

Nov. 24, 1953

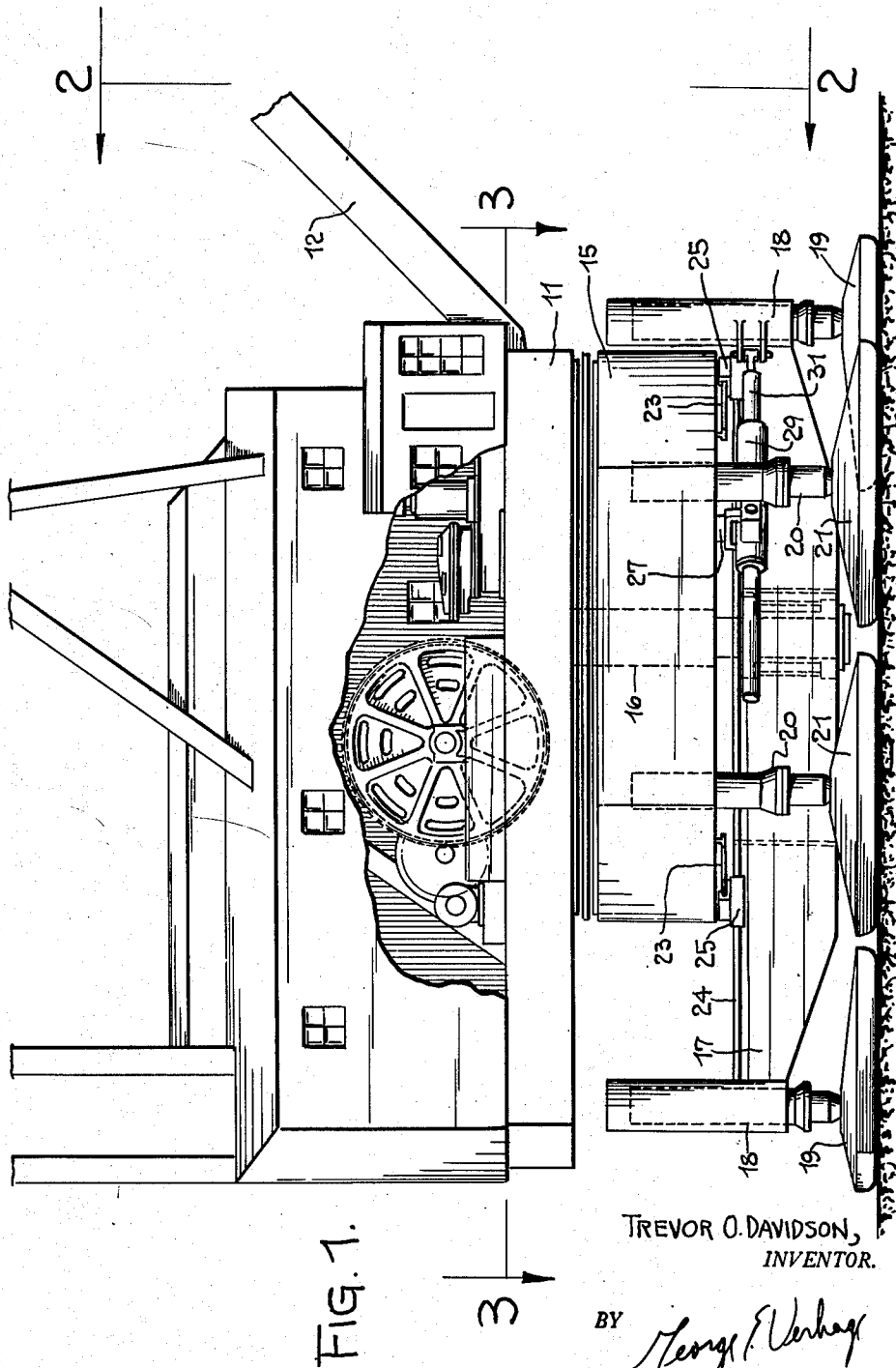
T. O. DAVIDSON

2,660,253

SUPPORTING PROPULSION MEANS FOR DRAGLINES AND THE LIKE

Filed Dec. 31, 1951

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

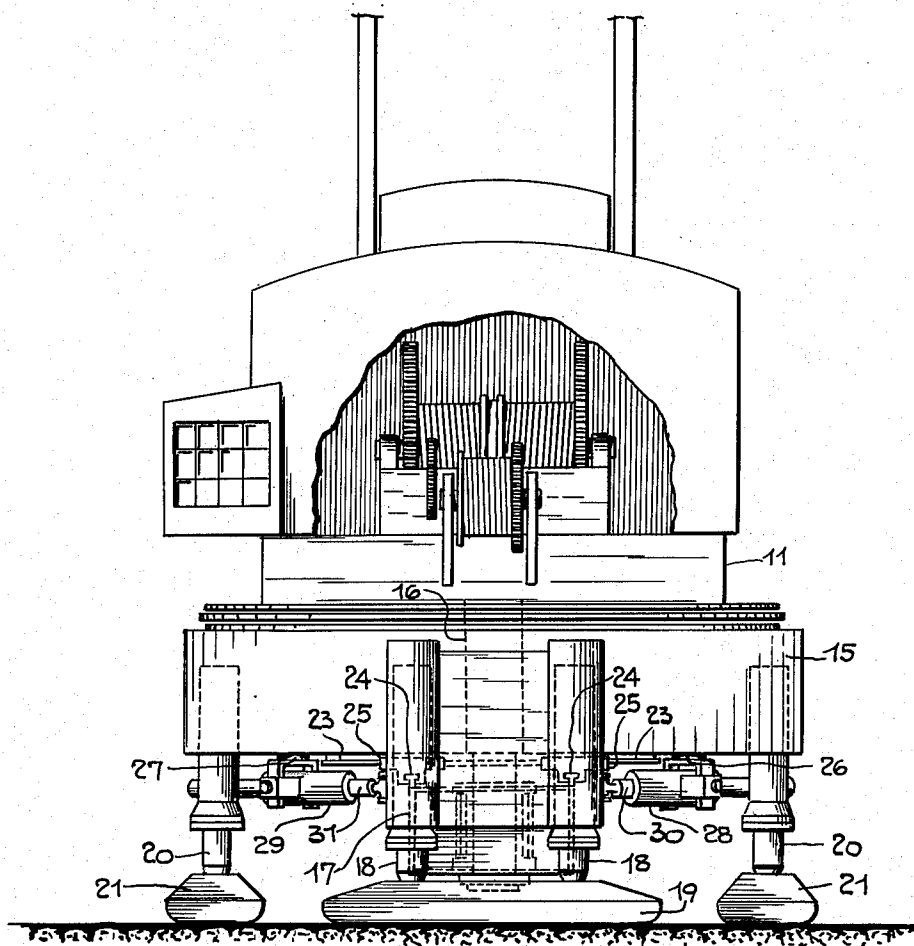


FIG. 2.

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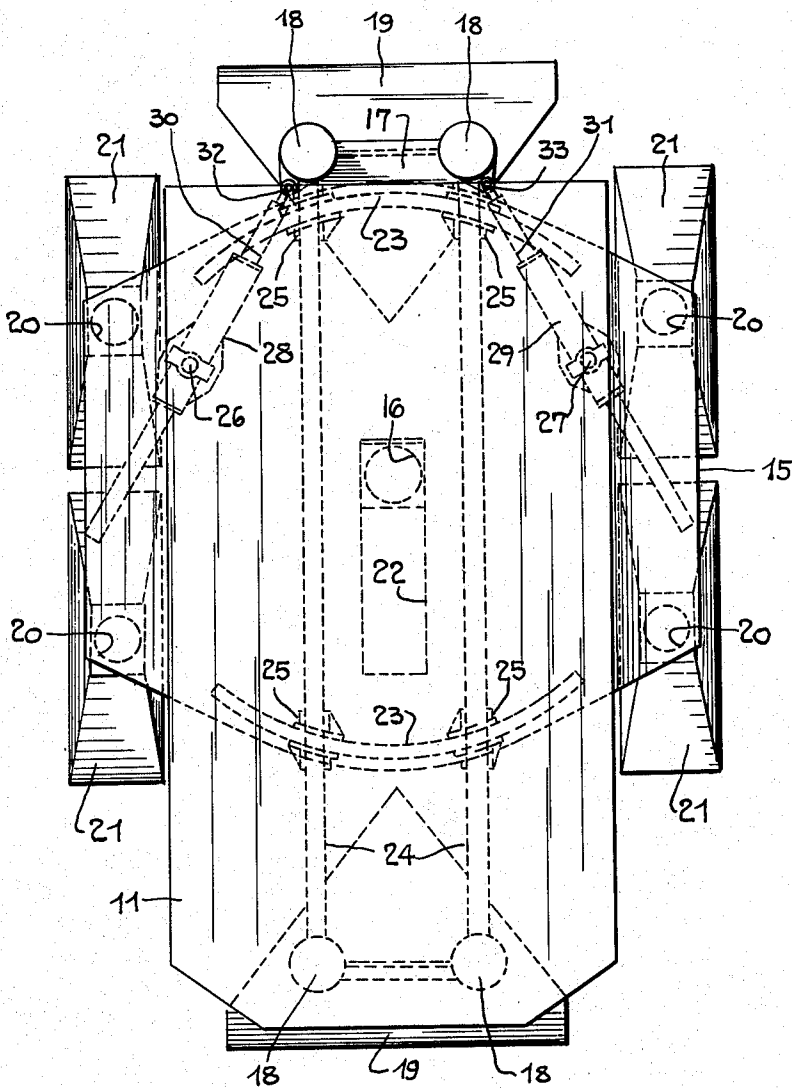


FIG. 3.

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4 Sheets-Sheet 4

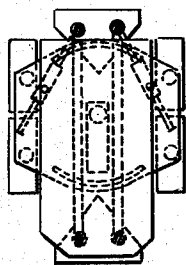


FIG. 4c

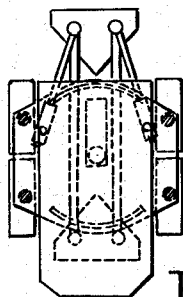


FIG. 4b

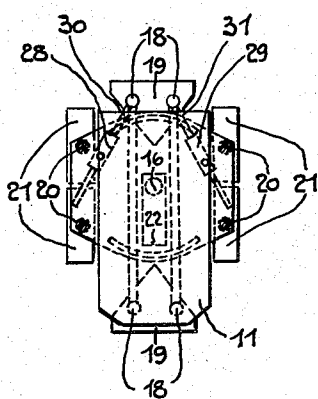


FIG. 4.a

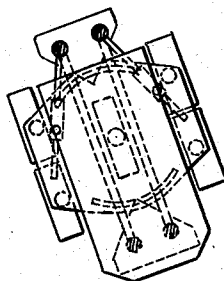


FIG. 5e

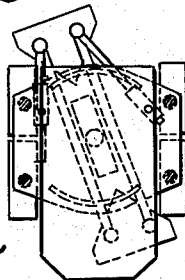


FIG. 5d

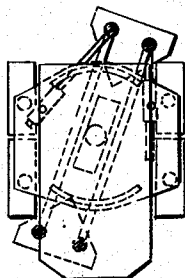


FIG. 5c

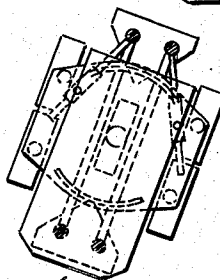


FIG. 5b

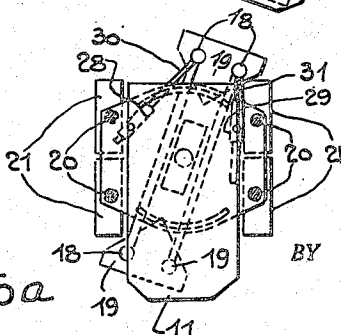


FIG. 5a

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UNITED STATES PATENT OFFICE

2,660,253

SUPPORTING PROPULSION MEANS FOR
DRAGLINES AND THE LIKE

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Application December 31, 1951, Serial No. 264,321

19 Claims. (Cl. 180—8)

1

This invention relates to new and useful improvements in supporting propulsion means for mobile articles, more particularly to such means for stripping shovels, draglines and the like.

In the past such excavating machines have employed one or the other of two general methods of propulsion: (1) walking apparatus, in which the machine with its main supporting base is partially lifted from the ground by auxiliary bases or feet and then slid forward by steps, as described, for example, in U. S. Patent No. 1,095,464 to O. J. Martinson; (2) caterpillar traction, in which the machine is supported by jacks mounted on caterpillar-type units, as shown, for example, in U. S. Patent No. 2,101,837 to L. E. Blanchett.

Long usage of these two types of propulsive methods has made apparent several disadvantages in each. Although the first method affords a ground support with large bearing-surface, considerable jarring of the main machine results, the large walking shoes require an inconveniently large working area for movement when the digging operation is being carried out, and very little levelling of the machine is possible. The second method is readily adaptable to levelling, and does not jar the machine, but the caterpillar units cannot without undue expense, be built to provide the desired bearing-surface when the machine works on soft ground, and in addition these units are heavy and comparatively expensive to manufacture.

Accordingly, the principal object of the present invention is to provide a supporting propulsion means in which:

- (1) A large bearing-surface is provided at minimum cost.
- (2) The propulsion means has continuous ground contact, with no jarring of the machine.
- (3) Levelling of the machine can be readily provided.
- (4) Steering is independent of swing of the main machine.
- (5) Use of heavy expensive caterpillar units is eliminated.
- (6) All ground supports are employed when the machine is at work.

In addition to the principal object, above stated, a number of novel and useful details have been worked out, which will be readily evident as the description progresses.

The invention consists in the novel parts, and in the combinations and arrangements thereof, which are defined in the appended claims, and

2

of which one embodiment is exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description the same reference number is applied to the same member or to similar members.

Figure 1 is a side elevation of a shovel excavator embodying the invention, partially cut away, showing the machine at one stage of travel.

Figure 2 is a front elevation, partially cut away, of the machine shown in Figure 1, taken along the line 2—2 in Figure 1.

Figure 3 is a top view, partly in cross-section, taken along the line 3—3 in Figure 1.

Figures 4a, 4b, and 4c consist of three outline top views, each similar to Figure 3, showing consecutively the various positions of the machine during straight travel.

Figures 5a, 5b, 5c, 5d, and 5e consist of five outline top views, similar to Figure 3, showing consecutively the various positions of the machine while turning.

Referring first to Figure 1, it is seen that 11 is the main frame of a shovel excavator, carrying boom 12, and a handle and dipper (not shown). The details of the main machinery are well known in the art, and need not be explained here. Main frame 11 is rotatably supported by main base 15 through center pintle 16. Pintle 16 extends below base 15 to rotatably and slidably (as will be described later herein) connect the main base to a sub-base or pontoon 17 for support thereon.

Referring also to Figures 2 and 3, it is seen that pontoon 17 carries at each end two hydraulically-operated jacks 18, which at their lower ends are connected in pairs in limited universal relation to two jack pads 19. Jacks 18 are actuated by conventional hydraulic means, which, being well known in the art, need not be shown here. Jack pads 19 form one of the two sets of ground supports for the machine.

Still referring to Figures 1, 2 and 3, it is seen that fixed adjacent each of the four corners of base 15 is a second hydraulic jack 20, to each of which in limited universal relation is connected a jack pad 21. Jacks 20 are actuated by conventional hydraulic means, which, being well known in the art, need not be shown here. Jack pads 21 form the second set of ground supports for the machine. Referring particularly to Figure 3, it is seen that pontoon 17 contains a rectangular aperture 22, through which pintle 16 is fitted, thus permitting a limited amount of horizontal longitudinal, as well as rotational, move-

ment between the pontoon 17 and base 15. Fixed to the underside of base 15 are two curved T-rails 23, and fixed longitudinally along the top of pontoon 17, but below rails 23, are two straight T-rails 24. At their four points of intersection (Figure 3), the curved rails 23 are slidably constrained by the upper portion of X type slide shoes 25, and straight rails 24 are slidably connected to the lower portion of slide shoes 25. This connection by means of shoes 25 permits both relative longitudinal and rotational sliding motion between base 15 and pontoon 17. Thus it is seen that the supporting connection between base 15 and pontoon 17, consists of pintle 16, rails 23 and 24, and slide shoes 25. Although this complete supporting connection is preferred, it is readily evident that shoes 25 may be eliminated, in which event curved rails 23 merely slide on straight rails 24, and pintle 16 provides the sole vertical connection between pontoon 17 and main base 15.

Pivotaly attached to the underside of base 15 at points 26 and 27 respectively are two double-acting hydraulic cylinders 28 and 29, coacting with piston rods 30 and 31, which in turn are pivotally connected to the front of pontoon 17 at 32 and 33. Hydraulic actuating fluid is supplied under pressure by conventional means not shown. The two cylinder-piston assemblies thus constituted provide the force necessary to cause relative rotational and/or longitudinal movement between the base and the pontoon.

From the foregoing description it will be seen that the operation of the invention is as follows. When the machine is engaged in the digging operation, the supporting underbody is in the position shown in Figures 1, 2, and 3. In this position ground support is provided by both sets of jacks, 18 and 20, bearing on jack pads 19 and 21 respectively. These jacks are held in extended position by hydraulic pressure. There are thus six points of support, a marked advantage over the four-point support found in large conventional, caterpillar-mounted excavators. This type of support also is not subject to the instability frequent to conventional walking machines, due to the "dishing" of earth under the conventional tank-type supporting base.

When it is desired to move the machine ahead (to the right in Figure 1, and up in Figures 3 and 4) to a new location, the hydraulic pressure holding jacks 18 in extended position is released, so that the machine is supported on base 15 through jacks 20 and jack pads 21. This support by only jacks 20 is indicated in Figure 4a by the fact that jacks 20 are cross-hatched while jacks 18 are not so marked. Hydraulic fluid under pressure is then forced into one end of each of cylinders 28 and 29 so as to expel piston rods 30 and 31 from their respective cylinders. This expulsion forces the pontoon 17 to move forward with respect to base 15. During this forward movement of pontoon 17, jack pads 19 slide over the ground, their lower edges being rounded or bevelled to facilitate this purpose. When this forward movement has proceeded to the point where the relative positions of pontoon and base are as shown in Figure 4b, with the pintle 16 at the rear of aperture 22, the motion is stopped by cutting off the flow of hydraulic fluid into cylinders 28 and 29. This may be done by automatic limit means, which are well known in the art and need not be shown here.

Hydraulic fluid is then forced into jacks 18 under pressure sufficient to extend them to the

point where the weight of the machine is carried by pontoon 17 through jack pads 19 and jacks 18. The hydraulic pressure in jacks 20 and in the one side of cylinders 28 and 29 is then released, and fluid is forced into the other side of cylinders 28 and 29 so as to retract piston rods 30 and 31. This retraction carries base 15 forward until it reaches the initial relative position shown in Figure 4c, and Figures 1 and 2, jack pads 21 sliding along the ground. On uneven ground, jacks 20 may be used to prevent any tendency of the machine to tip while it is supported by jacks 18 on the relatively narrow pontoon 17. Jacks 20 are then again extended, whereupon the cycle may be repeated as many times as is necessary to move the machine to the desired position.

It is obvious that the machine can with equal facility travel to the rear.

To turn the machine in one direction about its vertical axis, piston rod 30 is forced forward (upward in Figures 3 and 5) through its cylinder 28 while rod 31 is retracted rearwardly into its cylinder 29, this being done when the pressure in jacks 18 is released, with jacks 20 carrying the weight of the machine. This causes pontoon 17 to rotate clockwise (Figure 3) about pintle 16 until it reaches the position shown in Figure 5a.

Jacks 18 are then extended by hydraulic pressure until they are carrying the weight of the machine, and the pressure in jacks 20 is released. By means of hydraulic pressure, piston rod 30 is forcibly retracted into its cylinder 28 while rod 31 is similarly extended forwardly through cylinder 29. This rotates base 15 clockwise (Figure 3) about pintle 16 until it reaches the desired point, such as the initial relative position as shown in Figure 5b. This cycle may be continued until the desired amount of turning is attained.

To turn the machine in the opposite direction, starting from the relative position shown in Figure 5b, piston rod 30 is extended forwardly from its cylinder 28 while rod 31 is retracted into cylinder 29, this being done while the pressure in jacks 20 is released, with jacks 18 carrying the weight of the machine. Base 15 then rotates about pintle 16 to the maximum point shown by Figure 5c. Further turning is achieved by extending jacks 20 and releasing jacks 18, then extending piston rod 31 while retracting rod 30, until the position shown in Figure 5d is reached. By partially continuing the cycle, the normal digging position as shown in Figure 5e may be reached.

It is obvious that the turning motion may be accomplished simultaneously with propulsion, by merely extending or retracting (as the case may be, depending upon the portion of the moving cycle involved) one of piston rods 30 or 31 at a faster rate than the other. It is equally obvious that the propulsion and turning movements, once initiated, may be controlled in the main by automatic means, which are well known in the art and hence need not be detailed here.

When the machine is stationed for digging, it may readily be levelled by merely extending jacks 18 and 20 to the degree required to produce the level position.

It is obvious that without departing from the invention pintle 16 may be fixed to pontoon 17 and the longitudinal slot 22 be formed in main base 15, in which event the curved rails 25 are fixed to the upper portion of pontoon 17 and straight rails 24 are fixed below the main base 15.

5

Although hydraulic jacks 18 and 20, and hydraulic cylinders 28 and 29, appear preferable, the functions performed by these means may be performed by air jacks and cylinders, or by mechanical, electrical or other equivalent means, without departing from the spirit of the invention.

Also, jacks 18 and 20 might be double acting, to permit the raising of jack pads 19 and 21 when traveling over exceptionally irregular terrain. But for travel over regular terrain, merely permitting jack pads 19 and 21 to drag over the ground reduces the total power requirement.

It will be readily seen that if when operating in exceptionally soft ground, the jack pads 19 and 21 sink into the earth, the bottom of pontoon 17 will provide a very large additional ground-support surface.

Having now described and illustrated one form of the invention, it should be understood that the invention is not to be limited to the specific form or arrangement of parts herein described and shown.

I claim:

1. In an excavator which includes a main base and a main frame rotatably supported thereon, propulsion means including: at least two vertically extensible jacks attached to and extending below the main base, to support said base when the jacks are extended; a sub-base below the main base and supportably connected therewith for relative pivotal movement about a vertical axis and for relative shiftable movement in a horizontal plane; at least two vertically extensible horizontally-spaced jacks fixed to and extending below the sub-base at points substantially removed from each other to support the sub-base, the main base and the main frame when the jacks are extended vertically; means to independently extend said jacks vertically; and means to independently or simultaneously pivot about said vertical axis and longitudinally shift horizontally the main base relative to the sub-base.

2. Apparatus of the type described, including: a main base; a sub-base below the main base and supportably connected therewith for relative pivotal movement about a vertical axis and for relative shiftable movement in a horizontal plane; first vertically-extensible ground-support means attached to the main base to support said base when said means are extended vertically; second vertically - extensible ground - support means including at least two vertically-extensible horizontally-spaced jacks attached to and extending below the sub-base to support said sub-base and main base when the means are extended vertically; means to independently extend said first and second ground-support means vertically; and means to independently or simultaneously pivot about said vertical axis and longitudinally shift horizontally the main base relative to the sub-base.

3. Apparatus according to claim 2, characterized by the fact that the first and second means and the means to pivot and shift the main base relative to the sub-base each includes an hydraulically-actuated cylinder-piston assembly.

4. Apparatus according to claim 3, characterized by the fact that the supporting connection between the main base and the sub-base includes a curved rail fixed to the under side of the main base, a straight rail fixed to the upper side of the sub-base, and shoe means interconnecting said rails in slidable relation.

6

5. Apparatus according to claim 2, characterized by the fact that the supporting connection between the main base and the sub-base includes a curved rail fixed to the under side of the main base and a straight rail fixed to the upper side of the sub-base.

6. Apparatus according to claim 5, further characterized by having shoe means interconnecting said rails in horizontally-slidable and vertically-fixed relation.

7. Apparatus according to claim 2, characterized by the fact that: the first and second means and the means to pivot and shift the main base relative to the sub-base each includes an hydraulically-actuated cylinder-piston assembly; the main base has an under side and the sub-base has an upper side; and the supporting connection between the main base and the sub-base includes a curved rail fixed to one of said sides and a straight rail fixed to the other of said sides, and shoe means interconnecting said rails in slidable relation.

8. Apparatus according to claim 2, characterized by the fact that the main base has an under side and the sub-base has an upper side, and the supporting connection between the main base and the sub-base includes a curved rail fixed to one of said sides and a straight rail fixed to the other of said sides.

9. Apparatus according to claim 8, further characterized by having shoe means interconnecting said rails in horizontally-slidable and vertically-fixed relation.

10. Apparatus of the type described including: a base; first vertically extensible ground-support means attached to the base; a pontoon below the base and supportably connected therewith for relative shiftable movement in a horizontal plane; second ground-support means including at least two vertically-extensible horizontally-spaced jacks attached to and extending below the pontoon and vertically extensible independently of said first ground support means; and means interconnected between the base and the pontoon to at will pivot and longitudinally-shift horizontally the pontoon relative to the base.

11. Apparatus according to claim 10, characterized by the fact that the first and second means and the means to pivot and shift the pontoon relative to the base each includes an hydraulically-actuated cylinder-piston assembly.

12. Apparatus according to claim 11, characterized by the fact that the supporting connection between the base and the pontoon includes a curved rail fixed to and below the base, a straight rail fixed to and above the pontoon, and shoe means interconnecting said rails and in slidable relation with each rail.

13. Apparatus according to claim 10, characterized by the fact that the supporting connection between the base and the pontoon includes a curved rail fixed to and below the base and a straight rail fixed to and above the pontoon.

14. Apparatus according to claim 13, further characterized by having shoe means interconnecting said rails and in slidable relation with each rail.

15. Apparatus according to claim 10, characterized by the fact that: the first and second ground-support means and the means connected between the base and the pontoon each includes an hydraulically-actuated cylinder-piston assembly; the base has an under side and the pontoon has an upper side; and the supporting connection between the base and the pontoon includes

a curved rail fixed to one of said sides, a straight rail fixed to the other of said sides, and shoe means interconnecting said rails in slidable relation.

16. Apparatus according to claim 10, characterized by the fact that the base has an under side and the pontoon has an upper side, and the supporting connection between the base and the pontoon includes a curved rail fixed to one of said sides and a straight rail fixed to the other of said sides.

17. Apparatus according to claim 16, further characterized by having shoe means interconnecting said rails in horizontally-shiftable and vertically-fixed relation.

18. Self-propelling means for a machine which includes a main frame supportably carried by a main base, said means including: at least two first vertically extensible ground-engaging jacks attached to and extending below said main base, to support said base when the jacks are extended; a pintle fixed to and extending below said main base and having a vertical axis; a curved rail fixed to and below the main base, formed as an arc of a circle the center of which is the vertical axis of said pintle; a pair of spaced connecting members, connected to said rail for sliding movement along the rail; a pontoon below the main base, having a longitudinal slot therein within which said pintle fits in pivotal and longitudinally-shiftable relation; two straight, transversely-

spaced rails, fixed to and above the pontoon, each having its lengthwise axis substantially parallel to the longitudinal axis of the pontoon and each slidably connected to one of said connecting members; at least two second vertically extensible horizontally-spaced, ground-engaging jacks attached to and extending below said pontoon, to support said pontoon, main base and main frame when the jacks are extended vertically; means to independently extend said first and second ground-engaging jacks vertically; and means to at will independently or simultaneously pivot about said vertical axis and longitudinally-shift horizontally the main base relative to the pontoon.

19. Self-propelling means according to claim 18, further characterized by the fact that the means to extend said first and second ground-engaging jacks each includes an hydraulically-actuated cylinder-piston assembly, and the means to pivot and shift the main base relative to the pontoon is connected to the main base and to the pontoon and includes an hydraulically-actuated cylinder-piston assembly.

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