passes over uneven ground.

It is another object of the invention to provide guide elements for positively guiding the tracking and rolling movement over the ground of each of a plurality of annular disc packer wheels with respect to a wheeled towable

frame, by the arrangement of a rib or ribs and groove or grooves extending radially within the bore of each annulus for co-operative engagement with frame-supported thrust rollers spaced along a horizontal diameter of the annulus for preventing axial displacement and skew while permitting some vertical motion therebetween.

It is yet another object of the invention to provide a three point suspension in a packer wheel support for rolling packer wheels employing thrust rollers engaging inwardly directed wheel flanges and other rollers engaging the sides of the wheel and journalling in the support about axes at right angles to the axes of the thrust rollers.

Still another object of the invention is the provision of positively acting supporting and guiding structure for maintaining an annular packer wheel in a constant plane with respect to a towing frame, wherein a pair of frame-supported flanged or grooved rollers disposed at opposite sides of a central bore through an annular disc wheel are in free rolling contact with the wall of the bore permitting limited movement in the plane of the disc but preventing relative axial movement between the rollers and the disc, and wherein a further pair of frame-supported rollers having axes at right angles to the roller axes engage the side margins of the annulus at points angularly spaced from the flanged rollers.

Still other objects and features of the invention will be made apparent from the exposition of preferred embodiments in which the invention may be realized or put into effect, as now follows, with reference to the accompanying drawing, wherein:

FIGURE 1 is a perspective illustration of a land packer embodying the principles of the invention, in partly cut away form as viewed from the left rear;

FIGURE 2 is a cross section taken on line 2—2 showing one form of thrust roller and annulus rib;

FIGURES 3, 4 and 5 are sections similar to FIGURE 2 showing alternative roller guiding arrangements;

FIGURE 6 shows in partial section a modification of the FIGURE 5 structure;

FIGURE 7 is a cross-sectional detail in part of an axle support and roller journalling construction;

FIGURE 8 shows an elevation end view taken on line 8—8 of FIGURE 1;

FIGURE 9 is a modification of the FIGURE 8 structure; and

FIGURE 10 is a rear elevation view of the implement shown in FIGURE 1.

In a land packer as shown in FIGURES 1 and 10, a plurality of annular wheels **10**, **10** of cylindrical disc form, in axially ganged array, have cylindrical exterior faces **11**, whose lowermost portions compact areas of the ground which sustain the entire weight of each wheel. The wheels are contained and guided for rolling movement within a towing framework **13** having a forwardly extending A frame **14** equipped with a hitch **15** for connection with a suitable vehicle such as a tractor (not shown).

Transverse horizontal beam members **16** passing through wheel apertures **17** are connected between longitudinal side frames **18** to rigidly brace the framework. A respective plurality of longitudinal thrust members **19** are fixed at spaced intervals along the length of the beam members.

Each annular wheel **10** has a relatively thick rim portion **20** which is bounded by the ground-engaging face **11** and which is integrally formed on its radially inward side **21** with a projecting central rib or flange **22**. Roller means **23** having their peripheral surfaces shaped to complementarily engage the flanges are secured in the forward and rearward ends of the thrust members **19** and with a longitudinal spacing so chosen that when one roller

bears against face 21 at one side of the wheel aperture 16 the other roller has a small clearance from the face 21 opposite, but the clearance is not so great that the flange 22 may disengage from roller groove 24.

Side faces 25 of each annulus are planar, and lie in a plane perpendicular to the cylindrical axis. The side faces may be shaped integrally with rim 20 or they may be formed as radial out-turned flanges 26 as in FIGURES 2 and 6. Each annulus is maintained erect by a pair of vertically disposed rollers 27 which engage the side faces at points above the wheel axis. These rollers are supported upon and journalled on rods 28, which are secured by their upper ends in upper transverse frame member 29, and supported by their lower ends in extension bars 30 fixed upon thrust frame members 19.

Referring additionally to FIGURE 8, the maximum distance between the axes of forward and rearward rollers is so chosen in conjunction with the diameters of rollers 23, that the annulus is free to move horizontally only a small amount, while being also free to move vertically a considerably greater distance between limit positions 23' and 23'' as indicated by phantom outline positions. Accordingly, a packer wheel so constructed is free to roll over an obstruction, or to drop into a depression in the ground below adjacent wheels of the gang, without either lifting the packer frame or burdening it with the load of the wheel, provided the vertical displacements do not bring the rolling faces of the pair of rollers simultaneously into contact with wheel face 21. The extent to which the annulus is free to move in the frame while still retaining the rollers 23 captive with their grooves 24 engaged upon rib or flange 22 when the line between roller centers lies along a wheel diameter, depends upon the depth of the groove and rib. With suitable guide/thrust rollers which have a diameter of the order of 1/6 of the wheel diameter, the required rib height as measured radially is of the order of 1/20 of the wheel diameter if the roller maximum clearance from face 21 is of the order of 1/30 the wheel diameter. Packer wheels of the larger sizes, for example from 3 to 4 feet in diameter, may have a total excursion between upper and lower limit positions ranging from 10 to 15 inches.

Since the presence of a hummock or boulder having a height greater than half of such excursion distance tends to cause an undue amount of localized compaction while leaving other land areas unpacked, the normal position of the thrust frames 19 and side frames 18 are preferably adjusted so that the line between roller centers is somewhat above a horizontal wheel diameter. This is effected, for example, by positioning axle 31 and mounting 32 with respect to the side frame, thereby establishing a datum with respect to ground-engaging wheels 70.

Such adjustment permits a correspondingly higher obstruction to be passed over with the packer wheel "floating" while reducing the distance to which the wheel may drop into a depression before being supported on the thrust frame.

Vertical rollers 27 are preferably paired at positions between adjacent packer wheels, one roller of each pair being disposed for rolling contact engagement with the side face of a respective wheel rim, and the rollers being spaced transversely so that they are either in direct rolling contact with each other, or very slightly spaced apart. In the latter relation, upon deflection of a roller due to side thrust exerted by either or both adjacent wheels, the pair come into contact. It will be apparent that since the adjacent rollers are turning in opposite senses, they will roll freely upon each other.

When a pulling force is applied to hitch 15 to tow the packer, its individual wheels will each be urged in the direction of towing pull by the thrust force developed between the forward roller 23 and the face 21 of the wheel, causing the wheel to roll much as a hoop may be pulled along by a stick. The fore-and-aft alignment of the wheel will be maintained by the guiding action of the

rib 22 engaging the respective grooves 24 of forward and rearward rollers 23, the engagement with the groove of the latter roller by the wheel rib being relatively looser than the engagement with the forward roller where the sides 33 of the roller grooves are bevelled. The verticality of the wheel is maintained by the side rollers 27, so that any tendency for the wheel to incline laterally is resisted. Accordingly, operation of the packer on side hills is improved and the wheels roll straight along at all times, thereby requiring a minimum of pulling force.

Various alternative thrust/guide roller and packer wheel forms may be employed, as will be described with reference to FIGURES 3 to 6. By employing a non-grooved roller 35 as in FIGURE 3, for guidedly engaging a pair of laterally spaced ribs or flanges 36, 37 hollow rollers formed as shell bodies may be used.

A groove 38 may be radially recessed into the inner face 21 of the packer wheel for use as in FIGURE 4 with a ridged roller wherein cylindrical end boss portions 34 are separated by a ridged portion 39, the latter being formed with a profile complementary to that of the groove. The radial height of the ridge is made less than the radial depth of the wheel groove with respect to face 21.

A wheel rib formed with a domed or rounded shape in cross-section may be employed as in FIGURE 5 for engagement within groove roller 23. The rib 40 projects radially inwardly a lesser distance than the depth of grooves 41 in which it is received. Such rib section may be integrally formed in casting iron or steel rims 20.

The rim portion of a wheel 10 of the cross-sectional form similar to that shown in FIGURE 5 may be fabricated as a steel pressing as shown in FIGURE 6, having a rib 140 centered on face 21, and side flanges 125 forming a curved channel section. Affixed to the rim by any suitable means are a peripheral group of sectoral weights 100 formed of metal or composition. Such sectoral bodies may have their ground-engaging faces 11 patterned in any suitable manner, and are preferable apertured at peripherally spaced intervals by stepped bores 42, 43. Headed bolt 44 is formed so as to be received in the bores, and has a shank formed with threaded bore 45 wherein is received a flat-head bolt 46, the latter being passed through the wheel rim from the side 21 into countersunk aperture 47. Other fastening means including permanently affixed clips or rivets may be used.

A replaceable roller and journal structure is detailed in FIGURE 7, showing in half section a roller 23 having a central groove 24 adapted to be received between a forwardly projecting side flange 50 of channel section thrust member 19. The roller has a stepped bore wherein the bore 51 recessed inwardly from the right side of the roller has the largest diameter, a main bore 52 extends nearly through the roller, and connects with a lesser bore 53 opening into the left side. Axle bolt 54 having a straight shank 55 and threaded end 56 is made long enough that nut 57 and lock washer 58 may be received on the projecting threaded end.

A stepped diameter sleeve 48 has an internal bore 59 which is a sliding fit upon the bolt shank and has an enlarged end 49 which provides a shoulder 60 against which stationary race of a radial thrust ball bearing 61 bears. A spacer sleeve 62 coaxial about sleeve 48 bears by its end against the inner races of each of the pair of thrust bearings 61, 61', while end sleeve 63 which is also coaxial with sleeve 48 extends between the outside of the inner race of 61' and the frame 50. The combined length of sleeve end portion 49, the axial lengths of the inner races, and of sleeves 62 and 63 is made only slightly less than the distance between flanges 50 so that the assembly may be inserted therebetween, while pressure exerted by turning down nut 57 maintains the inner races fixed in member 19.

The outer race of bearing 61 is held against the shoul-

der 64 formed between the junction of bores 53 and 52, and that of 61' is held against a keeper disc 66 removably held in bore 51 by spring ring 65 seated in groove 67 in the roller. A spacing sleeve 68 chosen so as to provide an axial separation of the inner races with respect to the separation of the outer races provides for pre-loading of the balls when the assembly is made. Suitable seals 70 are seated in the roller ends to wipe upon the sleeve portion 49 and upon the spacer sleeve 63. Sleeve 48 must have a length greater than the roller width, but less than the distance between opposed faces of frame extensions 50.

The roller assembly with its sealed bearings is readily removed by releasing nut 57 and lock washer 58, and withdrawing the bolt clear of the left-hand frame extension. When one or both rollers are so removed, the annulus may be rolled out of line with respect to adjacent wheels to enable maintenance operations to be carried out.

The embodiment of FIGURE 9 provides a relatively greater stability of packer wheel trailing, and permits a relatively greater vertical displacement for the annulus, by providing at all times for at least three-point guidance by rollers. The axes of rollers 23 may be relatively more closely spaced, so that when either roller is engaged with the face 21 of the wheel the other roller, located along a wheel diameter from the first, may be completely unguided by the rib 22. The guidance is provided by employing a pair of rollers 27, 27', angularly spaced apart at about 60 degrees of arc from nearest roller 23 and from each other. The provision of such multiple side rollers determines the plane of the wheel by reference to three points, two of which at all times are the points of contact of the rim side faces with each of rollers 27, 27', and a third point located at the engagement of rib 22 in groove 24 on a roller 23. It is to be understood that the support rods 28 are made suitably stiff that side thrusts will not allow a disengaged roller 23 such as the rearward roller to be forced out of registry with the plane of wheel rib 22.

While specific and preferred embodiments of the invention have been described with reference to the accompanying drawings, it is to be understood that many variations of dimensions and frame re-arrangements may be effected as will yet retain the teachings of my invention, whose scope is delineated by the appended claims.

I claim:

1. In a land packer,

(1) a towable transverse horizontally extending frame,

(2) having ground engaging support wheels journalled in opposite ends thereof,

(3) a plurality of thrust and guiding members in said frame aligned with the towing direction and having thrust roller means journalled in the forward and rearward ends of each of said members,

(i) portions of the periphery of said roller means being radially offset from adjacent portions, and

(4) a like plurality of annular packer wheels disposed between said support wheels and spaced closely axially apart along said frame,

(ii) the inner periphery of said packer wheels comprising complementary radially formed surface portions engageable by and spaced radially from opposed peripheral portions of respective roller means interfitting said inner surface portions in flange-and-groove relationship, whereby to prevent axial displacement of said packer wheels with respect to said frame but allowing limited displacement therebetween in the vertical direction.

2. A packer as claimed in claim 1 further comprising other roller means disposed on each side of a packer wheel and journalled in the frame to rotate about upwardly extending axes, said other roller means engaging the side faces of said wheels.

3. A packer as claimed in claim 10 further comprising a pair of other roller means journalled in the frame to rotate about upwardly extending axes, said axes lying in a common vertical plane parallel with the towing direction and being angularly spaced, said other roller means engaging the side faces of said wheels.

4. A packer as claimed in claim 2 wherein said other roller means are journalled to rotate about vertical axes and are disposed in pairs on respective side faces of said packer wheels.

5. A packer as claimed in claim 1 wherein said frame is carried above ground level at such distance that the point of contact of a thrust roller with the inner periphery of a respective packer wheel rolling on level land normally lies above the center of said packer wheel.

6. A packer as claimed in claim 1 wherein said packer wheels have a medianly disposed radially inwardly projecting rib and said thrust rollers have complementarily grooved cylindrical faces having said rib received in said groove.

7. A packer as claimed in claim 1 wherein said packer wheels have a medianly disposed groove projecting radially outwardly into the wheel and said thrust rollers have a medianly disposed complementarily shaped disc portion received in said groove.

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