FRONT END LOADER WITH VARIABLE ACTUATING ARM

Elmer F. Silbaugh, Humboldt, Iowa

Application January 2, 1953, Serial No. 329,225

5 Claims. (Cl. 214—131)

This invention relates generally to front end loaders and particularly to a front end loader with an automatically variable actuating lever arm.

In the design of front end loaders and the like it has been well known in the field that materially greater lifting force is required at the lower load elevations than at the upper. This is due to the longer horizontal load lever arm distance of the lower portion of the stroke as well as to the excessive force required to break the load loose at the bottom of the lifting stroke. It is also important that as much speed is produced in the lifting stroke as possible and particularly during the upper portion thereof where the lifting force required can be materially reduced.

The fluid capacity of hydraulic systems is also a critical consideration in the design of the hoisting mechanism for the front end loaders and, of course, the smaller the actuating rams, the smaller the reserve of fluid supply required and also the faster the possible elevating speed of the boom.

It is therefore an object of my present invention to provide a front end loader for farm tractors and the like which varies the applied lifting force with the requirements produced by the varying resisting force produced by the load during the various portions of the lifting stroke.

It is a further object to provide a front end loader having a lifting mechanism constructed to exert its maximum lifting force until the full boom extension position is obtained and to progressively reduce the lifting force exerted on the boom as the same is elevated above its fully extended position.

It is another object to provide a front end loader having a lifting mechanism adapted to exert its lifting force on an actuating lever arm of maximum length during the lower portion of the lifting stroke and progressively shortening said actuating arm during the upper portion of said lifting stroke, permitting the maximum lifting force to be exerted during the lower portion of said stroke where it is required and increasing the elevating speed during the upper portion of the lifting stroke.

More specifically, it is an object to provide a front end loader having a pair of swingably mounted booms, each having a slideable connection intermediately mounted thereon for attachment of a hydraulically actuated lifting mechanism with link means attached to said sliding connections for shifting the same toward the pivot points of the booms to shorten the actuating lever arms of said booms as the same are raised above horizontal position, but constructed to maintain the maximum actuating arm during elevation to horizontal fully extended position.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views and in which:

Fig. 1 is a side elevational view showing my new loader attachment with the scoop in lowered position by full lines and in progressively raised positions by dotted lines; Fig. 2 is a top plan view thereof; Fig. 3 is a fragmentary raised view shown on the elevation along the line 3—3 of Fig. 1 and Fig. 4 is a fragmentary sectional view taken substantially along the line 4—4 of Fig. 1 and showing the attachment of the arm shortening link with the boom mounting member.

As illustrated in the accompanying drawings, I provide a conventional farm tractor designated as an entirety by the numeral 7 and having a pair of longitudinal frame members 8 disposed along the sides thereof in the usual manner. The tractor 7 is provided with a rear axle 9 on which rear wheels 10 are mounted. The front wheels 11, of course, steer the tractor and are mounted in a conventional manner.

The ease with which my loader can be mounted on the tractor is an important feature thereof. The pair of longitudinally disposed rigid mounting members 12 are adapted to be very easily attached to the tractor as best shown in Figs. 1 and 2. A forward mounting bracket 13 is rigidly fixed to the forward portion of each tractor frame member 8 as by the plurality of attachment bolts 14 and each bracket 13 has a laterally outstanding attachment member 13a as best shown in Fig. 2. The forward end of each longitudinal mounting member 12 is securely anchored to outer portion of the respective laterally outstanding attachment member 13a as by a pair of U bolts 15 embracing the forward portions of each of the mounting members 12. The rear ends of the two longitudinal mounting members 12 are securely anchored to the respective sides of the rear axle 9 as by the U bolts 16.

An upstanding boom supporting structure 17 is mounted in fixed relation on an intermediate portion of each of the mounting members 12 and the two upstanding mounting structures 17 as by the pivot pins 20. The upper forward portion of the two boom members 19 are rigidly interconnected by the bracing structure 21 as shown in Fig. 2 and a scoop member 22 is pivotally mounted on said forward boom portions in a conventional manner. In the form shown, the booms 19 are suitably reinforced by the overlying tie rods 19a as best shown in Fig. 1.

The boom elevating mechanism consists in a pair of inclined hydraulic rams 23 having their lower rear ends respectively pivoted to the lower portions of the upstanding structures 17 as best shown in Fig. 1. A slideable sleeve 24 is shiftable mounted for longitudinal movement along intermediate portions of each of the booms 19 as best shown in Figs. 1 and 2. A depending attachment web 24a is securely fixed to the lower portion of each of the sleeves 24. The upper forward ends of the rams 23 are respectively pivoted to intermediate portions of said attachment webs 24a as best shown in Fig. 1. Suitable means for limiting the forward movement of the sleeves 24 along the booms 19 are provided such as the stop collars 25 which are respectively fixed to the booms 19 as by being welded thereto.

In order to provide the desired shifting movement of the sleeves 24 when the booms are swung upwardly beyond their horizontal fully extended position, an arm shortening link 26 is pivotally attached at its forward end to each of the webs 24a and the rear ends of said links 26 are respectively pivotally connected to intermediate portions of the upstanding supporting structures 17 as by pivot pins 17a. This pivotal connection between the respective supporting structure 17 and the rear end of the respective link 26 attached thereto, is made in the form shown, by a clevis 27 having a guiding sleeve 27a rigidly attached thereto. It is necessary that a limited amount of free extensibility of links 26 be provided before the same begin to pull downwardly and rearwardly on the sleeves
2,725,995

3
to which the same are connected since the actuating arms should not be shortened until after the booms 19 have been raised above horizontal position where, of course, the load is applied to the maximum horizontal lever arm. In the form shown, this extensibility is provided by a lost motion connection between the clevis 27 and link 26a slidably received through the guiding sleeve 27a and forming the rear end portion of link 26. Suitable stop means are provided at the rear end of each rod 26a such as the adjustable nut 26b which engages the outer end portion of clevis 27 after the rod 26a has moved a predetermined distance rearwardly through the clevis 27 and guiding sleeve 27a. Until the stop nut 26b actually moves into engagement with the end of the clevis 27, the actuating arm of each of the booms 19 will remain at a maximum length and no shortening thereof will take place. However, upon engagement of the stop nut 26b with the respective clevis 27, the two sleeves 24a will be progressively shifted rearwardly along the booms 19 and the actuating arms of said booms will thus be shortened requiring less extension of the rams 23 and, of course, producing faster elevation of the scoop 22 at the upper portion of the elevating stroke. This increased speed, of course, is possible since the shorter actuating arm will swing farther for each increment of projection of the rams 23 than would a longer actuating arm.

In the form of my invention illustrated in addition to the method of stop nuts 26b to vary the point at which the arm shortening links 26 actually begin their arm shortening function, I have provided a vertical adjustment of the clevis mounting pin 17a at the rear of each of the links 26. This vertical adjustment is permitted by selectively inserting the pivot pin 17a in one of a plurality of holes 17b formed through each upwardly supporting structure 17. As best shown in Figs. 3 and 4, each of these upwardly supporting structures 17 is constructed of a pair of spaced upwardly facing plates 17c interconnected at their rear edges by a web plate 17d and the clevis 27 is interposed between said two plates with the pin 17a extending through both plates and through the rear portion of the clevis as best shown in Fig. 4. The adjustment of the elevation of pins 17a, of course, varies the rate at which the actuating arms of the booms 19 are shortened by varying the relative pivot points of the booms 19 and the links 26.

The following is a description of the assembly and operation of my improved front and loader mechanism. The longitudinal mounting members 12 are secured to the tractor as has been previously described, by the use of the U bolts 15, which permit the space between the rear axle 9 of the tractor and the forward attachment mounting brackets 13 to be easily varied which, of course, greatly simplifies the attachment of said longitudinal members 12. After said members 12 have been secured to the tractor, the booms 19 are respectively mounted on the upper portions of the upwardly supporting structures 17 and the rams 23 and links 26 respectively connected to the depending webs 24a. The rams 23 are connected in the usual manner to a conventional hydraulic pump (not shown) which may be a part of the tractor equipment. The scoop 22 is, of course, filled by driving a tractor into the pile of material to be elevated, and a large breaking force is applied to initially elevate the loaded scoop from the ground. The scoop is then elevated progressively as shown by the dotted line positions of Fig. 1. The lost motion connections respectively provided between the links 26 and the respective clevises 27 permits the sleeves 24 to remain in forwardly projecting position with the respective stop collars 25 until the boom has been elevated at least into horizontal, fully extended position. Above this limit, the stop nuts 26b will engage the ends of clevises 27 and cause the respective sleeves 24 to be shifted rearwardly as shown by the upper dotted positions of Fig. 1 wherein the sleeves are spaced rearwardly from the collars 25. This shorten-

4
ing is, of course, due to the spaced relation between the pivot points of the booms 19 and the links 26 and, as has been pointed out, this spaced relationship can be adjusted by varying the positions of the link pivot pins 17a.

It will be seen that I have provided a relatively yet highly efficient front end loader with a controllably variable actuating lever arm which is progressively shortened after the load has been elevated above a predetermined limit to permit not only faster elevation of the load at the higher elevations thereof, but also to permit materially less fluid to be required than is normally the case where the actuating lever arm remains constant throughout the entire elevating structure of the boom. It will, of course, be understood that various changes may be made in the form, details arrangement and proportions of the parts without departing from the scope of my invention, which generally stated, consists of the matter shown and described herein and set forth in the appended claims.

What I claim is:

1. A hoisting mechanism comprising a supporting structure adapted to be mounted on a wheeled vehicle, a forwardly extending boom pivotally mounted at its rear end on said supporting structure for swinging movement on a horizontal transversely disposed axis, a ram mounting member slidably mounted on an intermediate portion of said boom in forwardly extending transversely disposed axis of the boom, a hydraulic ram connected at its rear end to said supporting structure and extending generally forwardly therefrom and pivotally connected at its forward end to said slidable mounting member, positive stop means connected to said boom and constructed to positively limit the forward sliding movement of the mounting member, a shortening link connected at its forward end to said mounting member and its rear end to said supporting structure in spaced relation below the pivotal axis of the boom whereby the tensile force exerted by said link between said mounting and said supporting structure when said boom is elevated by said ram will pull said slidable mounting member rearwardly on said boom to shorten the actuating lever arm of the ram on the boom.

2. The structure set forth in claim 1 and the rear end of said ram being mounted a substantial distance below the pivotal axis of said boom, so that forcible extension of said ram will produce elevation of said boom.

3. A hoisting mechanism comprising a supporting structure, a boom pivotally mounted at its rear end on said supporting structure for swinging movement on a horizontal axis disposed transversely of said boom, a mounting member slidably mounted on an intermediate portion of said boom in forwardly spaced relation to the transverse pivotal axis thereof for back and forth movement longitudinally of the boom, positive stop means fixed to said boom structure and positively limiting the forward shifting movement of the mounting member, lifting mechanism operatively associated with said mounting member for exerting lifting force on said boom, and a shortening link interconnecting said mounting member and said supporting structure in a manner to shift said mounting member rearwardly on said boom toward the pivotal axis thereof to shorten the actuating arm thereof as the boom is elevated by said lifting mechanism, said shortening link having provision for limited initial extension to permit said boom to be elevated a predetermined distance before the actuating arm thereof is shortened by said link.

4. A front end loader for farm tractors and the like comprising a boom supporting structure adapted to be mounted in fixed relation on a farm tractor, a pair of transversely spaced generally forwardly extending substantially parallel booms pivotally mounted on said supporting structure for swinging movement on a horizontal axis disposed transversely of said booms, a pair of generally forwardly extending hydraulically actuated boom
lifting rams respectively connected at their rear ends to said boom mounting structures in spaced relation below the pivotal mountings of the two booms, a mounting slide mounted on each of said booms at a point disposed in forwardly spaced relation to the pivotal mountings thereof and said mounting slides being respectively connected to the forward ends of said rams, a pair of generally forwardly extending shortening links respectively connecting said slides with portions of said boom mounting structure disposed in spaced relation below the pivotal mountings of the booms thereon whereby said mounting slides are respectively shifted toward the pivotal mountings of said booms as the same are elevated, and means rigidly interconnecting the forward portions of said booms to form a single hydraulically actuated boom structure.

5. A hoisting mechanism comprising a supporting structure adapted to be mounted on a wheeled vehicle, a boom pivotally mounted at its rear end on said supporting structure for swinging movement on a horizontal transversely disposed axis, a mounting member shiftably mounted on said boom in forwardly spaced relation to the pivotal mounting thereof for back and forth longitudinal shifting movement on said boom, means engaging said mounting member and positively limiting the forward shifting movement thereof to provide a maximum actuating lever arm for the initial lifting movement of the boom, lifting mechanism operatively associated with said mounting member for exerting lifting force on said boom, a shortening link connected at its forward end to said mounting member and at its rear end to said supporting structure in downwardly spaced relation below the pivotal boom mounting, the rear connection of the shortening link with the supporting structure permitting limited free extensibility of said link during the initial lifting movement of said boom but shifting said mounting member toward said boom pivot when this limited initial shifting movement has been reached, and means permitting the adjustment of said free extensibility to vary the initial operating point of said shortening link.

References Cited in the file of this patent

UNITED STATES PATENTS

2,465,476 Pokorny et al. Mar. 29, 1949
2,468,602 Lord Apr. 26, 1949
2,501,797 Ulrich Mar. 28, 1950
2,524,203 Mott Oct. 3, 1950