United States Patent

Magee

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[54] **ANGLE AND TILT MECHANISM FOR DOZER BLADE**

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[52] **U.S. Cl.** **172/804,** 172/805, 172/807

[51] **Int. Cl.** **A01b 3/76,** A01b 59/048

[58] **Field of Search**.....172/801, 803, 806, 807, 276, 172/254, 245, 250, 251, 804; 37/117.5, 50

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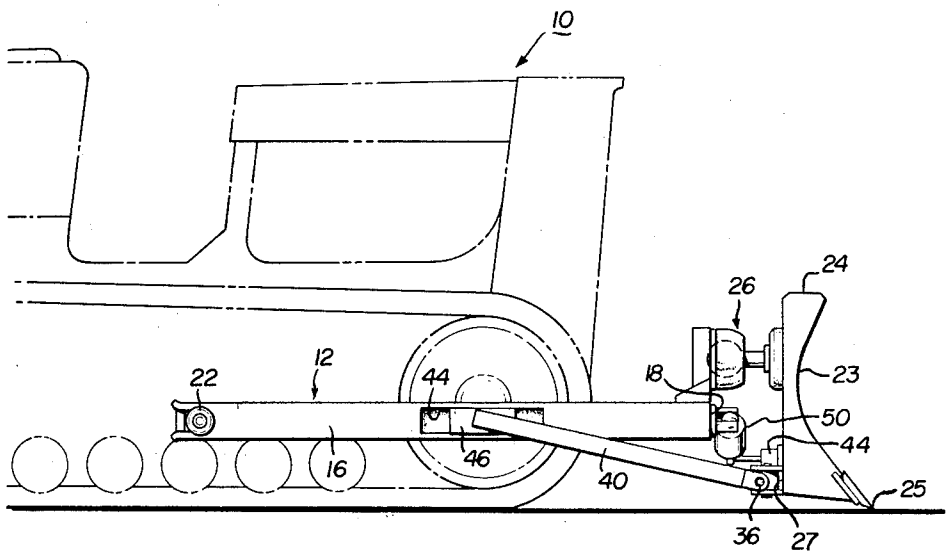
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[57] **ABSTRACT**

A mechanism for an angling and tilting dozer blade in which the dozer is provided with a blade supporting frame and the blade is universally pivotally connected to the front end of the frame within a vertical plane containing the longitudinal axis of the dozer; the opposite lower corners of the blade are pivotally connected by links to the blade supporting frame and the links are longitudinally slidably supported on the frame to thereby angularily reposition the blade when the links are actuated; an extendable link is provided positioned along the rear-side of the blade and towards one side of the blade from the blade center for pivotal connection of the blade to the front end of the frame to tilt the blade around an axis normal to the longitudinal axis of the dozer when the extendable link is actuated. Actuation of the links may be manual or by fluid power.

10 Claims, 5 Drawing Figures

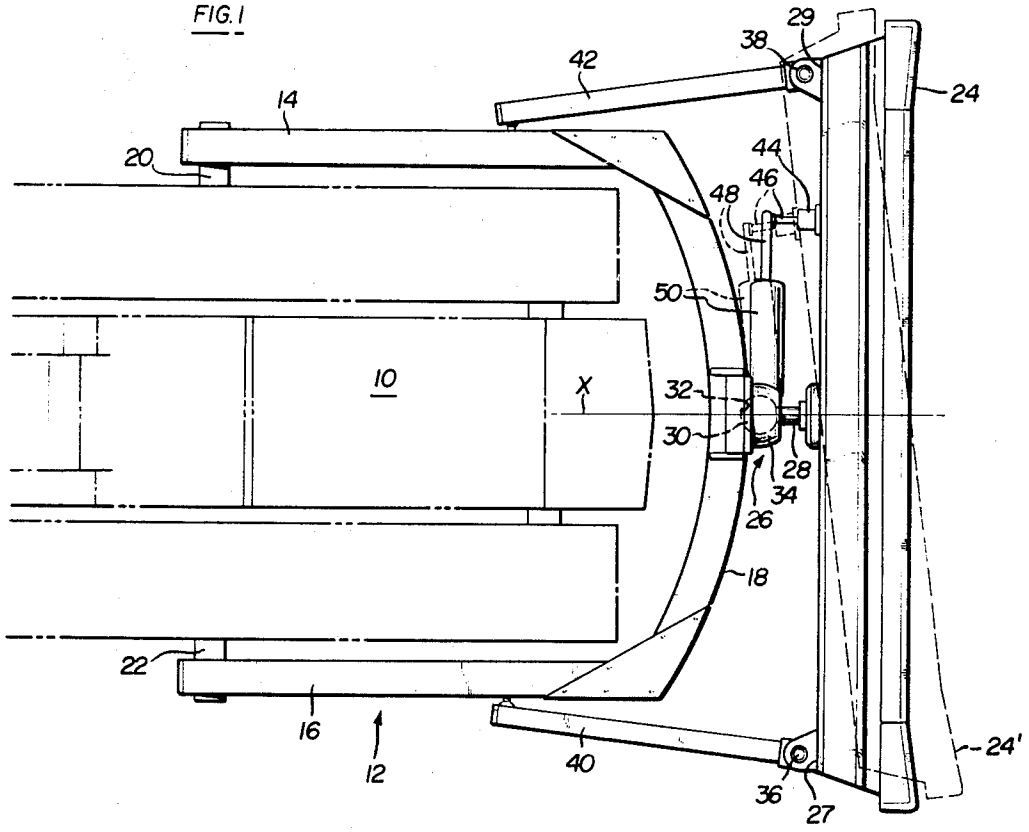


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SHEET 1 OF 2

FIG. 1



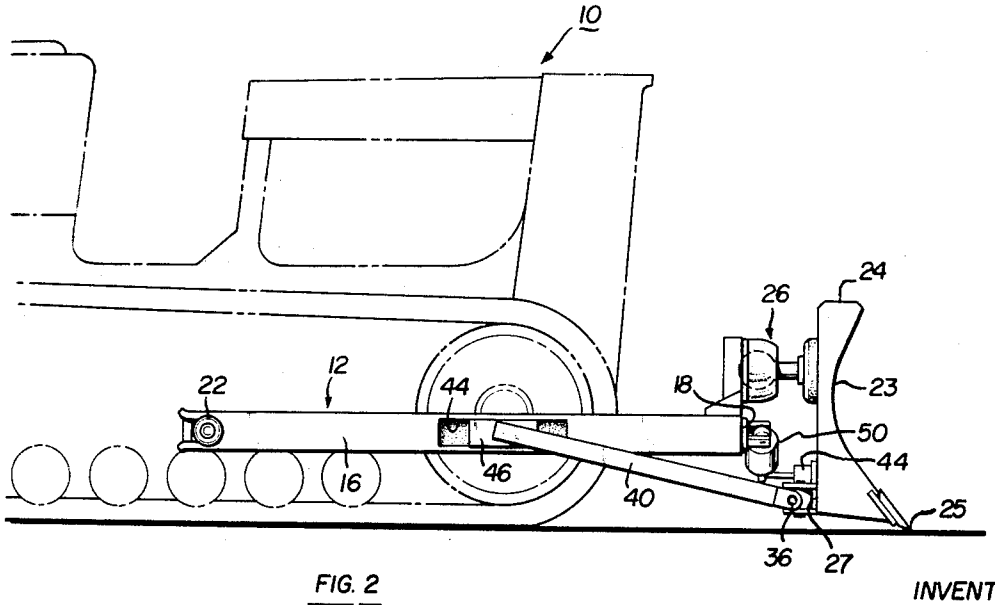


FIG. 2

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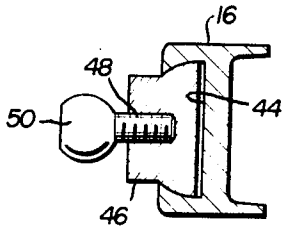


FIG. 5

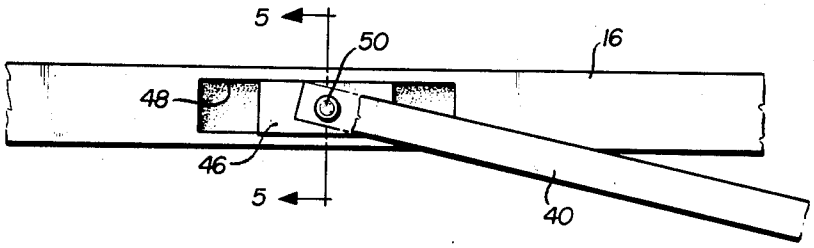


FIG. 4

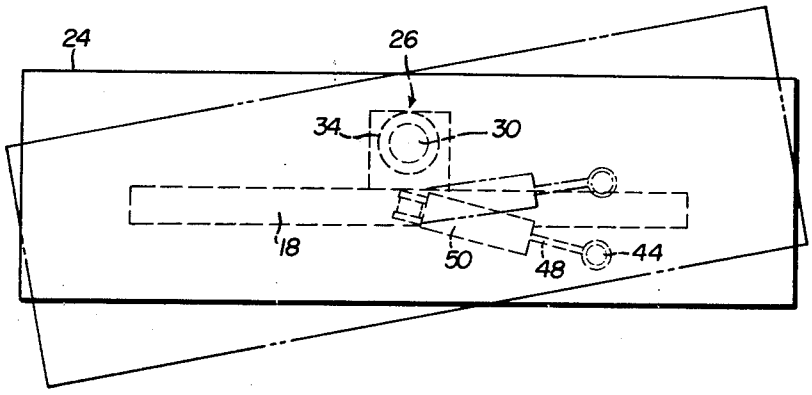


FIG. 3

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ANGLE AND TILT MECHANISM FOR DOZER BLADE

BACKGROUND OF THE INVENTION

The present invention relates to a mechanism for angling and tilting a material moving blade, such as used in a bulldozer or similar earth working machine, and more in particular relates to an improved simplified arrangement for such blade.

It is known to provide in bull-dozers or similar types of earth working machines, to which this invention is more particularly related, a pusher frame of U-shaped configuration which surrounds the front end of the dozer and the rear ends of the two arms of the U-shaped frame are being pivotally connected to the sides of the dozer to permit raising and lowering of the U-shaped frame about a transverse axis to lower the blade to a working position on the ground and to raise the blade for transport of the dozer to another location. Conventionally, the blade is mounted on the transverse bight portion of the U-shaped frame and usually in such a way as to permit either up and down movement, pivotal side movement or edgewise tilting movement of the blade.

In the angling type of bulldozer blades, the center of the back of the blade is conventionally mounted on the center portion of the transverse bight section of the U-shaped frame by means of a pivot joint which permits the blade to be angled in a horizontal plane.

Conventionally, on each side of the U-shaped frame an adjustable brace or link extends from the side arm of the U-shaped frame to the adjacent end of the blade. The rear end of each brace or link is then usually attached to the adjacent side arm of the U-shaped frame at various adjustable positions to permit the blade to be angled in a horizontal plane and to be locked in the selected angular position.

Various problems occurred in the design of such mechanism, particularly when in addition to the angling provision of the blade, tilting of the blade about a fore and aft axis is desired.

In non-angling types of known bulldozer blade arrangements, tilting of the blade has been accomplished conventionally by pivotally connecting the back of the blade to the forward end of the push arms of the U-shaped frame, providing extensible and retractable braces or links between each push arm and the top of the blade. Tilting of the blade in this known construction is accomplished by retracting the brace or link on one push arm and at the same time extending the brace or link on the other push arm. This provision, however, requires the use of three pivots between the blade, push arms and the adjustable brace or link just back of the blade where the connection to the push arms should be rigid.

Furthermore, this known construction places the adjusting brace or link in an exposed position and is not an arrangement that can be used on an angling type of bulldozer blade.

In known angling type of bulldozer blades, tilting of the blade has been accomplished by employing a double swivel joint between the blade and the central portion of the U-shaped frame that will permit tilting about a fore and aft axis as well as angling about the vertical axis, and by providing a sliding connection between the forward end of each adjustable brace or link in the back of the blade along a circular track in a vertical plane. This known construction, however, makes it difficult to mount the blade compactly and securely on the U-shaped frame, requires tilting adjustment at both ends of the blade and, in addition, it not suitable for use on non-angling types of bulldozer blades.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides an improved angle and tilt mechanism for the blade of an earth working machine, or the like, which is simplified in construction and provides a tilt mechanism which can be used for non-angling blades as well.

The mechanism of the present invention comprises a U-shaped frame, having opposite leg or arm portions extending alongside the vehicle and which carries the blade. The rear ends of the arms are pivotally connected on transverse axes to the vehicle. The arms of the U-shaped frame constitute the push arms for the blade and are forwardly connected by a transverse cross beam or bight portion extending transversely in front of the vehicle.

The blade of the present invention is connected by means of a universal joint to the center of the bight portion of the U-shaped frame and near the upper edge of the blade. The opposite lower corners of the blade in the present invention are pivotally connected by means of a pair of links to the respective push arms of the U-shaped frame along which they are secured for adjustable sliding movement in directions opposite to each other to thereby angularly move the blade around a vertical axis of the universal joint. Controlled idling movement of the links can be accomplished by either mechanical or fluid power means as required.

The blade of the present invention is further additionally connected to the bight portion of the U-shaped frame by means of an extendable link which is disposed parallel to the rear surface of the blade and towards one side thereof. The extendable link is universally connected with the frame and the blade to permit universal movement when the blade is being angularly positioned by the pair of sliding links. The pivotal connection of the extendable link to the blade is such that, when the extendable link is contracted or extended, the blade will be rotated around a longitudinal axis intersecting the vertical angling axis within the universal joint, so as to reposition the blade edgewise relative to the ground surface.

The present mechanism is particularly simple in construction, installation, maintenance and operation and does not require a complex hydraulic system for operation, and at the same time eliminates conventional complex push lever and linkage arrangements.

Other novel features and distinct advantages of the present invention will become clearly evident or particularly be pointed out in the followed detailed description when read in conjunction with the appended drawings forming a part thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings schematically illustrate a preferred embodiment of the present invention, in which:

FIG. 1 is a top plan view illustrating in phantom lines the angling position of the blade by means of the present improved mechanism;

FIG. 2 is a schematic side view of the front part of a vehicle embodying the present improved blade angling and tilting linkage arrangement;

FIG. 3 is a schematic front view of the blade of the present invention, illustrating in phantom lines the tilted position of the blade by means of the present improved mechanism;

FIG. 4 is an enlarged fractional side view of the sliding connection of the angling link to one of the pusher arms of the U-shaped frame; and

FIG. 5 is a transverse cross-section through the sliding connection of the angling link to the pusher arm.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGS. 1 and 2 a vehicle, such as a tractor, is indicated at 10 having a longitudinal center axis X.

The vehicle 10 carries a frame 12 at the forward end thereof, which is substantially U-shaped in a horizontal plane, providing opposite parallel arms 14 and 16, respectively, which, forwardly of the vehicle, are connected by a transverse bight portion 18. The free ends of the opposite parallel arms 14 and 16 extend longitudinally along opposite sides of the vehicle 10 and are pivotally connected thereto by means of transverse axially aligned pivot shafts 20 and 22 respectively, to enable the frame 12 to be raised or lowered relative to a ground surface on which the vehicle 10 is disposed. This is usually done by a conventional lift arrangement which is well known in the art and need not further be described. Any such known lift arrangement being adaptable to the improved blade angling and tilting mechanism of the present invention.

The arms 14 and 16 of the frame 12 comprise primary rigid pusher bars for a blade 24 pivotally supported on the bight portion 18 of the frame 12 by means of a universal joint 26 which has a longitudinal axis coplanar with the longitudinal axis X of the vehicle 10. The universal joint 26 preferably comprises a ball and socket joint composed of a ball stud 28 which is attached to the rear of the blade 24 near the upper edge thereof. The stud 28 has a ball 30 at the end thereof adapted to engage within a socket 32 provided in a bracket 34 which is secured to the bight portion 18 of the frame 12 and extends upwardly therefrom, as seen in FIG. 1, to align the socket with the center line of the ball stud 28 when the blade is in its normal upright position. Thus, the blade 24 is pivotally supported about an axis located in a horizontal plane disposed above the horizontal plane in which the arms 14 and 16 of the frame 12 are located.

The blade 24 is a material handling blade, such as is used for earth removal, and has a curved mold board surface 23 which terminates at the lower end of the blade in a cutting or digging edge 25. The opposite lower rear end corners 27 and 29 respectively of the blade 24 are attached by means of universal joints, such as ball and socket joints 36 and 38 respectively, to a pair of links 40 and 42 which extend rearwardly from the blade for pivotal connection of the link 40 to the arm 16 and link 42 to the arm 14 of the blade supporting frame 12.

With further reference to FIGS. 4 and 5, each of the arms 14 and 16 is provided with a longitudinal slot 44 in which is disposed a sliding block 46 for longitudinal sliding movement therein The sliding block 46 carries a ball stud 48 having a ball 50 at its outer end adapted for pivotal engagement within a suitable socket (not shown) at the end of the link 40. It will be understood that the opposite link 42 is similarly pivotally and slidably secured to the arm 14 of the frame 12.

With particular reference to FIG. 2, each of the sliding blocks 46 in the opposite arms 14 and 16 are operably connected to a mechanical or fluid power actuated operating mechanism (not shown) of conventional construction in accordance with known practice, and which need not further be described. Thus, when, for instance, the link 40 is moved forwardly by movement of the sliding block 46 within the slot 44, the blade 24 will be angularily moved around a vertical axis of the universal joint 26, to the position 24¹relative to the longitudinal axis X of the vehicle 10. Forward movement of the link 40 causes the opposite link 42 to be moved rearwardly a like distance by sliding movement of the respective sliding block 46 within the arm 14 in an opposite direction.

Angular positioning of the blade 24 is accommodated for and made feasible by means of the universal joints 36 and 38 by which the links 40 and 42 are attached to the blade and together with the central universal joint 26 form a three-point pivotal attachment for the blade 24, arranged in a geometrical triangular pattern. The upper apex (universal joint 26) defines the primary pivot point of the blade 24 and the opposite lower apexes (i. e., universal joints 36 and 38) constitute secondary pivot points for tilting and angling and to maintain the blade in balanced condition in any adjustable position.

The links 40 and 42 provide rigid push arm extensions and, due to their connection at the lower corners of the blade 24, provide maximum pushing force to the cutting edge 25 of the blade so as to most effectively absorb the load applied to the mold board surface 23 by means of the mass of material loosened by the cutting edge 25 as the blade is moved through the ground by forward movement of the vehicle 10.

It will be understood that, when the opposite link 42 is actuated to move forwardly, the blade 24 will be angled in the opposite direction from that shown in FIG. 2, thereby moving the link 40 rearwardly within the slot 44 a distance corresponding to the forward movement of the link 42.

A bracket 44 is disposed at the rear of the plate 24, at one side from the center line thereof and slightly below the blade support frame 12. A stud 46 is attached to the bracket 44, adapted for universal connection to the end of a piston rod 48 which is reciprocably supported within a cylinder 50. The rear end of the cylinder 50 is pivotally attached to the bight portion 18 of the frame 12 at the center thereof but below the universal joint assembly 26.

Thus, as piston rod 48 is extended outwardly from cylinder 50, an upward push will be exerted at the upper edge of the blade 24 nearest to the piston rod and a downward pull is exerted on the lower edge of the blade, diagonally positioned therefrom to thereby rotate the blade about the longitudinal axis of the universal joint 26, as seen in FIG. 3. The link 42 swings upward with the blade and the link 40 swings in opposite direction downwardly with the blade which is ac-

commodated for by the universal joint connections of the links to the blade and to the frame **12**.

Conversely, when the piston rod **48** is retracted within the cylinder **50**, the blade **24** is caused to rotate around the longitudinal axis of the universal joint **26** in the opposite direction from that shown in FIG. **3**.

The pivot connection of the piston rod **48** to the blade **24** and of the cylinder **50** to the bight portion **18** of the frame **12** is preferably by universal joint, such as a ball and socket joint or the like, to permit the cylinder and piston rod to accommodate any adjusted angular or tilting movement of the blade.

Instead of a fluid actuated cylinder and piston rod assembly, such as shown, a mechanically extendable link can be provided to obtain the same tilting effect.

Likewise, instead of the provision of rigid links **40** and **42** as herein shown, the rigid links could be replaced by extendable links, mechanically or fluid actuated, whereby the link sliding arrangement **44** and **46** along the arms **14** and **16** would be eliminated. edge

Thus, it will be seen from the foregoing description in connection with the attached drawings, that the present invention provides an improved simplified three-point pivot attachment arrangement for a dozer blade for universal pivotal adjustment of the blade angularily in a horizontal plane and for tilting of the blade in a vertical plane.

The present improved arrangement lends itself for incorporation in any conventionally known type of dozer vehicle and requires no complex hydraulic piping or multi-lever and linkage arrangements to accomplish the desired purpose.

By the present arrangement the blade **24** can be (1) angled without tilting the blade, (2) tilted without angling the blade or (3) angled and tilted in a multitude of positions.

Although the pivot joints in the present invention have been described preferably as comprising ball and socket joints, other conventional universal joints may be incorporated instead or a combination thereof to accomplish the same purpose.

Although the present invention has been described in connection with a schematically illustrated preferred embodiment, it will be obvious to a person skilled in the art to which the invention pertains that various changes in structural detail and arrangement may be made without departing from the spirit and essential characteristic of the invention within the scope of the appended claims.

I claim:

1. In combination with a ground working machine having a longitudinal axis; a frame pivoted on said machine on an axis transverse to the longitudinal axis; and a ground moving blade pivotally attached to said frame; the improvement comprising: a universal joint connecting a generally upper portion of said blade to said frame and disposed in a vertical a pair of longitudinally movable links disposed on opposite sides of said frame, each of said pair of links being pivotally connected to said frame and to opposite lower corners of said blade at the rear thereof; each of said movable links being oppositely slidable on said frame so that by slidable extension of one of said links and simultaneous slidable retraction of the other of said links said blade will be angularly moved around a vertical axis of said universal joint; adjustment means adapted to oppositely slide said links, on said frame, to angularly adjust the blade; a third extendable link disposed between the frame and said blade and pivotally connected to said blade and to said frame; said third extendable link extending along an axis substantially normal to said longitudinal axis and operable upon extension or retraction to tilt said blade in either direction around a horizontal ai axis intersecting said vertical axis within said universal joint; said frame comprises a U-shaped structure having a pair of legs disposed on opposite sides of said machine and extending forwardly; the free ends of the legs being pivotally connected to said machine for selectively lowering or raising said frame relative to a ground surface; the other ends of said legs being connected by a transverse portion extending forwardly across said machine; said third extendable link comprising a first member pivotally connected to said transverse portion of said frame below said universal joint, and a second member longitudinally movable relative to said first member for selective extension or contraction relative thereto; the free end of the said second member being universally pivotally connected to said blade towards one side thereof and in a plane intermediate said universal joint and a said pivotal connection of said pair of links to said blade.

2. In the combination as defined in claim **1**, each of said legs being provided with a longitudinal slot along the lateral outer side thereof; sliding blocks slidably disposed within said slots; each of said sliding g blocks carrying a ball stud extending therefrom; socket means on the end of each of said pair of links for pivotal connection of said links to said ball studs on said sliding blocks; and means to selectively move said sliding blocks in opposite directions within said slots to thereby angle said blade around a vertical axis of said universal joint.

3. In the combination as defined in claim **1**, said first member being a fluid cylinder and said second member being a piston rod reciprocably disposed therein; and fluid power means to actuate said fluid cylinder to selectively extend or retract said piston rod to thereby tilt said blade around longitudinal axis intersecting said vertical axis at the center of said universal joint.

4. A tilting and angling mechanism for the blade of an earth moving machine having a blade supporting frame, said frame being of substantial U-shape comprising a pair of parallel arms extending along opposite sides of said machine for pivotal connection thereto and a transverse bight portion connecting the other ends of said arms in front of said machine, said transverse bight portion adjustably supporting a material moving blade; means to universally pivotally connecting said blade to said bight portion at the center thereof midway between the ends of said blade and adjacent the upper edge thereof to permit angular adjustment of said blade about intersecting axis; a pair of links each of which being pivotally connected to a respective one of said arms and the lower edge of said blade; said pair of links being individually, longitudinally adjustable along said arms to thereby cause angling of said blade about a vertical axis when said links are longitudinally moved in opposite directions; and an extendable link extending in longitudinal direction of said blade comprising a first member universally, pivotally connected to the bight

portion of said frame and a second member longitudinally movable relative to said first member and universally, pivotally connected to said blade at one side thereof so that upon selective extension or contraction of said extendable link said blade will be tilted about an axis longitudinally of said machine and intersecting said vertical axis within said universal pivoting means.

5. In the mechanism as defined in claim 4, in which said universal pivoting means comprises a ball and socket joint; each of said arms being provided with a longitudinal slot at the outer side thereof; a block slidably disposed in each of said slots and each of which being provided with a ball stud; socket means at one end of each of said pair of links for pivotal connection of said links to said ball studs on said blocks; and means to selectively move said sliding blocks in opposite directions within said slots to thereby angle said blade around a vertical axis of said universal pivoting means.

6. In the mechanism as defined in claim 4, said first member of said extendable link comprising a fluid cylinder and said second member of said extendable link comprising a piston reciprocably disposed within said fluid cylinder; and fluid power means to actuate said fluid cylinder to selectively extend or retract said piston rod to thereby tilt said blade around a longitudinal axis intersecting said vertical axis.

7. A three point pivotal attachment arrangement for a material moving blade of a dozer having a blade supporting frame comprising a pair of oppositely disposed push arms pivotally connected to said dozer; first means defining a first pivot point disposed adjacent the upper edge of said blade and centrally thereof to universally, pivotally connect said blade to said frame; second and third means pivotally connecting opposite lower corners of said blade to said push arms, said pivotal connections defining a second and third pivot point respectively; and an extendable link disposed between said frame and said blade and pivotally connected to both; said extendable e link being disposed alongside said blade towards one side thereof; and means causing selective extension or contraction of said extendable link to thereby tilt said blade about said first pivot point.

8. In the arrangement as defined in claim 7, said first means defining a first pivot point comprising a ball and socket joint.

9. In the arrangement as defined in claim 7, said second and third means comprising a pair of links, each of which slidably pivotally supported on a respective one of said arms for selective individual sliding movement therealong in opposite longitudinal directions to thereby angularily repositioning said blade relative to a longitudinal axis of said dozer.

10. In the arrangement as defined in claim 7, said extendable link comprising a fluid cylinder and a piston rod slidably disposed therein; said fluid cylinder being pivotally connected to said frame and said piston rod being pivotally connected to said blade; below the level of the frame and fluid power means to actuate said fluid cylinder to selectively extend or retract the piston rod to thereby tilt said blade around an axis of said first pivot point intersecting the pivot axis of angular repositioning of said blade.

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