This invention concerns a bulldozer blade having a blade tilt function effected by independently functioning lift cylinders thereby eliminating separate tilt hardware and controls.
DOZER BLADE TILT WITH INDEPENDENT FUNCTIONING LIFT CYLINDERS

FIELD OF THE INVENTION

[0001] The invention relates to push blade adjustments for a hydraulically adjustable bulldozer blade.

BACKGROUND OF THE INVENTION

[0002] Hydraulically adjustable bulldozer blades are well known in the art having been described in such U.S. Pat. Nos. 2,678,508 including tilting features therefore; Pat. Nos. 2,817,168; 3,184,869; 3,991,832; 4,487,269; and 4,828,045 all incorporated herein by reference.

SUMMARY OF THE INVENTION

[0003] The instant invention relates to hydraulically adjustable dozer blades incorporating electro-hydraulically controlled hydraulic cylinder movement to provide blade tilt without separate traditional tilt function hardware and controls.

[0004] The above mentioned and other features of this invention, and the manner of attaining them, will become more apparent and the invention itself will be better understood by reference to the following description of embodiments of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 presents a side view of the present invention showing lift a cylinder connected to the blade.

[0006] FIG. 2 illustrates the blade in a lifted position parallel to level ground.

[0007] FIG. 3 and FIG. 4 illustrates the blade in a tilt position.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0008] The term bulldozer 10 is applied to a vehicle for pushing material with a forward blade. Generally the vehicles are equipped with endless belts 14 or tracks for motive power. However wheeled vehicles equipped with forward blades 12 for pushing material also qualify as bulldozers. The term is frequently shortened to “dozer” and will be so identified hereafter. Dozer forward blade systems may be broadly classified as those having support bracing located outside of the vehicle tracks or wheels (“C”-frame type) and those having support bracing between the wheels or tracks (“C”-frame type).

[0009] Functions useful for dozer blades include the raising and lowering of the blade hereafter referenced as “lift”. Blade angle concerns movement of one end of the blade forward, corresponding with movement of the opposite end of the blade rearward. With the vehicle axis defined as parallel to the forward/rearward direction of travel, the pitch is described as movement of the top edge of the blade generally along the vehicle forward and rearward with respect to the lower blade edge so as to change the angle at which the blade intersects level ground. Some blades are contoured in a concave shape as viewed from the front of the vehicle. The blade-ground angle of intersection in the case of curved blades in such instance would relate to the angle created by the intersection of a tangent to the curve of the blade with level ground. Blade tilt involves raising, or lowering, one end of the blade relative to the opposite end.

[0010] Push-beam type blade supports are exemplified by disclosures such as U.S. Pat. No. 3,628,612. Disclosed is a blade support system involving jacks directly for the raising and lowering of the blade; the angling of the blade; and the pitch of the blade. Means by which blade tilt may be effected is not described. The push-beams outside the tracks are connected by a transverse intermediate portion 14 behind the blade.

[0011] U.S. Pat. No. 3,184,869, incorporated herein by reference, discloses a push beam support where a separate transverse structure is not employed. Rather, the blade structure serves the function of the intermediate portion of the transverse structure. The blade structure is disclosed as having a pitch function but apparently lacking an angle function.

[0012] U.S. Pat. No. 2,678,508, incorporated herein by reference, describes tilting a blade by extending or retracting a pitch jack on one side of the blade.

[0013] It would be advantageous to effect blade adjustment for lift, pitch and tilt adjustments wherein the blade structure involves fewer operating parts than disclosed by the prior art. Lift jacks 18 applicable to the instant invention include hydraulic cylinders of the double-acting type. Advantageously, the cylinders employ an electronic feed-back loop to a controller that informs the controller of the position of the piston within the cylinder which also relates to the position of the connection of the piston to the blade support structure, and through the structure to the position of the blade. Such cylinders are known in the art and commercially available.

[0014] The instant invention relates to blade support structures which employ at least two blade lift cylinders 18a, 18b situated with at least one lift cylinder on each side of the vehicle axis. The blade lift system makes advantageous use of electro-hydraulic controls for the lift cylinders. It is also contemplated that a plurality of cylinders appropriately configured may substitute for a single cylinder on each side of the vehicle axis.

[0015] The invention will be described as applied to dozer blades configured with a push-beam 16 support. As known in the art a spherical bushing connection 22 or other known connection for each leg of the push beam at the connection of the push beam and blade permits movement about the connection in more than one plane. The lift cylinders 18a, 18b connect to the blade 12 also by a fitting permitting movement about the connection 20. According to such an arrangement, independently actuating lift cylinders 18a, 18b attached between the blade and vehicle results in a tilted blade. The lift cylinders are affixed to the dozer frame by a connection 24a, 24b of the well known trunion and yoke type.

[0016] A dozer equipped as described herein may effect a blade tilt in response to a command or signal provided from the dozer operator without the necessity of separate blade tilting apparatus by independently extending (or retracting) one of the lift cylinders 18a, 18b, relative to the other lift cylinder 18b, 18a. The independent movement of the lift cylinders results in raising (or lowering) of the blade 12 on one side of the dozer axis relative to the other side, thereby effecting a change of blade tilt. Blade tilt may also be effected by operating lift cylinders in raising/lowering directions opposite one another.

[0017] Additional hardware required in systems known in the art making use of lift cylinders for blade tilt in push beam
style dozers include a means for by-pass of hydraulic fluid otherwise directed to the lift cylinders. When raising or lowering a blade that has been previously tilted as a result of the lift cylinders moving independently, the raising or lowering results in the cylinders operating in parallel. At maximum lift or maximum depth, a one of the cylinders necessarily reaches end-of-stroke before the other. In conventional cylinders, the hydraulic pressure is relieved by relief valves, either at each individual cylinder, or by a central relief valve.

[0018] Electro-hydraulically controlled cylinders of the type suggested for use with the instant invention provide feedback of the piston location to a controller. Pressure feedback is also available to the operator. When the piston reaches end-of-stroke, the feedback controller may be programmed by suitable algorithm to close the hydraulic valve to the cylinder contemporaneously with the piston reaching the end-of-stroke position. The use of electro-hydraulically controlled cylinders save costs, reduce cylinder complexity, and eliminate a potential maintenance item by deletion of the by-pass valve.

[0019] The feed-back data of the location of the piston in the hydraulic cylinder is provided to an algorithm in a controller (not shown). The controller limits hydraulic fluid feed to pistons at their end-of-stroke. The controller activates pistons in parallel for lifting the blade, and separately to engage the tilt function.

What is claimed is:
1. A dozer comprising a blade adjustable for tilt by means of independently operable lift jacks.
2. The dozer of claim 1 where the independently operable lift jacks comprise electro-hydraulically controlled cylinders.
3. The dozer of claim 2 where blade tilt results from differential extension of the pistons of the lift jacks.
4. The dozer of claim 2 whereby the lift jacks are independently controlled by a suitable algorithm programmed into a controller.