Jan. 21, 1958 E. L. MILLER 2,820,558

TRACTOR-MOUNTED LOADER

Filed June 15, 1954 2 Sheets-Sheet 1

Fig. 1

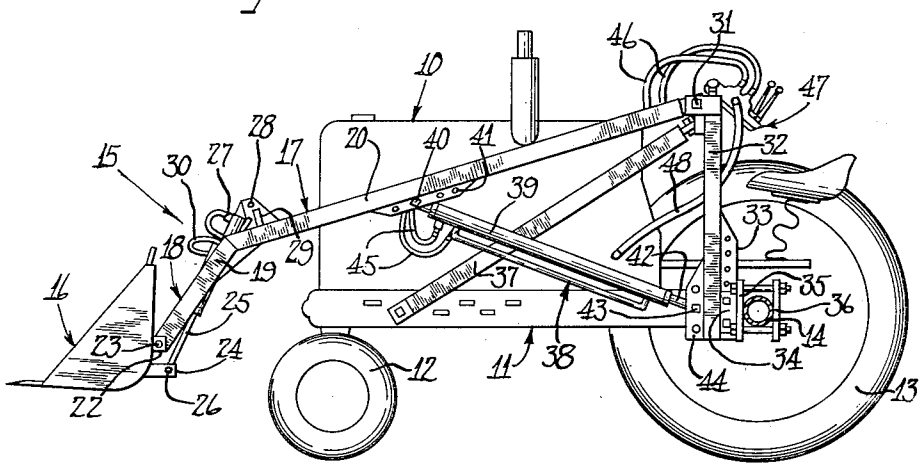
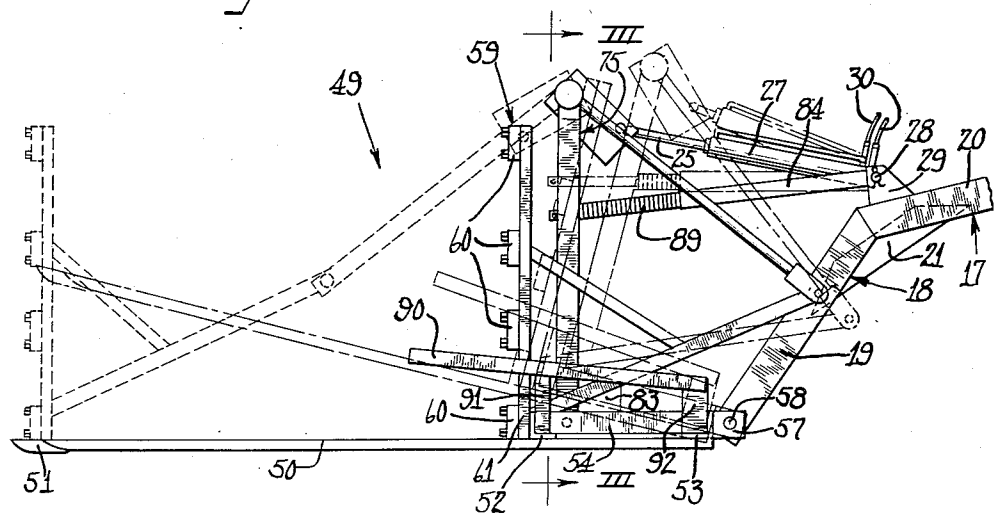


Fig. 2



Inventor

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by Hill, Sherman, Meroni, Gross & Simpson

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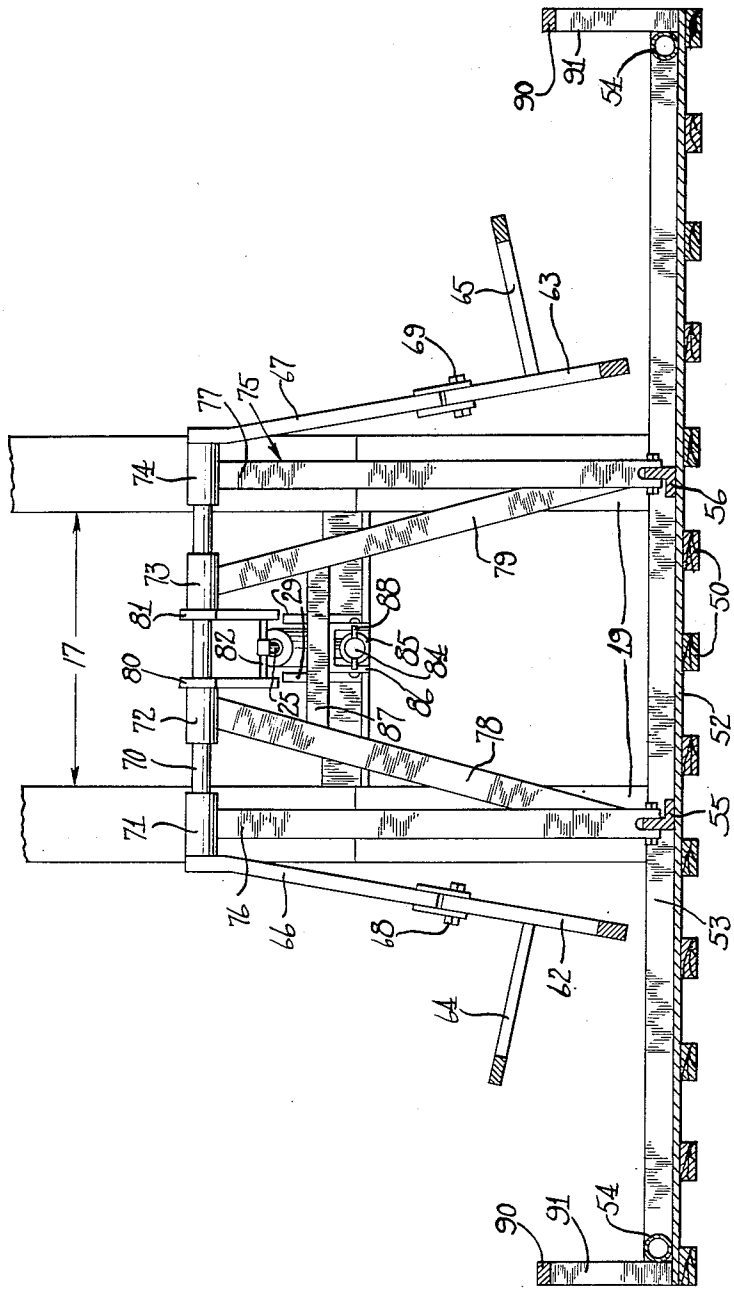

Fig. 3

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TRACTOR-MOUNTED LOADER

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3 Claims. (Cl. 214—510)

This invention relates to a tractor-mounted loader and more particularly to a loader that in relation to its size and weight can carry a load of maximum size and weight to a maximum height and which is rugged, easily operated and readily constructed from a minimum number of parts.

In an exemplary application of this invention, a loader comprises arm means arranged for connection to a tractor for raising and lowering movements, preferably about a pivotal axis above the axis of the rear tractor wheels. A sweep arranged to underlie and support a load, such as a load of hay, is pivotally connected to the arm means and push-off means are mounted for movement over the sweep for discharging the load therefrom.

In operation, the arm means may be lowered to position the sweep close to the ground and the tractor may be driven forwardly toward a pile of material such as hay so that the sweep is in underlying supporting relation thereto. The sweep may then be tilted upwardly to retain a maximum amount of material thereon and thereafter the arm means may be elevated. The tractor may then be driven to a place where it is desired to deposit the load on the sweep and after the arm means are elevated to the required height, the push-off means may be actuated to discharge the material therefrom.

Through the combination of the pivotal support of the sweep from the arm means with the push-off means on the sweep, a maximum load may be retained on the sweep by tilting the same and the load can be carried to a maximum height relative to the size of the arm means since the push-off means can elevate the load to discharge the same from the sweep and the load is not discharged downwardly as would be the case if the pivotal connection of the sweep to the arm means were relied on for discharging the load. Also, the pivotal movement of the sweep required to retain a maximum load thereon is limited and because of the push-off means, the sweep need not be pivoted through a wide arc as would be required if pivotal movement of the sweep were relied on for discharging the load therefrom.

According to an important feature of the invention, the same means are used to both retract the push-off means and control pivotal tilting movement of the sweep. In particular, actuating means may be connected between the push-off means and the arm means and stop means may be provided for limiting rearward or return movement of the push-off means. After the push-off means retracted to a position where further movement thereof is limited by the stop means, further movement of the actuating means will tilt the sweep. Accordingly, it is not necessary to provide separate actuating means for tilting the sweep and retracting the push-off means. At the same time, optimum control is achieved because in all cases wherein it is desired to tilt the sweep, the push-off means will be in a fully retracted position.

The actuating means may take the form of cables or the like but preferably fluid actuated are employed and most preferably double-acting fluid actuating means are employed which may actuate the push-off means in a

discharging direction as well as in a retracting direction. Hence the actuating means performs three different functions which might otherwise require three separate actuating means. For positive control of the push-off means and the sweep, the fluid actuated means should be hydraulic and may, for example, comprise a piston and cylinder assembly.

The push-off means could be actuated directly from the actuating means. For example, the push-off means might be connected to a piston movable in a cylinder connected to the arm means supporting the sweep from the tractor. However, a motion-multiplying means is preferably employed between the actuating means and push-off means to limit the required movement of the actuating means.

In particular, a pivotal arm may be pivotally connected to the push-off means and the actuating means may act at a point much closer to the pivotal axis of the arm than the axis connection of the arm to the push-off means. Preferably, a pair of arms may be employed and such may be pivoted to the upper end of an upright frame structure. With this arrangement, the arm or arms may each pivot between a position extending downwardly and rearwardly from the upper end of the upright frame and a position extending downwardly and forwardly from such upper end of the frame and the lower end portion of the load-engaging surface of the push-off means is maintained at least as far forward as the upper end portion of such surface as the push-off means is moved between the retracted and discharged positions thereof.

In accordance with a specific feature of the invention, the upright frame may be pivoted at its lower end to the sweep to allow the upper end of the frame to be moved as far forwardly as is necessary for the required movement of the push-off means. Means are provided for limiting such forward movement of the frame relative to the arm means supporting the sweep from the tractor so that upon actuation of the actuating means in a discharging direction, the actuating means will act to move the push-off means forwardly after the frame is moved forwardly to a predetermined position. Preferably, spring biasing means may act between the arm means supporting the sweep from the tractor and the upright frame to urge the frame to its forward position. This serves to keep the push-off assembly in position regardless of the angle of the sweep as, for example, when pivotal movement of the sweep is limited by engagement of the sweep with a stack of hay.

For both urging the upright frame forwardly relative to the arm means and limiting such forward movement, the upright frame at a point intermediate its lower and upper ends may have means receiving a bar connected to the arm means that support the sweep from the tractor. Such a bar may have a pin or the like at its outer end to limit forward movement of the upright frame and may also have a coiled compression spring thereon between the frame and the arm means to urge the frame outwardly. The bar may be pivotally connected to the arm means and by a pin also serving as a pivotal connection for a hydraulic cylinder used to actuate the assembly.

A feature of the loader is in the configuration and actuation of the arm means supporting the sweep from the tractor. Heretofore, it has been the practice to couple the sweep to the tractor through a pair of arms connected to the sweep and pivotally connected to the tractor and actuate the arms through hydraulic rams coupled to the arms at or adjacent the connection of the arms to the sweep and coupled to the tractor at points below the axis of pivotal connection of the arms to the tractor. This, of course, provides a maximum leverage for the hydraulic rams and hence decreases the force to be applied by the rams. However, such long rams are expensive to man-

ufacture and further, in order that the rams may have the required strength against bending in their extended position, the cross-section thereof must be greater than dictated by the force to be applied thereby. In the loader of this invention, fluid-actuated rams are employed which act on the arm means at a point intermediate the end thereof connected to the sweep and the access of pivotal connection of the arm means to the tractor. Thus the rams can have a much shorter overall length and can have much greater rigidity with greatly reduced cost. The force required to be exerted by the rams is not increased in proportion to the decrease in length but is increased by only a small percentage and the required force can be readily obtained with the cross-section necessitated by rigidity requirements.

The arm means preferably has an outer end portion projecting angularly downwardly with the sweep being pivotally connected thereto at the end of such outer portion. The hydraulic ram means are connected to the inner portion of the arm means at a point which is spaced a substantial distance above a line from the access of pivotal connection of a sweep to the arm means and through the access of pivotal connection of the arm means to the tractor. With this arrangement, the extended length of ram means required to achieve a given height of a sweep is substantially reduced and it is possible to obtain greater rigidity with reduced expense.

The fact that the outer end portion of the arm means slopes downwardly is also an advantage in that the actuating means for the sweep and push-off assembly may be connected to the arm means at a point adjacent the inner or upper end of the downwardly projecting outer portion thereof, this point being opposite the optimum connection point of the actuating means to the push-off assembly. The fact that the outer end portion of the arm means slopes downwardly is also an advantage in that great rigidity may be achieved merely through the use of struts connecting such outer end portion of the arm means to the inner end portion to provide a truss-like structure.

An object of this invention, accordingly, is to provide an improved loader which relative to its size can carry a load of maximum size and discharge such load at a maximum height.

A further object of this invention is to provide an improved loader having a sweep tiltable to a limited extent and having push-off means thereon.

Another object of this invention is to provide an improved loader having a tiltable sweep with push-off means thereon and with a single actuating means for both tilting the sweep and actuating the push-off means.

Still another object of this invention is to provide an improved loader which is very strong, rugged and durable and yet readily manufacturable from a minimum number of parts.

This invention contemplates other objects, features and advantages which will become more fully apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate a preferred embodiment and in which:

Figure 1 is a side elevational view, partly in section, of a tractor having mounted thereon a loader incorporating certain features of the present invention and having a sweep in the form of a scoop;

Figure 2 is a side elevational view illustrating a sweep assembly constructed according to the principles of this invention and mounted on the loader of Figure 1 in place of the sweep illustrated in Figure 1; and

Figure 3 is a cross-sectional view taken substantially along lines III—III of Figure 2.

Reference numeral **10** generally designates a tractor which may be of conventional construction and may comprise a frame **11** supported by a front wheel or wheels **12** and rear wheels **13** at opposite ends of a rear axial housing **14**.

A loader **15** constructed according to the principles of this invention is adapted to be mounted on the tractor **10** and may comprise a sweep **16** in the form of a scoop pivotally connected to arm means **17** which may be pivotally connected to the tractor for raising and lowering movements. The arm means **17** may have an outer downwardly projecting portion **18** and may preferably comprise a pair of arms on opposite sides of the tractor each having an outer downwardly projecting portion **19** and an inner portion **20**. Each arm may preferably be of tubular metal having a generally square cross-section. To rigidify the outer portions of the arms, a plate **21** may be secured between the portions **19** and **20** of each arm across the joint therebetween, to define a generally truss-like structure.

The scoop **16** may have rearwardly projecting plates **23** receiving the terminal ends of the downwardly projecting arm portions **19** with pins **23** extending through such plates and such terminal ends to provide the pivotal connection between the scoop **16** and the arm means **17**.

To control pivotal movement of the scoop **16**, a pair of plates **24** may project rearwardly therefrom to receive and to be connected to a piston rod **25** through a pin **26**. The piston rod **25** may carry a piston movable in a cylinder **27** pivotal on a pin **28** extending between upstanding plates **29** secured to the arm means **17**. Fluid under pressure, preferably liquid, may be supplied through lines **30** to the cylinder **27** on opposite sides of the piston therein to control pivotal movement of the scoop in either direction.

To pivotally support the arm means **17** from the tractor **10**, the inner end of each inner arm portion **20** may be journaled on pins **31** carried at the upper ends of upright support members **32** which may have lower end portions secured to the axial housing **14**. For this purpose, the upright support members **32** may have rearwardly projecting plates **33** bolted to a plate **34** which is secured to a plate **35**. The plate **35** together with a plate **36** may be clamped by bolts on the rear axial housing **14**. It may be noted that the plate **33** may have a plurality of openings therein so that the vertical position of the upright supports **32** may be adjusted.

To provide additional support for the upright support members **32**, bars **37** may extend between the upper end portions of the supports **32** and forward end portions of the tractor frame **11**.

To control raising and lowering movements of the arm means **17**, fluid-actuated means generally designated by reference numeral **38** may be provided which may comprise a pair of cylinders **39** each having an end portion journaled on a bolt **40** between plates **41** on the underside of each inner arm portion **20** of the arm means **17**. A piston rod **42** may carry a piston movable in the cylinder **39** and may be pivotal on a bolt **43** extending between plates **44** extending forwardly from the lower end portion of the upright supports **32**. Both the plates **41** and the plates **44** may have a plurality of holes for receiving the bolts **40** and **43** so as to permit adjustment of the connections. By proper adjustment, the scoop **16** may be positioned at a desired level relative to ground level when the fluid-actuated means **38** are in retracted positions.

To control operation of the fluid-actuated means **38**, fluid under pressure, preferably liquid, may be supplied to the cylinders **39** on opposite sides of the piston therein through lines **45**.

The lines **30** connected to the cylinder **27** and the lines **45** connected to the cylinders **39** may extend through the arm means **17** and may be connected through lines **46** to a controller **47** supported in a position convenient for the tractor operator and connected to a pump through a line **48**. The controller **47** may be of any desired construction adapted to supply fluid under pressure selectively to the lines **30** and lines **45**.

In operation, the scoop **16** may be in a position as

illustrated and the tractor may be driven forwardly to drive the scoop into a pile of material, such as manure, to be carried. The scoop **16** may then be tilted upwardly to retain a maximum amount of the material by supplying fluid under pressure to an appropriate one of the lines **30**. Thereafter the arm means **17** may be raised by supplying fluid under pressure to appropriate ones of the lines **45** and the tractor may be then driven to a point where it is desired to unload the material. The scoop **16** may then be tilted downwardly by supplying fluid under pressure to an appropriate one of the lines **30** to discharge the material therefrom.

Referring now to Figure 2, reference numeral **49** generally designates a sweep assembly which incorporates very important features of the present invention and which is mounted on the arm means **17** in place of the scoop **16** illustrated in Figure 1. The sweep assembly **49** as illustrated is particularly designed for use in loading and stacking hay but it will be appreciated that the principles involved in the construction of the sweep assembly **49** may be applied as well to structures for loading other materials.

The sweep **49** may comprise a plurality of tines or teeth **50** arranged to underlie and support a load of material such as hay. The teeth **50** may preferably be of wood and may have tips **51** of steel or other strong, hard, durable material. To support the teeth **50**, the rearward end portions thereof may be secured to the underside of horizontal legs of a pair of spaced angle iron members **52** and **53** extending transverse to the teeth **50**. The angle iron members **52** and **53** may be secured rigidly together by rods **54** adjacent the ends of the members **52** and **53** and by angle iron members **55** and **56** intermediate the rods **54**, as shown in Figure 3.

To pivotally support the sweep **49** from the arm means **17**, pairs of plates **57** may project rearwardly from the rearward angle iron member **53** to receive the terminal end portions of the downwardly projecting portions **19** of the arms defining the arm means **17** and pins **58** may extend through such plates and such terminal ends to thereby provide the pivotal connection.

As will be described more in detail hereinafter, means are provided for tilting the sweep **49** upwardly to retain a maximum load thereon after the sweep has been driven into a pile of material to be carried. According to an important feature of the invention, such tiltable movement of the sweep **49** is not relied on for discharging the material, as is the case with the scoop **16** shown in Figure 1, but push-off means generally designated by reference numeral **59** are provided for moving forwardly over the sweep to discharge the material therefrom, thus greatly increasing the height from which material may be discharged from the sweep. It will be appreciated that this is particularly advantageous in a hay-loading sweep such as illustrated in which the tines or teeth are relatively long and in which the ends of the teeth may be elevated a comparatively great distance above the axis of pivotal connection of the sweep to the arm means.

The push-off means **59** may most preferably comprise a plurality of horizontal vertically spaced bars **60** secured to a plurality of vertical horizontally spaced bars **61**. For economy of construction, the bars **60** and **61** may be of wood bolted together.

For actuation of the push-off means **59**, a pair of bars **62** and **63** may project rearwardly, upwardly and slightly inwardly from the lower end of the push-off means **59** with brace rods **64** and **65** projecting rearwardly and downwardly from upper portions of the push-off means **59** to intermediate points of the bars **62** and **63**. The rearward ends of the bars **62** and **63** may be received by the bi-furcated ends of a pair of arms **66** and **67** with pins **68** and **69** extending through such bi-furcated ends of the arms **66** and **67** and through the rearward ends of the bars **62** and **63** to provide a pivotal connection between the arms **66** and **67** and the push-off means **59**.

The arms **66** and **67** may be secured to the ends of a horizontal shaft **70** which may be journaled for rotation in four axially spaced aligned sleeves **71**, **72**, **73** and **74**. The sleeves **71–74** may be disposed at the upper end of an upright frame structure generally designated by reference numeral **75** which may comprise a pair of rods **76** and **77** secured to the sleeves **71** and **74** and extending downwardly to bi-furcated lower end portions receiving and pinned to the vertical legs of the angle iron members **55** and **56**. The upright frame structure **75** may also include bars **78** and **79** extending upwardly and inwardly from lower end portions of the bars **76** and **77** to the sleeves **72** and **73**, respectively.

It will be apparent that with rotation of the shaft **70** about its axis, the arms **66** and **67** may be moved from positions in which they extend rearwardly and downwardly from the axis of the shaft **70**, as illustrated in full lines in Figure 2, to positions in which they extend forwardly and downwardly from the axis of the shaft **70**, as illustrated in dotted lines in Figure 2, to move the push-off means **59** forwardly over the sweep **49**, from a position as illustrated in full lines in Figure 2 to a position as illustrated in dotted lines therein, to discharge hay from the sweep **49**.

To effect this rotation of the shaft **70**, a pair of plates **80** and **81** may be secured thereto intermediate the sleeves **72** and **73** to receive the end of the piston rod **25** with a pin **82** extending through such plates and such end, to provide a pivotal connection. Fluid under pressure may then be admitted through the lines **30** to the cylinder **27** to control movement of the push-off means **59**.

According to an important feature of the invention, the actuating means for the push-off means **59** may also serve to control tilting movement of the sweep **49**. For this purpose, the lower end of the push-off means **59** in its retracted position may abut the vertical leg of the angle iron member **52** and rearward tilting movement of the upright frame **75** may be limited by blocks **83** secured to the rear sides of the bars **76** and **77** in position to engage the upper edges of the vertical legs of the agle iron members **55** and **56** when the upright frame **75** is at a position approximately normal to the teeth **50** of the sweep **49**.

With this arrangement, after the push-off means **59** have been fully retracted, further actuation of the piston rod **25** in a rearward direction will serve to tilt the sweep **49** upwardly about the axis of the pins **58**. Such a position is illustrated in broken lines in Figure 2.

As previously indicated, the upright frame **75** may have its lower end pivotally secured to the sweep **49**, which allows full floatation of the sweep head regardless of ground conditions. It is essential, however, that downward tilting movement of the sweep **49** be limited and for this purpose, a bar **84** is provided. The rearward end of this bar **84** may receive the same pin **28** that journals the cylinder **27**, so as to provide a pivotal connection between the bar **84** and the arm means **17**. The forward end of the bar **84** may be of reduced diameter to define an intermediate shoulder on the bar **84** and this forward end may ride in a sleeve **85** pivotally supported between the legs of an inverted U-shaped bracket **86** carried by a bar **87** secured between the rods **78** and **79** of the upright frame structure **75**. A pin **88** in the forward terminal end of the bar **84** may engage the sleeve **85** to limit forward movement of the upright frame **75** relative to the arm means **17** and thus limit downward tilting movement of the sweep **49**.

It will be appreciated that the sweep **49** may be tilted upwardly with the sleeve **85** riding rearwardly on the bar **84**. Such upward tilting movement of the sweep **49** may also be accomplished without the sleeve **85** riding rearwardly on the bar **84** because of the pivotal connection

between the upright frame **75** to the sweep **49**. It is desirable that when the push-off means **59** is to be actuated, the upright frame **75** should be in a forward position with the sleeve **75** engaged with the pin **88** regardless of the angle of the sweep. For this purpose, a coiled compression spring **89** may be disposed on the reduced diameter forward end portion of the bar **84** between the shoulder thereon and the sleeve **85**, the spring **89** thus urging the frames **75** to a forward position.

To provide for maximum loading capacity of the sweep **49**, a pair of bars **90** may be secured along the sides of the sweep **49** by upright supports **91** and **92**, such bars **90** serving to limit lateral movement of the hay or other material off of the sweep **49**.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. In a loader adapted for mounting on a tractor or the like, arm means arranged for connection to the tractor for raising and lowering movements, a sweep pivotally connected to said arm means, an upright frame having a lower end portion pivoted to said sweep, an arm pivoted to the upper end of said frame, push-off means connected to said arm, and actuating means between said arm and said arm means for both retracting said push-off means and controlling pivotal movement of said sweep.

2. In a loader adapted for mounting on a tractor or the like, arm means arranged for connection to the tractor for raising and lowering movements, a sweep pivotally connected to said arm means, an upright frame having a lower end portion pivoted to said sweep, an arm pivoted to the upper end of said frame, push-off means connected to said arm, actuating means between said arm and said arm means for both retracting said push-off means and controlling pivotal movement of said sweep, means limiting rearward movement of said frame relative to said sweep, and means limiting forward movement of said frame relative to said arm means.

3. In a loader adapted for mounting on a tractor or the like, arm means arranged for connection to the tractor for raising and lowering movements, a sweep pivotally connected to said arm means, an upright frame having a lower end portion pivoted to said sweep, an arm pivoted to the upper end of said frame, push-off means connected to said arm, actuating means between said arm and said arm means for both retracting said push-off means and controlling pivotal movement of said sweep, means limiting rearward movement of said frame relative to said sweep, means limiting forward movement of said frame relative to said arm means, and means biasing said frame forwardly relative to said arm means.

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