Review of Cabin Tilting Mechanism for Earth-Moving Machinery

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ABSTRACT

This paper provides a review of the literature on designing of Cabin tilting mechanism for Earth-moving machinery. In this review we are taking an Earth-moving machinery as a Skid steer loader(SSL). Skid steer loader is an important machinery in any industry. Skid loader is designed in such a way that it can use multiple equipment's in numerous engineering applications. As this is a compact machinery, therefore there are constraints for maintenance of various subsystem like hydraulics, mounting, engine systems etc., placed at bottom of the cabin. The cabin has got sufficient weight due to ROPS & FOPS considerations. As a solution, there is various methods are available. In this paper several methods of cabin tilting mechanism are reviewed.

Keywords – *Tilting mechanism, Skid steer loader, cabin tilting, tilting for Earth-moving machinery*

1. INTRODUCTION

Skid steer loader is one of the multi-purpose working machine, like drilling, pick and place, loading, transportation, spreading road cleaning and many more [1]. Skid-steer loaders are typically four-wheel vehicles with the wheels mechanically locked in synchronization on each side, and the left-side drive wheels can be driven independently of the right-side drive wheels. The wheels typically have no separate steering mechanism and hold a fixed straight alignment on the body of the machine. By operating the left and right wheel pairs at different speeds, the machine turns by skidding, or dragging its fixed-orientation wheels across the ground [2]. SSL is able to rotate 360^{o} turn is same place using skidding. Many manufacturers have their own versions of this vehicle, including Kubota, Bobcat, Terex, Case, Caterpillar, Gehl Company, Hyundai, JCB, John Deere, Komatsu, LiuGong, New Holland, Volvo, Wacker Neuson, and others. Different type of skid steer loader equipped either with tracks or wheels as shown in figure. [3]

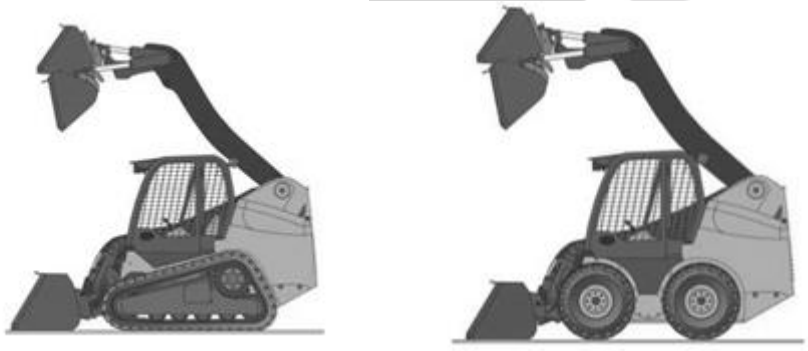

Figure 1 Types of skid-steer loaders according to travel train (1st: tracks, 2nd wheels)[3]

2. LITERATURE SURVEY

Albert W. Foster, Royal Oak. Mich [4] the present disclosure relates to a tilt cabin tuck having unique cab suspension means and cab tilting means. The suspension includes a pair of front and a pair of rear suspension arms that interconnect the cab and the frame. Front air springs are interposed between the front arms and the frame. The rear arms are connected to the frame by releasable latch mechanisms and rear air spring are interposed between the latch mechanism and the cabin. Power cylinder for tilting the cabin are arranged parallel to the front arms and are connected to the frame and the cabin.

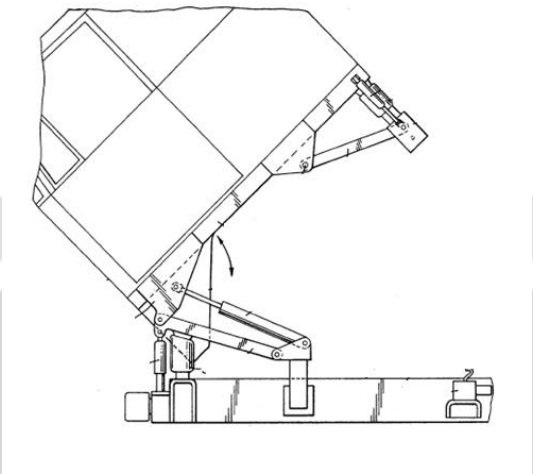

Figure 2 Side elevation view of the cabin in a partially tilted position [4]

The tilting of the cabin will occur about the axis of the pivot bushing. The transverse stabilizer tube will maintain the forward suspension arms and in fixed positons relative to each other so that the pivot axis of the tilting cabin will be maintained horizontal. It will be noted from Fig.4 that the support member rather than directly by the latches will permit the cabin to tilt forwardly without requiring the disconnecting of individual suspension components.

Alan Albert Selman [5] according to the preferred embodiment of this invention, a cabin of tilt cab truck is mounted on a chassis frame by suspension springs. A hydraulic ram is arranged to move the cabin from a riding position to a tilted position. The means connecting the ram to the cabin permits free movement of the cab on its suspension spring when the cab is in its riding position and provides a restraint against movement between the ram and cabin when the cabin is in its tilted position.

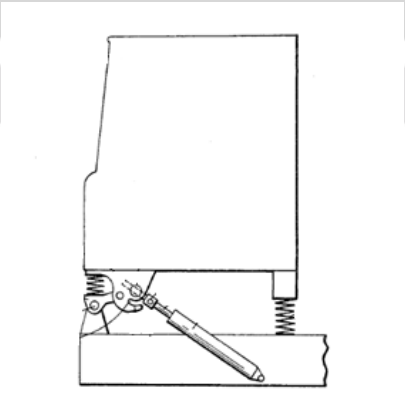

Figure 3 A side view of truck cab and chassis arrangement embodying the design [5]

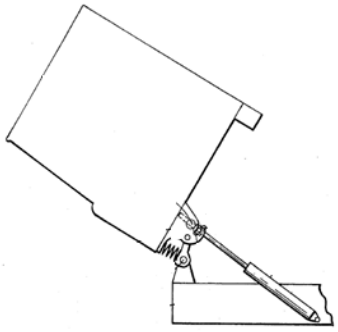

Figure 4 A side view similar to fig 1 showing the cab in its fully tilted position [5]

When it is desired to raise the cab to service the vehicle's engine, the hydraulic cylinder is pressurized. [6]

Upon extension of the ram to tilt the cab, the abutment member engages the trunnion and the cab is forced upwardly and forwardly. After the cab has been tilted through an initial movement of approximately 30°, the pegs enter the slots. Upon further extension of the ram to tilt the cab be yond its balance position in which its center of gravity passes over the pivot, the pegs engage the ramp surface and prevent any forward lurch of the cab. Subsequent tilting movement of the cab continues under the control of the ram.

It will be appreciated that the spacing between the ramp surface and the axis of the trunnion in relation to the spacing between the pegs and the same trunnion axis when the abutment member is engaged with the trunnion is such that there is sub statically no free movement after the pegs have entered the slots.

When the ram is closed or retracted to lower the cab, the initial forces are taken up by engagement of the pegs with the ramp surfaces until the cab again passes its balance point [7]. Beyond the balance point, the weight of the cab 11 is taken by engagement of the abutment member with the trunnion. The abutment member remains in engagement with trunnion after the cab is returned to its riding position. Subsequent deflection of the cab on its suspension springs closes the ram and establishes the free movement. This clearance enables free or uninhibited jounce movement of the cab on its springs whereby good cab ride qualities are assured. [8]

Verne c. Watts; Orlan J. Loraas; Wally L. Kaczmarski [9] a gas spring for supporting a cab enclosure pivot ably mounted to the body of a skid-steer vehicle. A stop tube is mounted to a piston rod and is telescopically cooper able with a cylinder body. Two parallel slots extend in a transverse direction through the stop tube. A stop slide has a pair of legs which are adapted to slide within the slots of stop tube. A release portion of the stop slide is sized to permit the cylinder body to pass between the legs, while a stop portion is sized to prevent the cylinder body from passing between the legs. A spring urges the stop slide toward a stop position at which the stop portion of the stop slide is aligned with the cylinder body when the piston rod is extended. The cab enclosure is thereby latched to a tilt-back position to lower the cab enclosure, the stop slide must be manually moved to a release position at which the release portion is aligned with the cylinder body, thereby permitting the cylinder body to pass between the legs of the stop slide with the piston rod retracted therein. A release cable coupled between a forward end of the cab enclosure and the stop slide can be actuated to conveniently move the step slide to its release position. [10]

The present invention is a gas spring which includes a cylinder body, and a piston rod having a first end extending from the cylinder body and adapted for reciprocal linear movement between a normally extended position and a retracted position. A stop tube mounted to the first end of the piston rod is telescopically cooper able with the cylinder body. Two slots are positioned on opposite sides of and extend through the stop tube. A stop slide has a pair of legs adapted to slide within the slots of the stop tube. [11] The stop slide has a release portion which will permit the cylinder body to pass between the legs, and a stop portion which prohibits the cylinder body from passing between the legs. Bias means bias the stop slide from a release position at which the release portion is aligned with the cylinder body, toward a stop position at which the stop portion is aligned with the cylinder body.

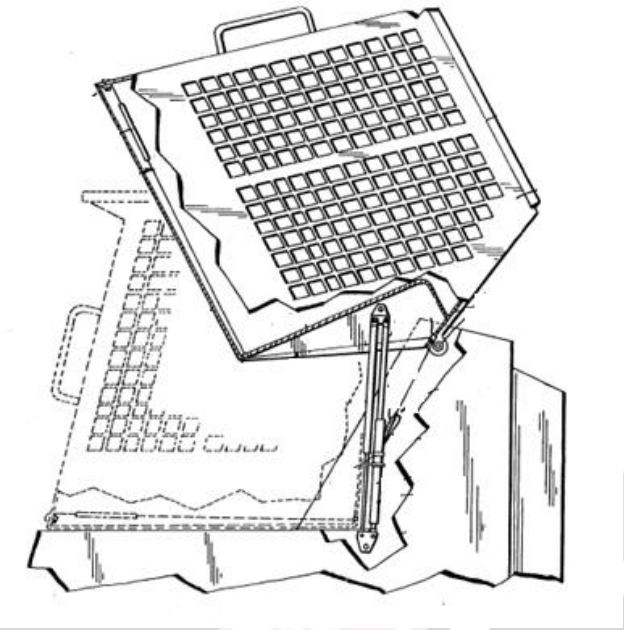

Figure 5 An illustration of a release cable in accordance with the present invention extending between the latch mechanism and the front of cab enclosure [9]

The gas spring is preferably used to support a cab enclosure pivotally mounted to a skid-steer vehicle. The bias means can include a spring. The two slots are parallel to one another, and positioned in a transverse direction with respect to the stop tube. The gas spring can be positively latched to support the cab enclosure in its raised or tilt-back position. The latch mechanism causes the gas spring to be linearly loaded under the relatively heavy cab enclosure. A release cable coupled between the latch mechanism and the front of the cab enclosure can be actuated to conveniently release the latch when the cab is to be lowered. [12]

Larry E. Albright; Lonnie D. Hoechst; Gwinner N. Dak [13] The present invention pertains to a latch mechanism used in conjunction with the Roll Over Protective Structure (ROPS) or cab enclosure of a skid-steer loader, the cab enclosure having tilt back capabilities. [14]

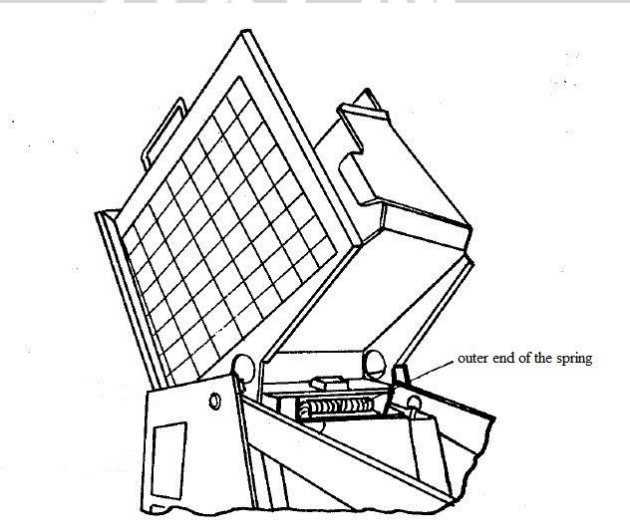

Figure 6 A perspective view of a skid-steer loader employing the present invention wherein the cab enclosure portion of the loader is in a tilt-back condition [13]

The Roll Over Protective Structure (ROPS) or cab enclosure of a skid-steer loader has been modified and a latch mechanism has been added to the loader to facilitate servicing of the loader. The Roll Over Protective Structure (ROPS) or cab enclosure is now positively biased at its rear pivot point away from the frame by means of a torsion spring mounted between the cab and the roll over protective structure. In addition, a latch mechanism for the cab enclosure is provided, the latch mechanism comprising a cam member fixedly mounted on the frame and a latch member fixedly mounted on the cab enclosure. The latch member is positively biased toward the cam surface of the cam member and slides along the cam member as the cab enclosure is rotated away from the frame. At the end of its travel the latch bar slides into a notch provided on the cam member that positively retains the cab enclosure in a full tilt-back position while the loader is being serviced. [15]

3. CONCLUSION

Skid steer loader compact earth moving machinery. It can be utilized in any industry and construction work. The literatures on the tilting mechanism concluded that, there are various types of tilting mechanism available in industry. Numerous patents are registered on these mechanisms. Cabin can be tilt in front & back two different directions. The designer has to design their own mechanism based on their machine intricacies. We have abstracted that in place of complicated design we can simply act use by using gas strut (Spring) for tilting & small contrivance for holding the cabin.

4. REFERENCES

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