March 13, 1945. J. S. BURNS 2,371,502

EARTH MOVING MACHINE

Filed Dec. 6, 1943 2 Sheets-Sheet 1

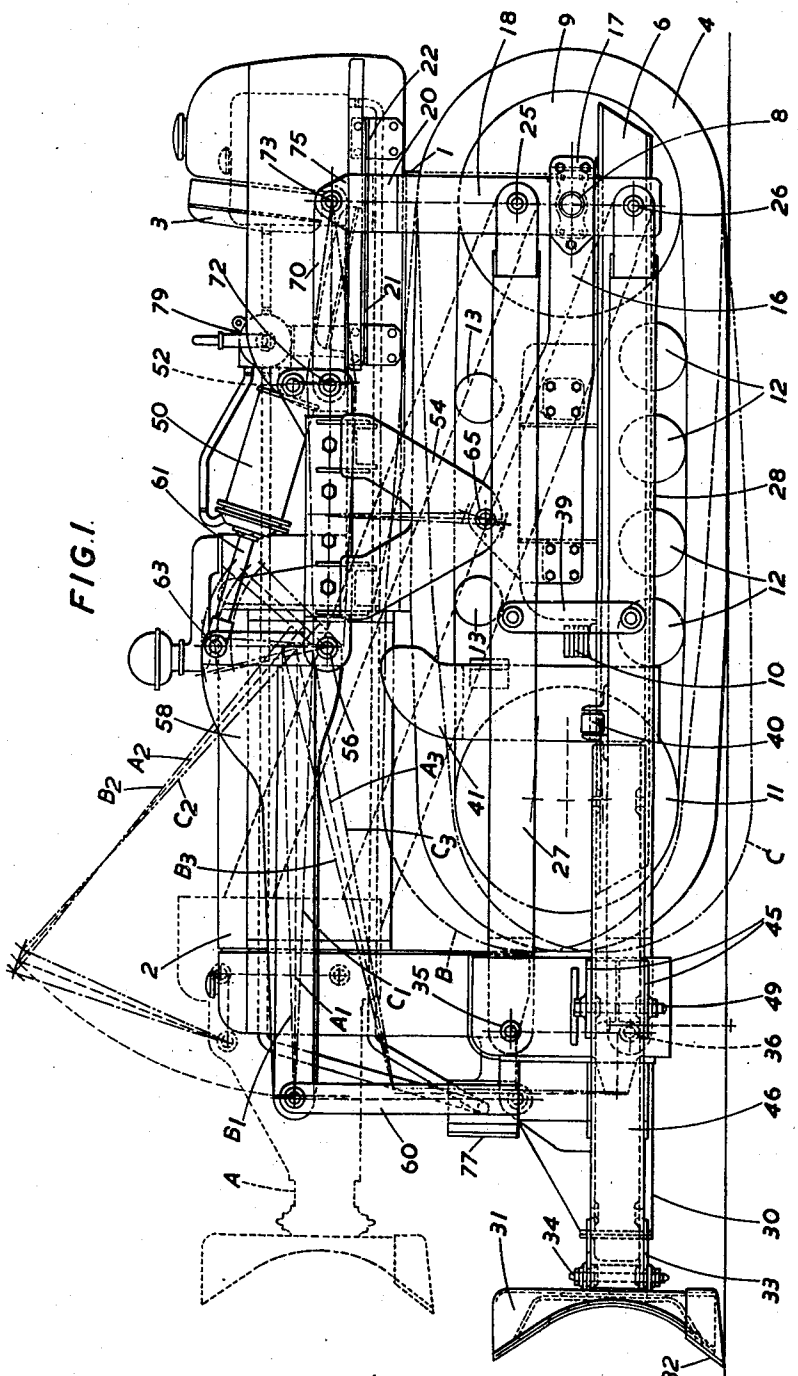


FIG. 1.

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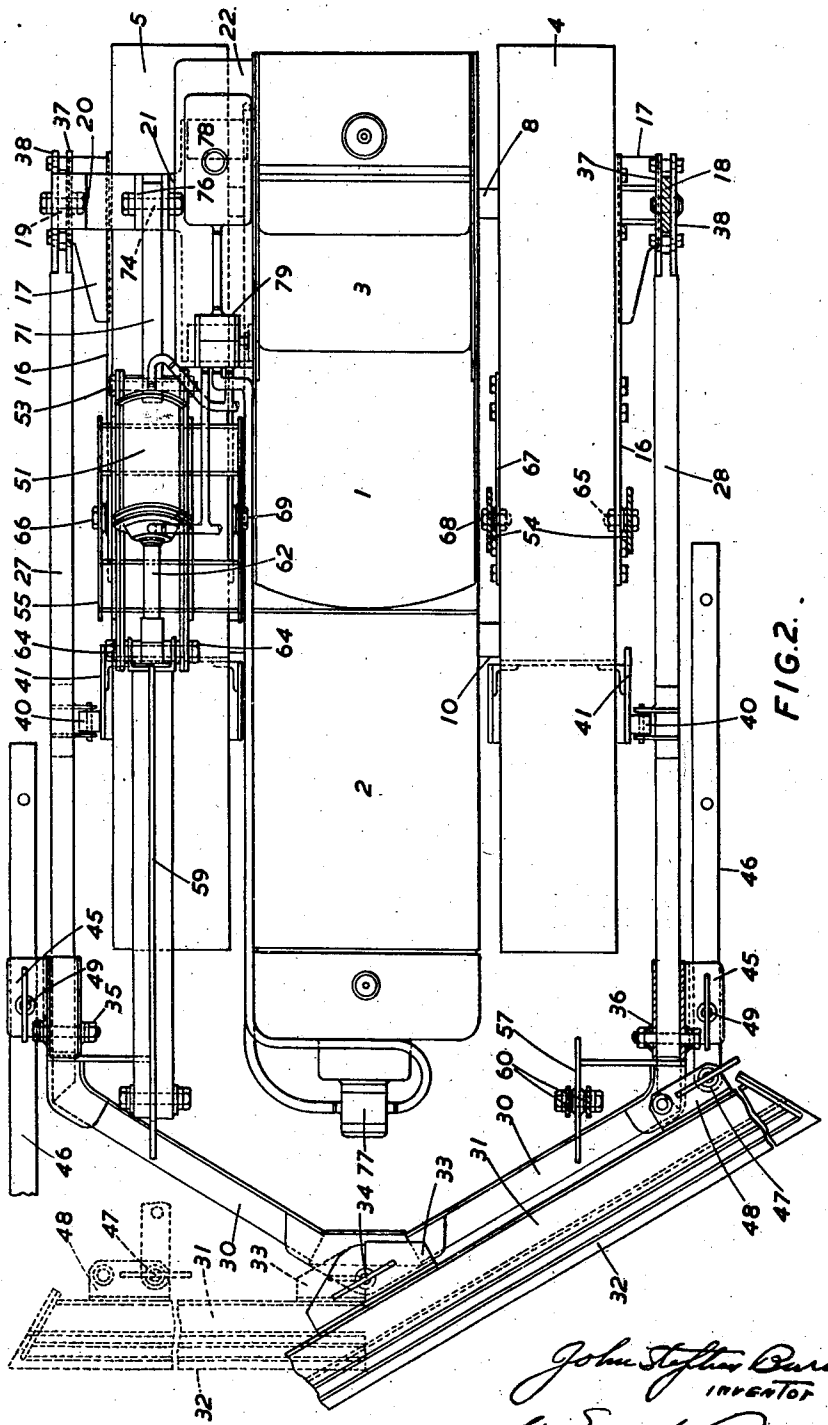


FIG. 2.

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UNITED STATES PATENT OFFICE

2,371,502

EARTH-MOVING MACHINE

John Stephen Burns, Walton on Thames, England

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In Great Britain October 8, 1942

8 Claims. (Cl. 37—144)

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

Hitherto, machines of this character have employed a blade carriage comprising a rigid and massive yoke fulcrumed near the rear of the track subframe and embracing the front of the tractor, but in my co-pending applications Serial Nos. 393,819, 490,822 a blade carriage for such machines is described comprising a parallel linkage extending longitudinally outside each track subframe, the lower links whereof are trunnioned to the track subframes near the rear thereof and a front cross member carried by said linkages adapted to adjust the depth of cut without changing the blade rake and camber from that to which it has been set, thus obviating structural and/or operational disadvantages of the known types of machine. Moreover, in the specific embodiment illustrated in my aforementioned application Serial No. 393,819, 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.

In some cases however, it may be considered desirable or necessary for the fluid pressure cylinders and their bell cranks or rocking plates operatively connected to the front cross member to be fulcrumed on the track subframes instead of on the main frame, and when the tracks oscillate due to the vehicle traversing ground inequalities, the symmetrical disposition of the operating mechanism and linkage is disturbed with consequent movement of the mouldboard and blade from its adjusted position or stressing of the links and cylinder mountings which is only partially relieved by the transference of the hydraulic medium from the cylinder at one side to that at the other.

The present invention has for its object to provide compensating arrangements for such subframe mounted operating mechanism effectively to stabilise the blade and minimise stressing of the parts incidental to oscillation of the track subframes when traversing surface inequalities.

Further and favourable objects will appear from the following description.

In accordance with the present invention arrangements for compensating the effect of track oscillations on the blade carriage operating mechanisms of bulldozers and angledozers comprise a swinging linkage for each bell crank or rocking plate of the carriage, each linkage including an oscillating support on the track subframe on the front of which support the bell crank is fulcrumed, and on the rear of which the operating mechanism for the bell crank is mounted, and a stabilizing link for said support pivoted on an axis fixed in relation to the main frame, the arrangement being such that as the subframe rocks upwardly the mounting of the operating mechanism is raised to an extent greater than the bell crank fulcrum so as to substantially retain the adjusted position of the front end of the bell crank and thus of the blade.

Preferably the oscillating supports have their axes fixed in relation to their respective track subframes and are in the form of triangular plates having a pivot or fulcrum at each of the three apices, the first constituting the axis about which the support rocks while moving bodily in consonance with the movements of the track subframe, the second the joint with the aforementioned co-operating link, and the third forming a fulcrum for the bell crank lever which operatively connects the piston rod of the fluid pressure cylinder which is itself mounted on the support to the blade carriage. By this arrangement, not only are the fulcra of the operating bell cranks moved in consonance with their respective cylinder fulcra when the tracks oscillate thus to effect compensation, but the additional advantage is obtained that the thrust of each fluid pressure cylinder between its own and its bell crank fulcrum is taken by its rocking support without being transmitted to the other parts of the machine and the necessity for providing complicated valve mechanism in the fluid system is thus avoided.

As will be understood, the triangular supporting plates preferred may be replaced by a triangular assembly of links of appropriate section structural material, and in either case it may be found convenient for upwardly projecting bosses on the supports to be furnished which serve as trunnions for the journals of the fluid pressure cylinders.

The invention will be further described with reference to the accompanying drawings which illustrate by way of example a specific embodiment of compensating arrangement for an underslung blade carriage such as that described in my specification Serial No. 490,822 applied to a tractor of the crawler type in which the tracks oscillate when traversing ground inequalities, about the axis of the rear sprockets.

In the drawings—

Fig. 1 is a side elevation, partly diagrammatic, of the angledozer with the blade in its normal working position and showing the manner in which the compensation is effected, and

Fig. 2 is a plan view partly diagrammatic and

partly in section, the upper half showing in plan the cylinder mounting the rocking plate and top link at the off-side, and the lower half or sectional plan view showing the lower link fulcrumed at the rear of the track subframe.

The tractor main frame is designated 1 and mounts the engine unit 2 and driver's seat 3, while 4 and 5 are respectively the nearside and offside crawler tracks carried by subframes or so-called track frames 6 and 7 which, when the tractor is traversing ground inequalities, oscillate about a track frame pivot 8 in the form of a horizontal axle borne at the rear of the tractor main frame 1 and which, in the tractor illustrated, is co-incident with the axis of rotation of the rear driving sprockets 9 of the crawler tracks.

10 represents the leaf spring of the track suspension extending transversely from one track frame 6 to the other 7 under the engine unit 2. 11 is the nearside front idler, 12 are the supporting wheels and 13 the jockey wheels for the crawler track 4, all being mounted for rotation in the track subframe 6. 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 except in so far as its parts mount the blade carriage.

Bolted to each of the track subframes 6 and 7 are side plates 16 extending from the track frame pivot 8 forwardly along each subframe, and welded to each side plate 16 is a bearing bracket 17, forming an extension of the track pivot 8, upon which brackets or extensions are mounted outside each track frame a vertical post, 18 for the nearside track 4, and 19 for the offside track 5, the upper ends of these posts being welded to or otherwise secured or prevented from relative movement in relation to, the tractor main frame 1. In the particular embodiment illustrated the mounting posts 18 and 19 are each welded or bolted to a depending lip 20 on a flange 21 projecting from the valance or fender 22 overlying the rear of the track, which valance is a conventional feature and, as will be appreciated, since the upper and lower attachments of the mounting posts 18 and 19 remain fixed in relation to the tractor main frame 1, they are not affected by the relative oscillation of the track frames 6 and 7 permitted by the track suspension 10 when traversing uneven surfaces.

The mounting posts 18 and 19 each carry trunnions or journals 25 and 26 for the upper and lower side links 27 and 28 of a parallel linkage, the front vertical links 29 whereof are upstanding portions at the ends of a front cross member or transom 30. As shown more clearly in Fig. 2 the transom 30 is V-shaped to permit angling of the mouldboard and blade which are of conventional form and are designated by the references 31 and 32 respectively, the mouldboard having at its rear a central bearing bracket 33 which takes over the front apex of the transom 30 and can be swung about a hinge pin 34 so that for bulldozing the mouldboard and blade are at right angles to the longitudinal axis of the tractor as shown in the upper half of Fig. 2, while for angledozing the mouldboard and blade may be inclined to either side, the lower half of Fig. 2 showing the blade set for angledozing to the nearside.

Each mounting post 18 and 19 similarly mounts a parallel linkage comprising an upper side link 27 and a lower side link 28 extending forwardly from its mounting post along the outside of the track 4 or 5 as the case may be to the front vertical links 29 upon which the front ends of the side links are pivoted at 35 and 36 respectively. Consequently, irrespective of the position of the vertical adjustment of the blade as set by the operating mechanism hereafter described, its rake and camber remain unaltered throughout the range of adjustment as indicated by the interrupted outline A in Fig. 1 and as in the aforementioned co-pending application Serial No. 393,819, but in contradistinction to the embodiment illustrated in that specification, owing to the lower link 28 being underslung in relation to the track subframe, and the upper and lower side links being equidistantly spaced from the axis of oscillation of the tracks, i. e., from the track frame pivot 8, notwithstanding the fact that the upper links are in compression as hereafter explained, the cutting thrust is applied to the track subframe at or below the axis of oscillation thereby counteracting or inhibiting any tendency of the front end of the track to lift from the ground, and thus ensuring stability during the working of the machine. This improved blade carriage forms the subject of my application Serial No. 490,822 and with such carriage, during normal working or with the blade raised or lowered the blade thrust exercises a clockwise moment as viewed from the nearside (see Fig. 1) about the front pivotal connections 35 of the lower side links 28 and transom 30 so that the upper side links 27 are in compression and share such thrust with the resultant advantage that the lower side links are correspondingly relieved of stress and may be of lighter section.

The side links 27 and 28 are advantageously of channel-section and at their rear ends have welded to them inner and outer eye-pieces 37 and 38 of strip, respectively one on each side of their mounting on the posts 18 and 19, so that the fulcrum pins are in double shear.

39 is an intermediate spacing link bridging the side links 27 and 28 approximately midway of their length for the purpose of reducing any tendency of the links to whip or bend under excessive blade thrust such as may occur during working when the blade strikes, for instance, a tree root or similar obstruction, and 40 are stabilizing rollers carried by the lower links 28 and riding the external vertical surfaces of cheek plates 41 mounted for the purpose on the track subframes near the front thereof so as to take the lateral thrusts applied to the blade-carrying structure, more particularly when angledozing.

At their front ends the side links engage the pivot pins 35 and 36 carried by the uprights 29 at each end of the transom 30, and projecting outwardly from the base of each upright or vertical link 29 is a guide channel 45 for the adjusting arms 46 which are similar to those described in the aforementioned co-pending application Serial No. 393,819, that is to say, their front ends are pinned at 47 to brackets 48 on the mouldboard while along their length three holes are provided to be selectively engaged by locking pins 49 passing through apertures in the guide channels 45, the central holes being used if the mouldboard and blade are to be set for bulldozing as in the upper half of Fig. 2, one front and one rear hole of the respective thrust arms being

used if the blade is to be set for angledozing as in the lower half of Fig. 2.

For adjusting the depth of cut of the blade according to the present invention, track frame mounted fluid pressure cylinders 50 and 51 including means compensating the effect of track oscillations are furnished. As illustrated the fluid pressure cylinders 50 and 51 are trunnioned at 52 and 53 on supports 54 and 55 bridging the respective tracks and carried by the track subframes 6 and 7. The supports 54 and 55 also provide fulcrums 56 for bell cranks or rocking plates 58 and 59 which extend forwardly and are connected by drop links 60 to webs 57 on the front cross member or transom 30. The rams or piston rods 61 and 62 of the fluid pressure cylinder are pivotally connected at 63 and 64 to the bell cranks 58 and 59, the arrangement being such as will be understood that when the rams 61 and 62 are pushed outwardly by the fluid pressure the bell cranks 58 and 59 are moved counterclockwise about their fulcrums 56 to lower the blade carriage, and conversely when the rams are moved rearwardly by the fluid pressure the bell cranks 58 and 59 move in a clockwise direction to lift the links 60 and thus raise the blade carriage, the maximum lifted position being represented by the interrupted outline A in Fig. 1.

In order to compensate for unwanted variation from the set position of the blade such as results from oscillation of the tracks when traversing uneven surfaces where the supports 53 and 54 are rigidly attached to the track frames 6 and 7 as conventional, the supports 54 and 55 are, according to the invention, pivoted at 65 and 66 on the side-plate 16 of their respective subframes which latter also carry inner plates 67 providing secondary bearings 68 and 69 respectively coaxial with the bearings 65 and 66.

70 and 71 are stabilising links for the respective oscillating supports 54 and 55 and have their forward ends pivoted to such supports at 72 immediately below the trunnions 52 and 53 while their rear ends have pivots 73 and 74 on the tractor main frame 1, and in the embodiment illustrated, carried by brackets 75 and 76 forming a vertical continuation of the mounting posts 18.

In consequence of this arrangement, as will be seen more clearly from Fig. 1, when the near side track 4 encounters a ground obstruction which causes it to oscillate about its track frame pivot 8 and take up the position represented by the dot and dash line B, instead of the fluid pressure cylinder 50 being moved bodily rearwardly and thus raising the blade from its adjusted position, the support 54 being held by its stabilizing link 60 rocks about its pivot 55 in a counterclockwise direction resulting in a compensatory movement of the fulcrum 56 for the bell crank 58 so that the blade carriage remains set in its adjusted position in relation to the tractor main frame 1, while as aforementioned the necessity of providing complicated transfer valve mechanism to permit the passage of the hydraulic medium from one cylinder to the other under these conditions is avoided.

The lines A1, A2, A3, B1, B2, B3, and C1, C2, C3, indicate the corresponding positions of the bell crank 58 in the normal, raised and lowered settings of the blade for the neutral and extreme positions of the track 4 when traversing ground inequalities from which it will be appreciated that the mechanism is fully compensating and the blade setting is unaffected by track oscillations.

77 indicates the engine-driven pump of the fluid pressure system, 78 the container for oil or other hydraulic medium employed and 79 the control valve conveniently placed for manipulation by the operator from the seat 3 to raise or lower the mouldboard 31 and blade 32, to hold such blade in any adjusted position, or to leave it free to "float" or ride over the surface of the ground.

What I claim is:

1. Apparatus for compensating the effect of track oscillations on the blade carriage operating mechanisms of bulldozers and angledozers having crawling tracks wherein the vertical position of the blade is adjusted through the medium of bellcranks mounted on the track subframes, comprising a swinging linkage for each bellcrank of the carriage, each linkage including an oscillating support on the track subframe on the front of which support the bell crank is fulcrumed and on the rear of which support the operating mechanism for the said bell crank is mounted and a stabilizing link for said support pivoted on an axis fixed in relation to the main frame the arrangement being such that as the subframe rocks upwardly the mounting of the operating mechanism is raised to a greater extent than the bell crank fulcrum, so as to substantially retain the adjusted position of the front end of the bell crank and thus of the blade.

2. Apparatus according to claim 1 wherein the mechanism is fluid pressure operated and the fluid pressure cylinders are journalled, one on each oscillating support, in such manner that as a subframe rocks upwardly the fulcrum of its cylinder is raised to an extent greater than the pivot of its oscillating support.

3. Apparatus according to claim 1 wherein the fixed pivots of the stabilizing links are located in the vertical plane of the axis about which the tracks oscillate.

4. Apparatus according to claim 1 wherein the blade carriage is suspended from the front ends of the rocking plates by drop links.

5. Apparatus according to claim 1 wherein the blade carriage includes a front cross member mounted on pairs of parallel side links extending longitudinally outside the track subframes, and wherein said cross member is suspended from the front ends of the bell cranks whereby the raising of the blade carriage does not affect the angular position of the blade.

6. Apparatus according to claim 1 including fluid pressure cylinders wherein the supports are furnished with bosses about the pivots of the stabilizing links which serve as trunnions for the journals of the fluid pressure cylinders.

7. Apparatus according to claim 1 wherein each oscillating support comprises an inverted yoke-shaped plate the limbs whereof bridge the top of the track and have their lower ends supported by co-axial pivots borne by members attached to the track subframe.

8. Apparatus according to claim 1 wherein the oscillating supports comprise V-shaped side plates connected to a channel member the latter providing bearings for the bell crank and stabilizing link pivots.

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