

Dec. 26, 1944.

J. S. BURNS

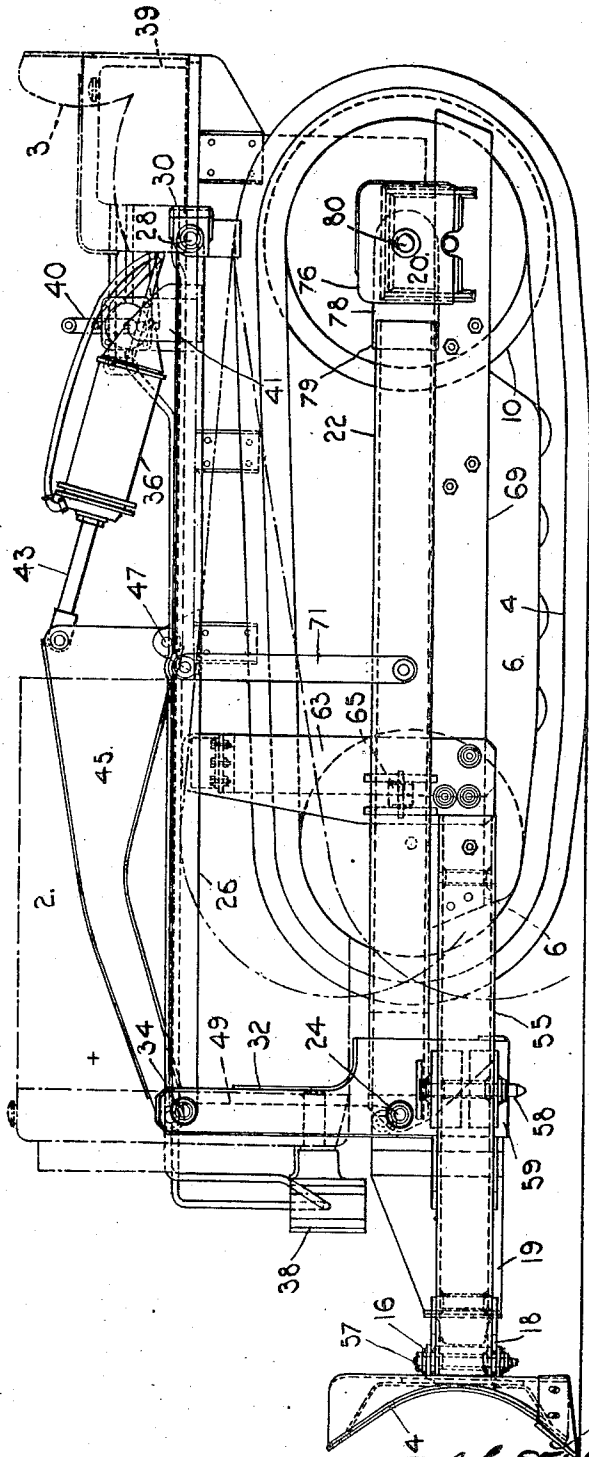
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EARTH MOVING MACHINERY

Filed May 16, 1941

3 Sheets-Sheet 1

FIG. 1.



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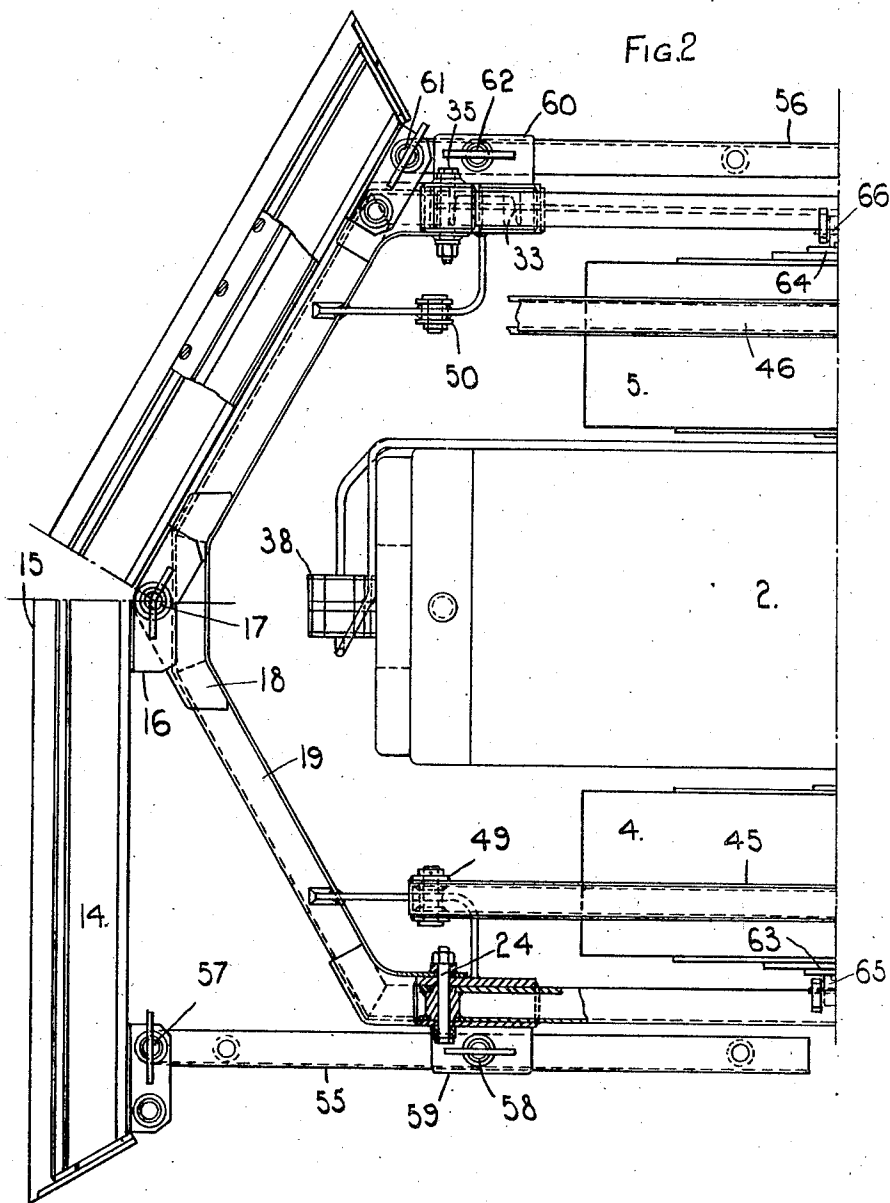
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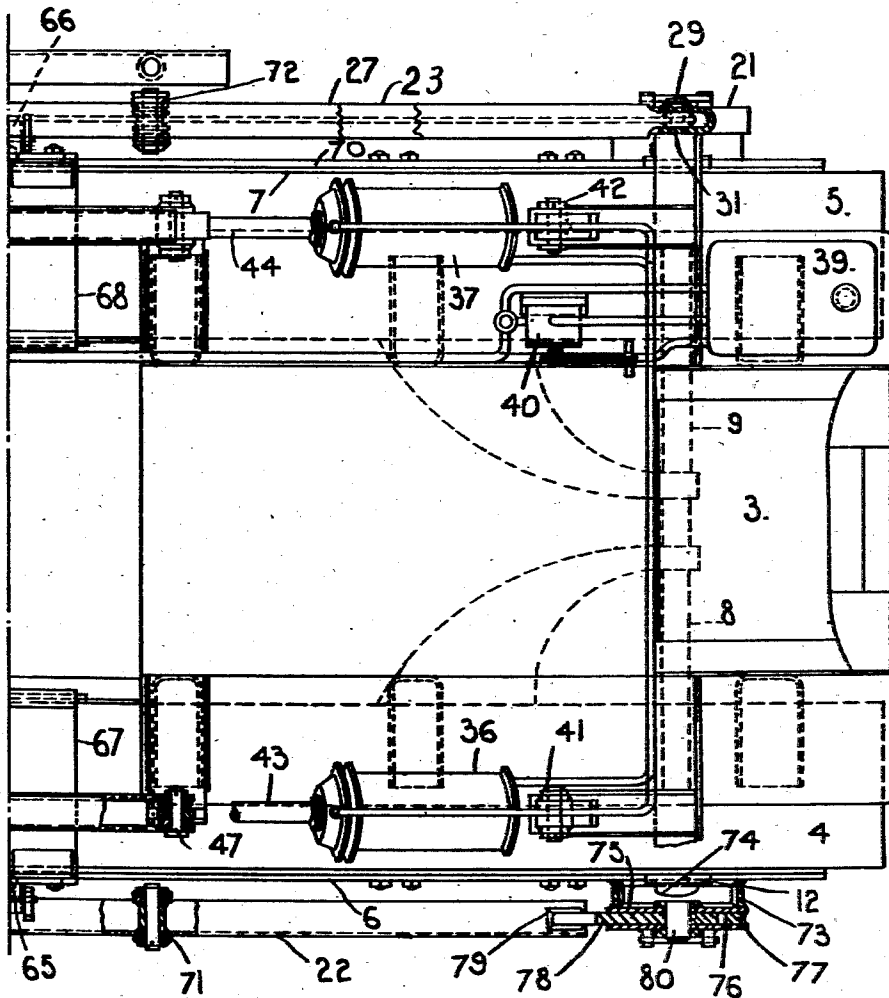
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FIG. 2A.



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# UNITED STATES PATENT OFFICE

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## EARTH-MOVING MACHINERY

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5 Claims. (Cl. 37-144)

This invention relates to earth moving machinery with more especial reference to bulldozers, angledozers, trailbuilders or bullgraders in which an earthmoving blade is adjustably carried in front of a self-propelled vehicle of crawler or tractor type by the track subframes thereof.

Various forms of blade carriage have been proposed employing a yoke or U frame embracing the front of the tractor and pivotally mounted on the track subframes so that by fluid pressure or other mechanism the yoke may be raised or lowered to adjust the depth of cut. Two main disadvantages are however inherent to the existing track mountings of the blade carrying yoke or frame, the first being operational in that the blade rake and camber is unavoidably altered each time the depth of cut is adjusted and the other being structural in that the normal oscillation of the tracks about the axis of their rear sprockets (or about their axis of oscillation if this does not coincide with the axis of the sprockets) when traversing inequalities is impeded by the mounting of the yoke which is correspondingly stressed under such conditions.

Although proposals have been made to obviate this structural defect the operating disadvantage remains and the present invention has for its object to provide an improved blade carriage for bulldozers and like earth moving machines, with which both the structural and operational disadvantages are removed.

Further and favourable objects will appear from the following description.

Broadly stated, a blade carriage or mounting embracing the front of the tractor, according to the present invention comprises a parallel linkage extending longitudinally outside each track subframe the lower links of which linkages are trunnioned to such subframes near the rear thereof, and a front cross member carried by said linkages and mounting the blade proper, adapted to adjust the depth of cut thereof on angular movement of said linkages without changing the blade rake and camber from that to which it has been set.

With such blade mounting, the rake and camber of the mouldboard and blade will be set to the optimum position, and this position will be maintained throughout the range of vertical movement of the blade when adjusting the depth of cut, such movement being conveniently effected from the operator's seat on the tractor through the medium of fluid pressure cylinders carried by the main frame.

Preferably, where the construction of the trac-

tor is such that the tracks oscillate about the axis of their rear track sprockets, the axes, i. e. the lower link trunnions of the blade carriage, are coincident therewith. In other cases where the respective tracks oscillate relatively to each other and to the tractor main frame about an axis on the main frame different from that of the rear sprockets, the trunnions for the blade carriage are conveniently coincident with such axis of oscillation. By mounting the blade carriage directly on the track subframes, the advantage is obtained that the blade thrust is applied to said subframes without stressing the main frame.

The top links are conveniently pivoted to members on an axis approximately perpendicularly above the axis of the rear track sprockets or the alternative axis containing the carriage trunnions.

The carriage is completed by the front cross member of the yoke which for angle dozing is V-shaped and at the forward extremity whereof is the mouldboard and blade, which member has at each end uprights pivoted to the respective pairs of side links and, since—owing to the parallel linkage—the inclination of these uprights in relation to the tractor frame is constant irrespective of the setting of the carriage, the rake and camber of the mouldboard and blade carried by the front cross member even where the blade is set for angledozing, is not effected by movement of the carriage to raise or lower the blade and thus adjust the depth of cut. Intermediate supporting links may bridge the side arms or top and bottom links to enhance the rigidity of the carriage and eliminate sources of vibration.

Conveniently, the rams of the fluid pressure cylinders, by which movement of the carriage is effected, operate through bell cranks or rocking plates fulcrumed on the main frame of the tractor and operatively connected to the front cross member of the blade carriage by drop arms whereby it is unnecessary to compensate the fluid pressure system for oscillations of the track.

The mouldboard and blade may be articulated or universally mounted at the centre of the front cross member, conventional or appropriate means being furnished adjacent each end of the blade for adjusting the angle of incidence or dozing angle, i. e., the position in a horizontal plane, rake i. e., the inclination from the vertical, and camber i. e., angle of the blade when viewed from the front, preparatory to the commencement of work, although preferably the mouldboard and blade is simply mounted on a vertical hinge pin carried in the centre of the front cross member which

as aforementioned is V-shaped so as to permit the blade to be swung in a horizontal plane from the bulldozing position in which it is at right angles to the longitudinal axis of the tractor to angular positions for angledozing to spoil at either side of the tractor, adjusting links or thrust arms being furnished which extend from the ends of the mouldboard or blade and engage with brackets carried by the front cross member of the carriage temporarily to fix the blade in any of its adjusted positions.

The invention will be further described with reference to the accompanying explanatory drawings which illustrate by way of example one embodiment of improved blade carriage or mounting applied to a tractor of the type in which the tracks oscillate about the axis of the rear sprockets, and in the drawings:

Fig. 1 is a side elevation of the tractor so equipped and

Fig. 2 and Fig. 2A together constitute a plan view showing how the mouldboard and blade may be shifted from the bulldozing to the angledozing position.

Referring now to the drawings, 1 generally designates the main frame of the crawler-type tractor mounting the engine unit 2 and operator's seat 3, and 4 and 5 designate the crawler tracks which are mounted on track subframes designated 6 and 7 respectively.

Projecting laterally from the rear of the main frame 1 are driving axles 8 and 9, mounting sprockets 10 respectively which in turn drive the crawler tracks 4 and 5. In the type of tractor illustrated, the track subframes 6 and 7 are arranged, when traversing uneven surfaces, to oscillate about the axis of the rear track sprockets 10 and so are journalled at 12 respectively to the axles 8 and 9, diagonal braces (not shown) being also furnished to withstand any torsional strains and shocks to which the journals and axles would otherwise be subject when negotiating uneven ground or meeting an obstruction. These are standard features of the tractor which, it will be appreciated, are illustrated purely by way of example and as the invention is applicable to other types of tractor further detailed description of the particular construction of the tractor itself is unnecessary.

14 indicates the mouldboard, conventionally of mild steel, and 15 its blade, advantageously of special alloy steel, the mouldboard having at its rear a central bearing bracket 16, permitting it for angledozing to be swung in a horizontal plane about a hinge pin 17, in turn carried at the forward central extremity 18 of a V-shaped transom or apron 19 forming the front cross member of the carriage.

The blade carriage is pivoted directly on the track subframes on an axis coincident with their axis of oscillation, i. e. the axis of the rear sprockets 10, and to this end there are attached to the rear of the track subframes 6 and 7, secondary journals or trunnions 20 and 21 co-axial with the main journals 12 and pivotally mounting side-arms or lower links 22 and 23 which extend forwardly along each side of the tractor outside its track 4 and 5 and are bridged at their front ends by the aforementioned cross member 19, being attached thereto by horizontal hinge pins 24 and 25 for the purpose now to be explained.

The trunnions 20 and 21 upon which the blade carriage is mounted for pivotal movements to raise and lower the mouldboard 14 and blade 15

to adjust the depth of cut, being coincident with the axis of oscillation of the tracks 4 and 5, any likelihood of the carriage impeding the normal operation of the tracks when traversing uneven surfaces is avoided. Moreover in existing plant the rake and camber of the mouldboard and blade is unavoidably altered when the depth of cut is adjusted and to obviate this disadvantage resort is had in the embodiment of carriage illustrated to parallel links, the side arms 22 and 23 forming the lower links and complementary upper links 26 and 27 being furnished pivoted at their rear ends on trunnions 28 and 29, carried respectively by brackets 30 and 31 provided for the purpose at each side of the rear end of the main frame 1 perpendicularly above the axles 8 and 9 of the rear sprockets.

At their forward ends the complementary links 22, 26 on the near-side and 23, 27 on the off-side are connected by members 32 and 33 in the form of uprights or standards which are an integral part of the front cross member or apron 19, the side arms 22 and 23 being hinged to the cross member by the pins 24 and 25 aforementioned, and the upper links or side arms 26 and 27 being similarly pivoted to the upper extremities of the uprights 32 and 33 by hinge pins 34 and 35 respectively.

With the links or side arms horizontal, as shown in Fig. 1, the uprights 32 and 33 are vertical or approximately so, and since the stationary axes of the links are disposed vertically one above the other, the uprights remain vertical when the linkages are oscillated up and down by the hydraulic system hereafter described to raise or lower the mouldboard 14. Consequently, as the mouldboard 14 is carried by the front cross member 19 of which the uprights 32 and 33 are integral parts, its rake camber and dozing angle remain constant throughout the vertical range over which it may be moved to adjust the depth of cut.

For adjusting the depth of cut, fluid pressure cylinders 36 and 37, which may be conventional, are provided in conjunction with an engine-driven pump 38, reservoir 39 for hydraulic medium and control valve 40.

The cylinders 36 and 37 are at their rear ends fulcrumed to brackets 41 and 42 on the main frame 1 of the tractor at each side of the operator's seat 3 and the rams or piston rods 43 and 44 are connected to rocking plates 45 and 46 which are adapted to oscillate about trunnions or hinges 47, carried by the main frame 1 of the tractor at each side of and in rear of the engine unit. The forward ends of the rocking plates 45 and 46 carry drop links or arms 49 and 50, connected to the front cross member or apron 19 to raise and lower such cross member and with it the mouldboard 14 as the plates 45 and 46 are rocked about their hinges 47 by the fluid pressure medium being pumped into the front or rear ends of the cylinders 36 and 37 by the pump 38 on actuation of the control valve 40.

It will be understood that the rams or piston rods 43 and 44 normally work in unison so that branch ducts from the valve 40 may serve both cylinders, and the arrangement of the valve and fluid pressure system is preferably such as to afford four operative positions:

- (1) Holding the carriage stationary;
- (2) Admitting fluid under pressure to the rear ends of the cylinders to lower the mouldboard 14;
- (3) Admitting fluid under pressure to the front

ends of the cylinders to lift the mouldboard 14 and

(4) A free or floating position in which the carriage falls about its rear trunnions 12 until the blade 15, or "mushrooms" conventionally mounted in rear of the mouldboard, come into contact with the ground or some other obstruction.

Moreover it will be appreciated that by pivoting the fluid pressure cylinders 36 and 37 and the rocking plates 45 and 46 to the main frame 1 of the tractor, instead of in the conventional way to the track frames, it is unnecessary to make provision for the transfer of fluid from one cylinder to the other to compensate for relative oscillation between the tracks and further that the camber, i. e. the angle of the blade in a transverse plane remains constant in relation to the axis of the rear sprockets, irrespective of the movements of the tracks when traversing uneven ground.

As aforementioned in addition to the vertical movement of the mouldboard 14 for adjusting the depth of cut which is effected by the control valve 40 through the medium of the fluid pressure system, the mouldboard and blade are adjustable in a horizontal plane and the preferred embodiment illustrated affords the mouldboard three positions as now to be described with more particular reference to Fig. 2. The mouldboard 14 has a central bracket 16, carried by a hinge pin 17, mounted at the front centre of the V-shaped cross member 19 as already described, and for bulldozing the mouldboard is fixed in a position at right angles to the longitudinal axis of the machine by adjusting arms 55 and 56 and locating pins 57 and 58, which as shown in the bottom left-hand corner of Fig. 2, engage coincident apertures provided for the purpose in the arm 55 and the mouldboard 14 on the one hand, and in the arm 56 and a projecting lug 59 formed for the purpose on the standard 32 on the other hand.

Each adjusting arm is furnished with two further apertures and, after withdrawing the locating pins, the mouldboard 14 may be swung manually to its position for angledozing to either side of the machine, Fig. 2 in its upper half showing the blade set for angledozing to the off-side with locating pins 61 and 62 in the two foremost apertures in the arm 56 and respectively engaging the mouldboard aperture and that furnished in a lug 60 on the standard 33 which is complementary to the lug 59 on the standard 32. In this position, as will be understood, the locating pin 58 in the rear side of the machine would fix the rearmost aperture in the side-link 55, coincident with the aperture in the lug 59.

The carriage of the mouldboard is subjected to side-thrust when angledozing and to stabilise its forward portion during this operation, rubbing or cheek plates 63 and 64 are mounted on the track subframe 6 and 7 respectively and on these rubbing plates, which have vertical wear surfaces outside the tracks 4 and 5, ride rollers 65 and 66 carried by and on the inside of the channel-shaped side-arms 22 and 23. The rubbing plates which are mounted on the track subframes as far forward as possible have supporting webs or yokes 67 and 68 bridging the tracks in the embodiment illustrated, although it will be understood that where there is sufficient clearance between the upper track rollers and the front idler, such re-inforcing webs may be located inside the track and still afford the rubbing plates

adequate re-inforcement to retain their wear-faces perpendicular under the most severe side-thrusts likely to be encountered when employing the machine as an angledozer.

5 The side-arms or lower links which during the working of the machine, are in compression are advantageously of channel section with the channel web outside, and the upper links 26 and 27 which when the machine is working are owing to the form of the front cross member in tension, are advantageously of T-section, all as shown.

10 11 and 12 are intermediate links respectively bridging the upper and lower nearside horizontal links 22 and 26, and the off-side horizontal links 23 and 27, between their rear trunnions and their front ends carrying the cross member 13 and the mouldboard 14. As shown, each link has two limbs converging from the bottom where they embrace the upper web of the channel section side-arm to the top where they lie on each side of the main web of the T-section, appropriate bushes being welded on to the parts to form the requisite bearings for the hinge pins.

20 The design throughout lends itself to cheap and rapid fabrication from rolled sections and in the lower right hand corner of Fig. 2 is shown how the mounting for the secondary journals or trunnions 20 and 21 may be built up from mild steel plate by welding. To facilitate attachment and removal of the blade carriage as a unit, running plates 69 and 70 are detachably connected by bolts to the track subframes 6 and 7 and extend along the respective outer flanges of such subframes. Attached by welding to the external surface of the running plate 69 around the hub or main journal 12 is a web 73 cut and shaped so as to bridge the hub-cap 74. To this web are attached by welding two rectangular plates 75 and 76, spaced by a packing 77 so as to accommodate between them an eye-piece 78, formed from a drilled plate and welded at 79 to the channel of the side-arm 22 to form the hinge thereof. A journal pin 80 completes the assembly which possesses the inherent advantage that the journal pin is in double shear between the plates 75 and 76.

40 By the present invention an improved blade carriage for bulldozers, angledozers, bullgraders and the like is obtained which may be cheaply and rapidly manufactured, readily attached to or removed from its vehicle and with which convenience and durability in operation are assured.

What I claim is:

1. An earth-moving machine provided with track sub-frames on each side of the same, an earth moving blade adjustably carried in front of said machine by members extending substantially parallel with said track sub-frames, said members comprising a parallel linkage, the lower links of said linkage being trunnioned to each sub-frame near the rear end thereof, the upper links of said linkage being mounted on trunnions carried by the main frame of said machine, a transom member carried by said linkage and forming the mounting for the blade proper whereby the depth of cut made by said blade may be regulated by angular movement of said linkage without changing the blade's rake and camber.

2. In an earth-moving machine, a blade, a carriage for such blade adapted to embrace the front of a crawler-type tractor having independent track subframes said carriage comprising a parallel linkage at each side of the tractor extending longitudinally outside each track subframe,

trunnions for such links at the rear of the tractor fixed in relation to the frame thereof, front uprights pivotally bridging the front ends of each pair of side links, and a cross-member rigidly connecting said uprights and mounting the blade.

3. In an earth-moving machine, a blade carriage according to the preceding claim 2 wherein the blade is mounted on the front cross member below the pivotal attachments of the uprights to the lower side arms of the linkage so that in use the upper side arms are in tension.

4. In an earth-moving machine, a blade carriage according to claim 2 having fluid pressure means for raising and lowering the blade to adjust the depth of cut wherein such means are mounted on the main frame of the tractor and operate through rockers pivoted on such main

frame and drop links slung from such rockers and connected to the front cross member carrying the blade.

5. In an earth-moving machine, a blade carriage according to the preceding claim 2 including on the front cross member a central forward projection on which the blade is articulated and is capable of being positioned angularly in relation thereto to direct the spoil to one or other side or to be at right angles to the longitudinal axis of the machine, means for temporarily fixing the relative angular position of the blade comprising side links cooperating with anchorages carried by the uprights bridging the front ends of the parallel linkages.

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