May 30, 1939. C. LE BLEU 2,160,596

TRAIL BUILDER, BULLDOZER, AND THE LIKE

Filed July 6, 1935 4 Sheets-Sheet 1

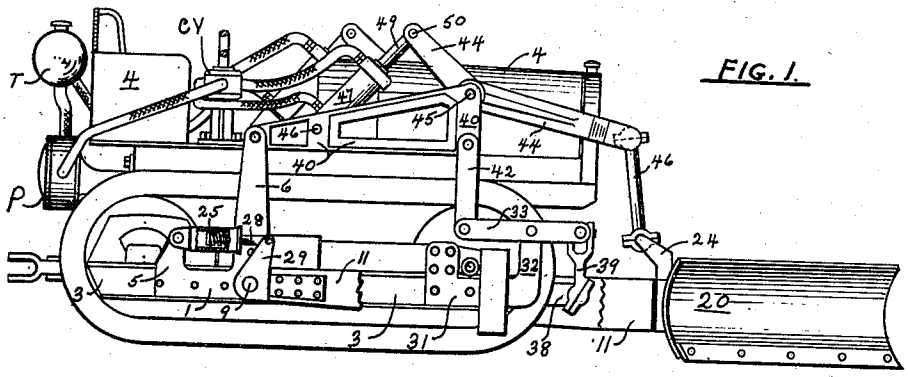


FIG. 1.

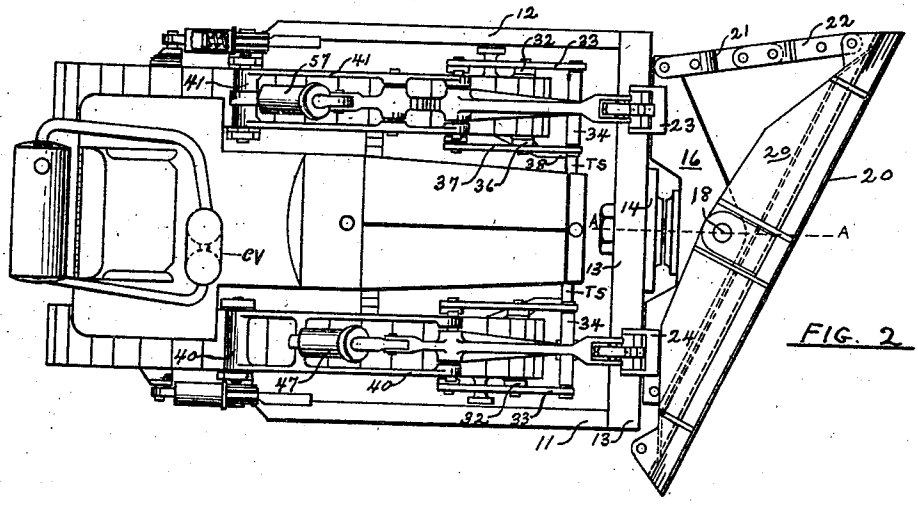


FIG. 2

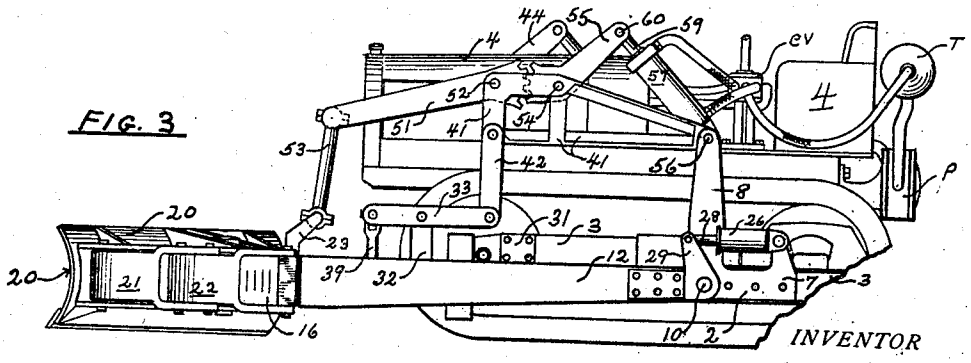


FIG. 3

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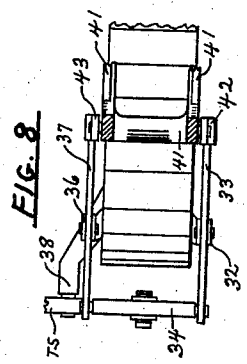


FIG. 8

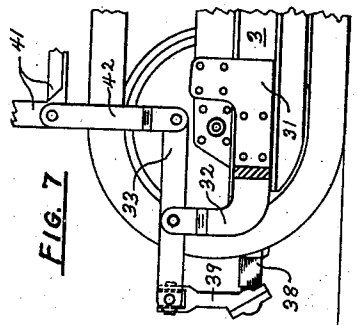


FIG. 7

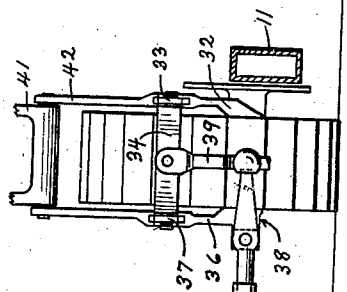
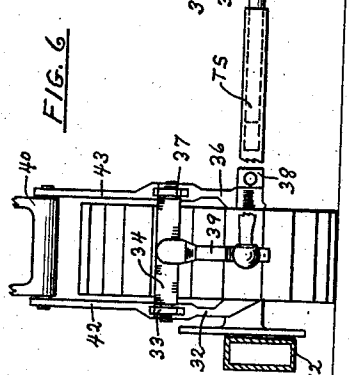


FIG. 6



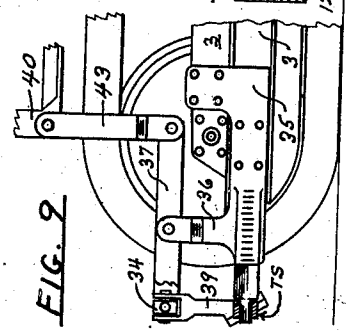


FIG. 9

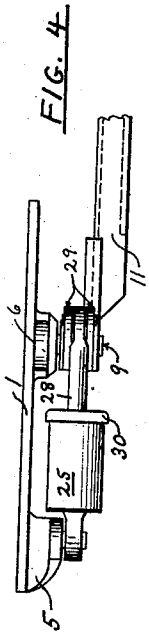


FIG. 4

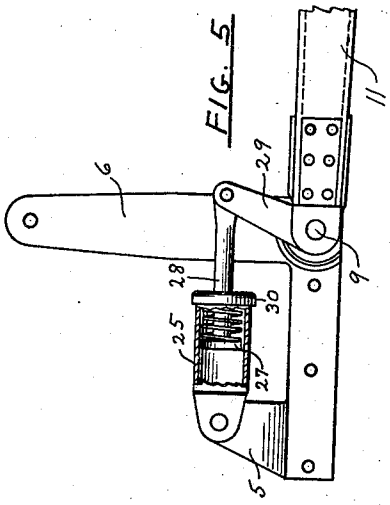


FIG. 5

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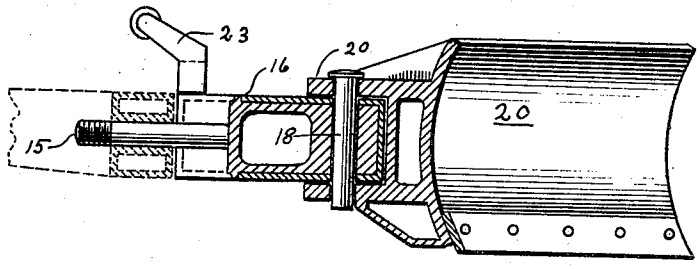


FIG. 10

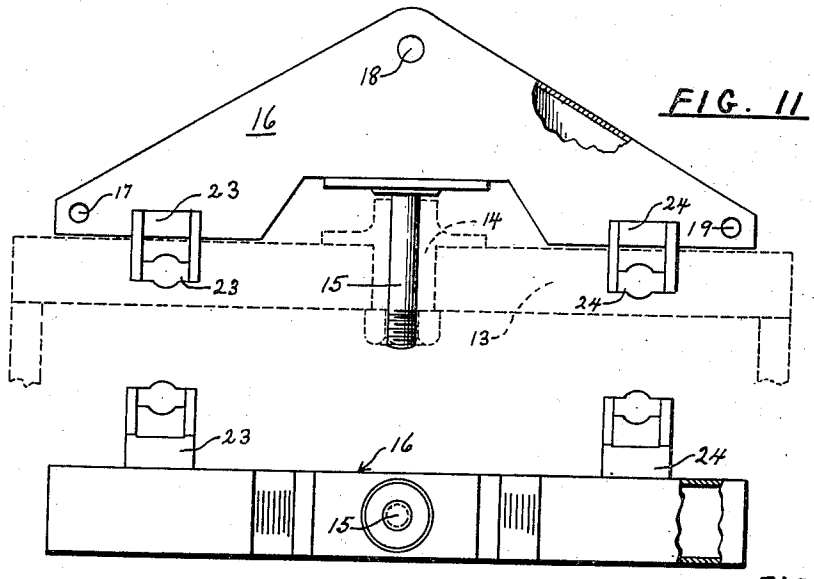


FIG. 11

FIG. 12

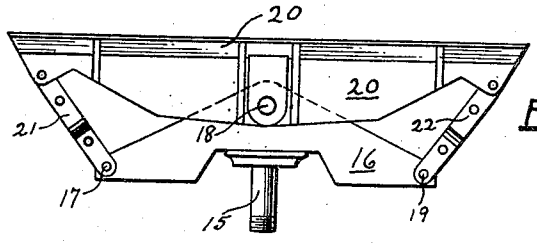


FIG. 13

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FIG. 14

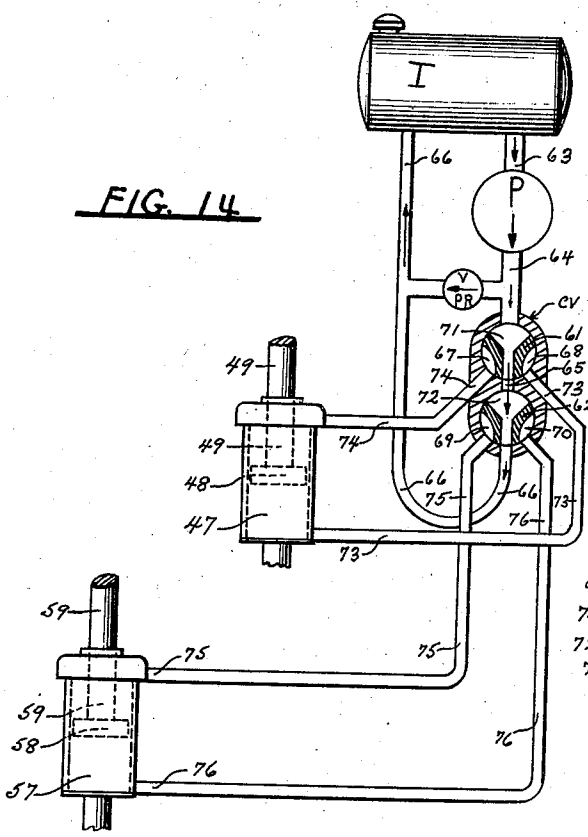


FIG. 15

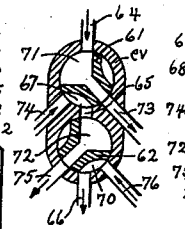
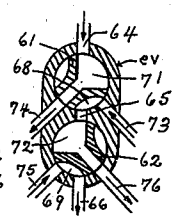


FIG. 16



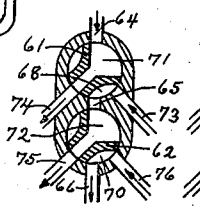


FIG. 17.

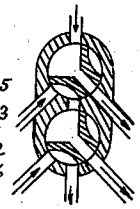


FIG. 18

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Patented May 30, 1939

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UNITED STATES PATENT OFFICE

2,160,596

TRAIL BUILDER, BULLDOZER, AND THE LIKE

Charles Le Bleu, Los Angeles, Calif.

Application July 6, 1935, Serial No. 30,113

5 Claims. (Cl. 37—144)

This invention relates to earth moving devices, the term "earth" being taken in the broad sense to include snow, ice, and the like, adapted to be connected to a tractor to be moved across a surface to be treated and includes a digging or scraping element disposed in operation forwardly of the tractor.

Such devices are commonly termed trailbuilders, bulldozers, snow plows, roadbuilders, grade-builders, backfiller, and the like.

An object of the invention is the provision in a device of the class named having a main frame adapted for connection to a tractor, of an implement carrying head piece connected thereto for transverse tilting movement that is, tiltable in a substantially vertical plane transversely of the line of travel, said head piece having an implement mounted thereon for horizontal swinging movement, that is, swinging movement in a substantially horizontal plane.

Still another object is the provision in devices of the class named, of an implement carrying head piece adapted to be supported for transverse tilting movement and having an implement swingingly mounted thereon, said head piece being adapted for connection to a control mechanism operable to raise, lower and transversely tilt said head piece.

Still another object is the provision in a device of the class named, of novel hydraulic control means whereby with the use of only one pump a pair of hydraulic jacks may be operated simultaneously and in unison in opposite directions even though said jacks may be unequally loaded.

Still another object is the provision in a hydraulic control mechanism, of a novel hook-up arrangement of a single pressure pump, a pair of control valves and a pair of hydraulic jacks whereby said jacks may be operated simultaneously in the same direction, simultaneously and in unison in opposite directions even though said jacks may not be equally loaded, or singly and independently in either direction.

Still another object is the provision of control means including a pair of hydraulic jacks operable in the same direction to collectively raise and lower the implement and operable in opposite directions to transversely tilt said implement.

In devices of the class here referred to as usually constructed, no power is needed to lower the device into scraping contact with the earth due to the weight of the device. However, power is required for raising the device.

A fault common in these devices is rapid wear and tear of hydraulic equipment due in a large measure to the pressure to which fluid must be subjected to accomplish the desired end. Obviously, hydraulic equipment constructed to withstand these pressures is more expensive than would be the case if such pressures per square inch could be reduced by one half.

Therefore, it is an object of this invention to provide in a device of the class named, yieldable means to resist the normal tendency to downward movement due to the weight of the device to the end that power will be required to lower the device thus, resulting in storing up power in the yieldable means which will assist in raising the device when this operation is performed. Thus, where formerly the pressure may have been say 300 pounds per square inch, by the use of yieldable means as contemplated in this invention, other things being equal, the operating pressure may be reduced to say, 150 pounds per square inch. Obviously one of two beneficial results may ensue. Hydraulic equipment may be constructed of lighter materials resulting in reduced costs, or it may be made of less capacity resulting likewise in reduced cost. It should be noted in this connection that while pressures may be reduced by increasing the diameter of the cylinders, if the speed of operation is to remain unaffected the output of the pump would have to be increased. This process would in most cases result in increased cost.

The type of tractor ordinarily used to operate the class of devices here named includes a pair of track laying units at the opposite sides thereof, pivoted behind their front ends to the body of the tractor on what I shall term a dead axle providing a horizontal axis about which said track laying units may independently swing in a vertical plane, and therefore, on uneven surfaces do not maintain a true parallel relationship. Now, it is desirable to mount the control mechanism for devices, of the class named herein, on said track frames instead of the body of the tractor, thus all excessive strains applied to the tractor through said control mechanism has no effect on the tractor body and the front springs, but is localized in the track frames. However, a big disadvantage is inherent in this arrangement because the track frames do not maintain a true parallel relationship and the relative movement of track frames due to uneven surfaces is imparted to the scraping element resulting in transverse tilting thereof with the result that the tractor and the device in com-

bination comprises a unit difficult to operate effectively under many conditions.

Therefore, it is an object of this invention to provide in a device of the class named having control means therefore mounted on the track frames of the tractor, compensating means mounted on the track frames and actuated by the relative movement therebetween to maintain the scraping element in a relationship substantially parallel to the dead axle of the tractor.

Other and further features and objects of this invention will be apparent to those skilled in the art, upon consideration of the attached drawings and the following specification, wherein I have disclosed and described only one exemplary embodiment of my invention while at the same time contemplating that such changes may be made in the combination, correlation and construction of parts, members, and features as do not constitute a departure from the spirit of the invention as defined in the claims.

Referring to the drawings:

Figure 1 is a side elevation of the device with a fragment of a pusher arm removed.

Figure 2 is a plan view of the device.

Figure 3 is a side elevation of the device.

Figure 4 is an enlarged fragmentary plan view of the rear end of a pusher arm and the associated bracket and resilient means.

Figure 5 is a side elevation of Figure 4.

Figure 6 is an enlarged front elevation showing the arrangement of the compensating mechanism.

Figure 7 is a side elevation of the outer side of Figure 6.

Figure 8 is a plan view of Figure 7.

Figure 9 is an inside elevation of Figure 6 taken as if standing between the two track frames of the tractor.

Figure 10 is a sectional view taken through A—A see Figure 2.

Figure 11 is an enlarged plan view of the scraper carrying head piece.

Figure 12 is a rear elevation of Figure 11.

Figure 13 is a plan view of the scraper carrying head piece with the scraper positioned thereon for bulldozing work.

Figure 14 is a diagrammatic view of the hydraulic control mechanism for the device for manipulating the various elements for raising, lowering and tilting the scraper carrying head piece.

Figure 15 is a plan view, in section, of the control valves with the plugs positioned for collectively lowering the scraper.

Figure 16 is a plan view, in section, of the control valves showing the plugs positioned for collectively raising the scraper.

Figure 17 is a plan view, in section, of the control valves showing the plugs positioned for transversely tilting the scraper by raising the right end thereof and lowering the left end.

Figure 18 is a plan view, in section, of the control valves showing the plugs positioned for transversely tilting the scraper by lowering the right end and raising the left.

The device as shown comprises brackets 1 and 2 secured to the track frames 3 of a tractor 4, said brackets 1 and 2 including upstanding arms 5 and 6, and 7 and 8 adapted at their upper ends for pivotal association with certain other structure to be described later.

Brackets 1 and 2 are provided with trunnions 9 and 10 pivotally supporting pusher arms 11 and 12, said pusher arms extending thence forwardly to a connection with cross beam 13, said pusher arms 11 and 12 and cross beam 13 constituting the main frame of the device.

Formed on cross beam 13 at 14 is a horizontally extending bearing bore having rockably mounted therein a trunnion shaft 15 secured at its forward end to a scraper carrying head piece 16. The head piece as here shown is triangular in shape and is provided with three vertically extending holes or bearings 17, 18, and 19. Swingingly mounted on head piece 16 at 18 is a scraper 20. Holes or bearings 17 and 19 are used to secure the scraper 20 in the desired adjusted position with respect to the head piece by the proper placing of members 21 and 22. Also secured to head piece 16 are brackets 23 and 24.

Pivotally secured to upstanding arms 5 and 7 are cylinders 25 and 26 having slidably mounted therein a head 27 secured to rods 28 secured at their outer ends to brackets 29 rigid with pusher arms 11 and 12. Encircling the rods 28 inside the cylinders 25 and 26 and interposed between the head 27 and the cylinder head 30, is a powerful compression spring continuously resisting the outward movement of piston 27, thus minimizing the normal tendency of the scraper to drop to the ground by reason of its weight.

Secured to the outside of each of the track frames 3 of the tractor, are brackets 31 provided with upstanding arms 32, pivotally supporting intermediate the ends thereof, bars 33, pivotally connected at their forward ends to the outer ends of bars 34.

Secured to the inner sides of each of the track frames 3 of the tractor, are brackets 35 provided with upstanding arms 36, pivotally supporting intermediate the ends thereof bars 37 pivotally connected at their forward ends to the inner ends of bars 34.

Brackets 35 are also provided with forwardly extending arms 38 adapted for and pivotally supporting at points spaced from the ends thereof a telescoping shaft TS pivotally supporting at its outer ends the lower ends of links 39 pivotally connected at their upper ends to bars 34.

Pivotally supported at their rear ends on the upper ends of upstanding arms 6 and 8, are beam brackets 40 and 41; pivotally supported on the outside at their forward ends on the upper ends of vertical bars 42 pivotally supported at their lower ends on the rear ends of bars 33; and pivotally supported on the inside at their forward ends on the upper ends of vertical bars 43, pivotally supported at their lower ends upon the rear ends of bars 37.

Viewing Figure 1, a beam 44 is rockably mounted upon beam bracket 40 at 45. The forwardly extending portion of beam 44 carries, by means of a ball and socket arrangement, a link 46 connected at its lower end, also by a ball and socket arrangement, to bracket 24 mounted on the head piece 16. Mounted on beam bracket 40 at 46, is a hydraulic cylinder 47. Slidably mounted in cylinder 47 is a piston head 48 secured to a piston rod 49 pivotally connected at its outer end to the rearwardly extending portion of beam 44 at 50.

Viewing Figure 3, a beam 51 is rockably mounted upon beam bracket 41 at 52 to introduce a reversal of direction of motion between cylinder 57 and the left hand end of the scraper blade. The forwardly extending portion of beam 51 carries, by means of a ball and socket arrangement, a link 53 connected at its lower end, also by means of a ball and socket arrangement, to bracket 23 mounted on the head piece 16. The

rearwardly extending portion of beam 51 is formed to constitute a gear segment. Mounted upon beam bracket 41 at 54 is a beam 55. The forward portion of beam 55 is also formed to constitute a gear segment which meshes with the gear segment of beam 51. Mounted on beam bracket 41 at 56 is a hydraulic cylinder 57. Slidably mounted in cylinder 57 is a piston head 58 secured to a piston rod 59 pivotally connected at its outer end to the rearwardly extending portion of beam 55 at 60.

A control valve CV, provided with a pair of valve plugs, is interposed in the system of conduits leading from the pump P to hydraulic cylinders 47 and 57 by means of which the raising, lowering and transverse tilting of the scraper is accomplished. This hydraulic control means will now be explained.

Referring to Figure 14, T is a reserve tank of fluid. P is a continuously running hydraulic pump. CV is a control valve provided with a pair of plugs 61 and 62 shown in the neutral or inoperative position. Thus, fluid flows from the tank T through conduit 63 into pump P, thence through conduit 64 into valve plug 61, thence from valve plug 61 through conduit into valve plug 62, thence into conduit 66 through which the fluid returns to the tank T. Thus, there is provided a continuous flow of fluid from the pump P to the tank T, there being interposed in the conduit through which this fluid flows, a control valve by means of which said fluid may be diverted to either end of either of the cylinders 47 and 57. It should be noted that the valve plugs 61 and 62 may be operated simultaneously, or singly. It should be noted that valve plugs 61 and 62 are provided with side ports 67, 68, 69 and 70, and center ports 71 and 72. Further explanation of the hydraulic system will be made in connection with a description of the device in operation.

It is a previously stated object of the invention to provide means whereby the total load handled by the hydraulic system during the complete operating cycle, of lowering the scraper and then returning it to the raised position, is substantially equally distributed between the lowering and raising operation to the end that the operating pressure of the fluid per square inch will be materially reduced. This means consists of the cylinder, head, rod, and compression spring arrangement shown on an enlarged scale in Figures 4 and 5. This spring may be of such tension as to require a small amount of power, in addition to the weight of the device, to lower the scraper 20 to its lowermost limit. Thus, as the scraper is lowered, power will be stored in the compression spring and this power will assist in again raising the scraper. The total load handled during a lowering and raising cycle is thus distributed throughout the whole cycle instead of being concentrated in the lifting half of the cycle resulting in higher operating pressures.

The compensating mechanism shown on an enlarged scale in Figures 6 to 9 inclusive functions as follows; assume that the forward end of the track frame on the left in Figure 6 drops in a low place in the ground and is thus lowered say 4 inches. Thus, the telescoping shaft will turn counterclockwise on the stub shafts on the forward ends of arms 38. The bar 34 on the left track will be drawn downwardly thus raising the rear ends of horizontal bars 33 and 37 on the left track frame, thus resulting in minimizing the downward movement of the corresponding end of the scraper to 2 inches, the proportionate leverages of the various bars being such as to accomplish this result. Simultaneously, on the right hand track frame, viewing Figure 6, the bar 34 will be forced upwardly, thus lowering the rear ends of horizontal bars 33 and 37 on the right hand track frame, resulting in lowering the corresponding end of the scraper 20, one half the downward movement of the left track frame as it dropped in the low place. To summarize, the forward end of the left track dropped say 4 inches and the scraper dropped collectively 2 inches but is thus maintained in a parallel relationship to the dead axle of the tractor. It is to be understood that the figures of 4 inches and 2 inches above referred to are exemplary only and that such correlation and construction of parts, members and features may be resorted to as will accomplish the stated purpose of the compensating mechanism.

In operation, the device is connected to a tractor and moved across a surface to be treated thereby, and the elevation of the scraper with respect to the surface of the earth is determined by power operated control means connected to the device and the tractor. Manually operable control means for said power operated control means are placed in reach of the tractor operator. The power necessary for the operation of the power operated control means is derived from the tractor and said power connection may be made at either end of the tractor, but is usually made at the rear thereof. In some tractors, this power may be taken at the side, or power may be derived from an auxiliary motor mechanism mounted on the device or the tractor.

Earth is removed by lowering the scraper into contact with the ground and advancing the tractor. Earth is discharged by then raising the scraper so that it will pass over the accumulated earth as the tractor advances.

Referring again to Figure 14, CV is a control valve provided with a pair of valve plugs 61 and 62.

Figure 15 shows the position in which the valve plugs are placed for collectively lowering the scraper 20. Fluid under pressure enters the through port 71 of plug 61, thence through conduit 73 into the plugged end of cylinder 47, forcing the piston 48 outwardly. Fluid displaced from the rod end of cylinder 47 by the outward movement of piston 48, flows into conduit 74, thence through side port 67 and conduit 65 into the through port 72 of plug 62, from which it enters conduit 75 and the rod end of cylinder 57, forcing piston 58 inwardly. The fluid thus displaced by the inward movement of piston 58 flows from the plugged end of cylinder 57 through conduit 76, side port 70 and conduit 66 from which it flows into the reserve tank T. Thus, the scraper is lowered collectively by the outward movement of piston 48 and the inward movement of piston 58, and the movement of piston 48 and 58 will be simultaneous and in unison. When the desired adjustment is attained the plugs are returned to the position shown in Figure 14.

Figure 16 shows the position in which the valve plugs are placed for collective raising of the scraper 20. Fluid under pressure enters the through port 71 of plug 61, thence through conduit 74 into the rod end of cylinder 47 forcing the piston 48 inwardly. Fluid displaced from the plugged end of cylinder 47 by the inward movement of piston 48 flows into conduit 73,

thence through side port 68 and conduit 65 into the through port 72 of plug 62, from which it enters conduit 76 and the plugged end of cylinder 57, forcing piston 58 outwardly. The fluid thus displaced by the outward movement of piston 58 flows from the rod end of cylinder 57 through conduit 75, side port 69 and conduit 66 from which it enters the reserve tank T. Thus the scraper is raised collectively by the inward movement of piston 48 and the outward movement of piston 58, and the movement of said pistons is simultaneous and in unison. When the desired adjustment is attained the plugs are returned to the position shown in Figure 14.

Figure 17 shows the position in which the valve plugs are placed for transverse tilting of the scraper 20. Fluid under pressure enters the through port 71 of plug 61 from which it flows into conduit 74 and the rod end of cylinder 47 and forcing piston 48 inwardly. The fluid displaced from the plugged end of cylinder 47 by the inward movement of piston 48 flows through conduit 73, side port 68 and conduit 65 and enters the through port 72 of plug 62 from whence it flows into conduit 75 and the rod end of cylinder 57 forcing piston 58 inwardly. Fluid thus displaced from the plugged end of cylinder 58 flows through conduit 76 side port 70 and returns to the tank T by way of conduit 66. Thus the scraper 20 is tilted transversely by raising the right end of the scraper and lowering the left end. When the desired tilt is obtained the plugs are returned to the position shown in Figure 14. At this point it should be noted that the pistons 47 and 57 are independently oil locked against movement, thus the tilted position is maintained even under conditions of unequal loading, which results would not obtain if the cylinders were connected in common to a valve with a single plug, because fluid would then be free to flow back and forth between cylinders as a result of unequal loading conditions.

It should also be noted that, having tilted the scraper, the valve plugs 61 and 62 may then be simultaneously positioned as in Figures 15 and 16 to lower and raise the scraper and the transverse tilted position will be maintained even under unequal load conditions.

Figure 18 simply shows the position in which the plugs are placed for transversely tilting the scraper 20 by lowering the right end and raising the left end. It is believed that further explanation of Figure 18 is unnecessary in view of the description of Figure 17.

It is also to be noted that each of the plugs 61 and 62 may be operated singly to raise or lower either end of scraper 20 without disturbing the other.

The power operated control mechanism is connected to a tiltable scraper carrying head piece and the scraper is tilted transversely by tilting the head piece carrying the scraper and not by tilting the main frame on the tractor as is usually done. Furthermore, the same power operated mechanism used in raising and lowering the scraper is adapted to tilting the scraper, thus simplifying and increasing the utility of the device with respect to these functions and the cost of manufacture.

Having thus described my invention, I claim:

1. In a device of the class described including a main frame adapted for connection to a vehicle; an implement carrying head piece, means connecting said head piece to said main frame for transverse tilting movement relative thereto; power operated control means connecting said head piece and said vehicle and operable to transmit power for collectively raising and lowering said head piece, for independently raising and lowering either end of said head piece or for simultaneously raising one end of said head piece while lowering the opposite end; and manually operable control means for said power operated control means to cause said power operated control means to operate.

2. A material handling device comprising a tractor including a pair of track laying units at the opposite sides thereof pivoted behind their front ends for independent vertical swinging movement to the body of the tractor, a main frame adapted for connection to a tractor behind the front ends thereof and carrying at the forward end a material handling implement, means interposed between said device and said tractor to yieldably resist downward movement of the material handling implement, control means adjustably connecting said device and said tractor and operable to cause said material handling implement to assume operative and inoperative positions, compensating mechanism mounted on the frames of said track laying units, means operably connecting said control mechanism and said compensating mechanism, said compensating mechanism being adapted to be actuated by relative movement as between said track laying units to maintain said material handling implement in a position substantially parallel to a horizontal plane through the pivoted connections of said track laying units with the body of the tractor.

3. In a device of the class described, a main frame carrying at one end a material handling implement, means for operably securing said main frame to a vehicle, link means mounted to the forward end of said main frame, the free end of said link means being provided with a gear segment, a bracket upon which said arm carrying the gear segment is pivotally mounted, a second arm carrying a gear segment, said arm being pivotally secured to said bracket whereby the gear segments of the arms will be in mesh, the other end of said second arm being pivotally secured to a hydraulic jack, a pair of manually operable control valves arranged in tandem to receive fluid under pressure successively, means to conduct fluid under pressure from said pump to said valves, conduit means connecting said valves and the hydraulic jack cylinders and means to manipulate said control valves to direct fluid under pressure to operate said arms and their gear segments to raise, lower and transversely tilt said material handling implement on the frame.

4. In a device of the class described, a main frame carrying at one end a material handling implement, means for operably securing said main frame to a vehicle, brackets mounted on the vehicle, a single beam pivotally mounted intermediate its ends on one of said brackets, a forwardly projecting beam pivotally mounted on the other of said brackets, links pivotally connected with the forward ends of said beams and said earth handling implement, a short beam pivotally mounted on the other of said brackets in operating relation to said forwardly projecting beam, means operably associating said short beam and said forwardly projecting beam whereby swinging movement of either of them in a given direction will impart a similar movement to the other of them, said short beam and said single

beam being swingable in opposite directions for collectively raising and lowering said earth handling implement without transversely tilting said earth working implement.

5. In a device of the class described, a main frame carrying at one end a material handling implement, means for operably securing said main frame to a vehicle, brackets mounted on the vehicle, a single beam pivotally mounted intermediate its ends on the one of said brackets, a forwardly projecting beam pivotally mounted on the other of said brackets, link means pivotally connected with the forward ends of said beams and said earth handling implement, a short beam pivotally mounted on said other of said brackets in operating relation to said forwardly projecting beam, means operably associating said short beam and said forwardly projecting beam whereby swinging movement of either of them in a given direction will tend to impart a similar movement to the other of them, said short beam and said single beam being swingable in the same direction for imparting transverse tilting movement to said earth handling implement.

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