

Dec. 13, 1955

F. G. HOUGH ET AL .
TRACTOR LOADERS

2,726,778

Filed Oct. 22, 1954

6 Sheets-Sheet 1

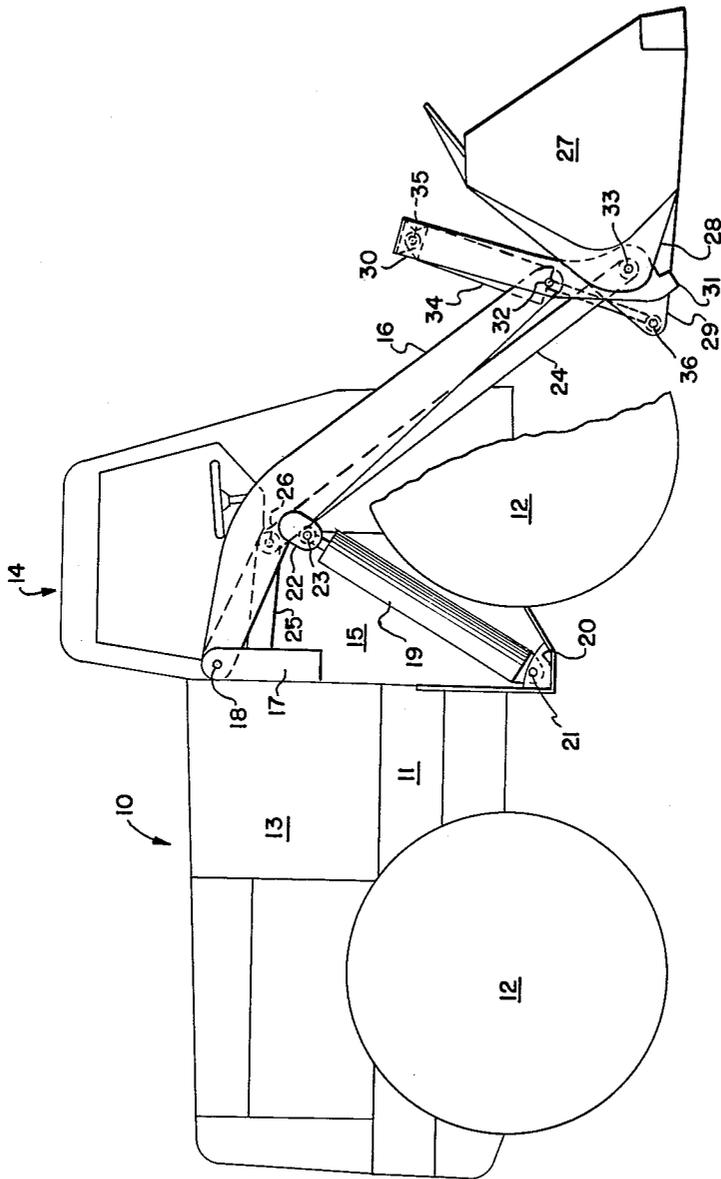


FIG. 1

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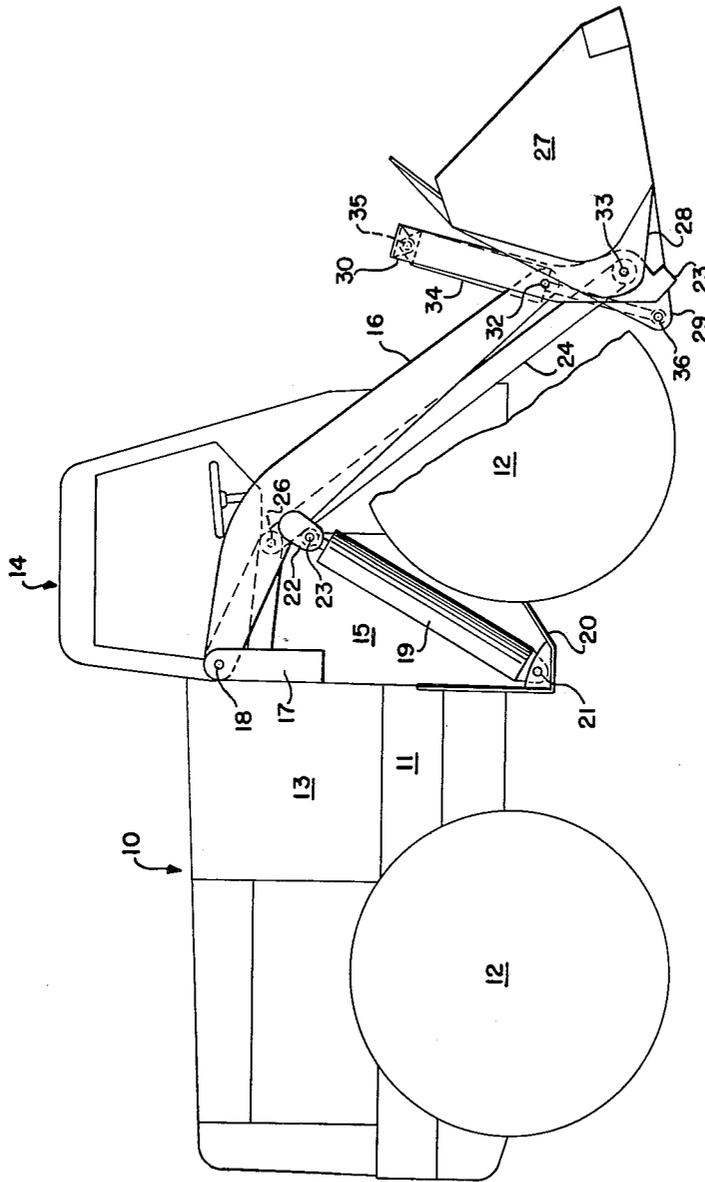


FIG. 2

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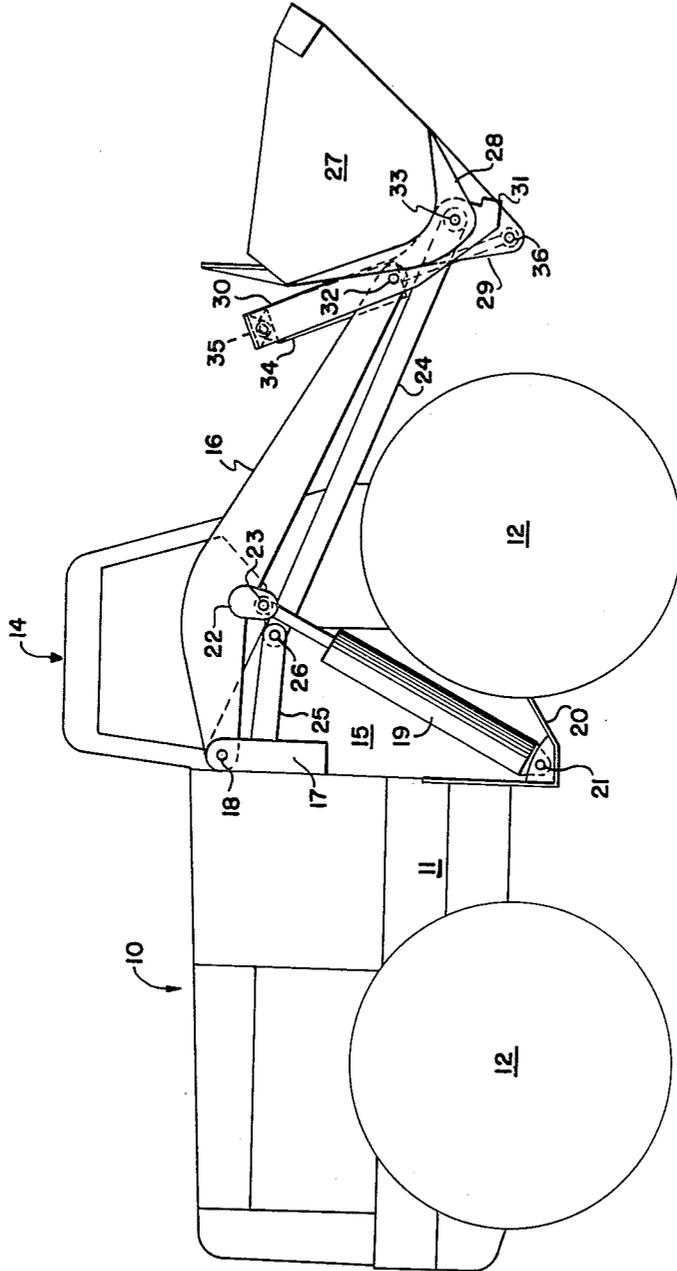


FIG. 3

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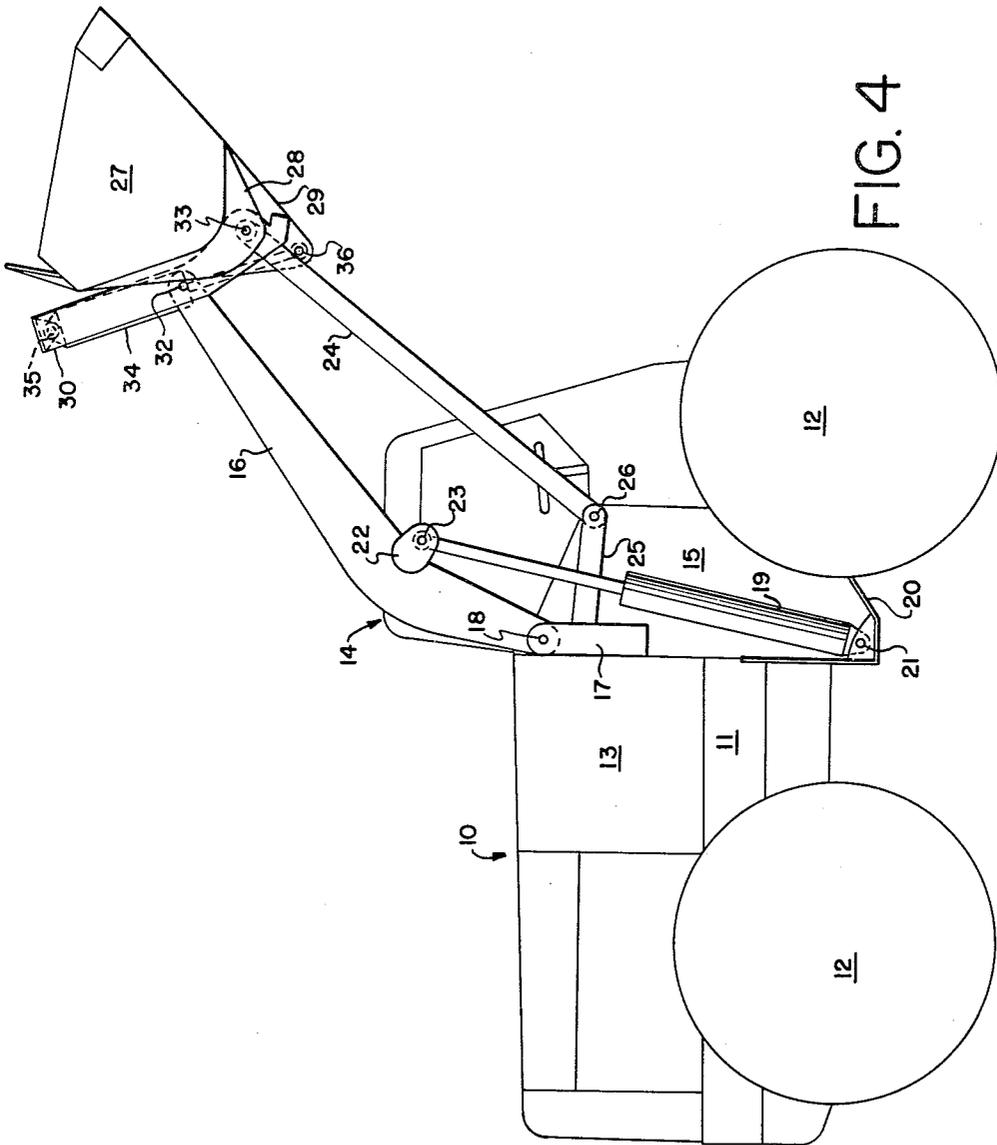
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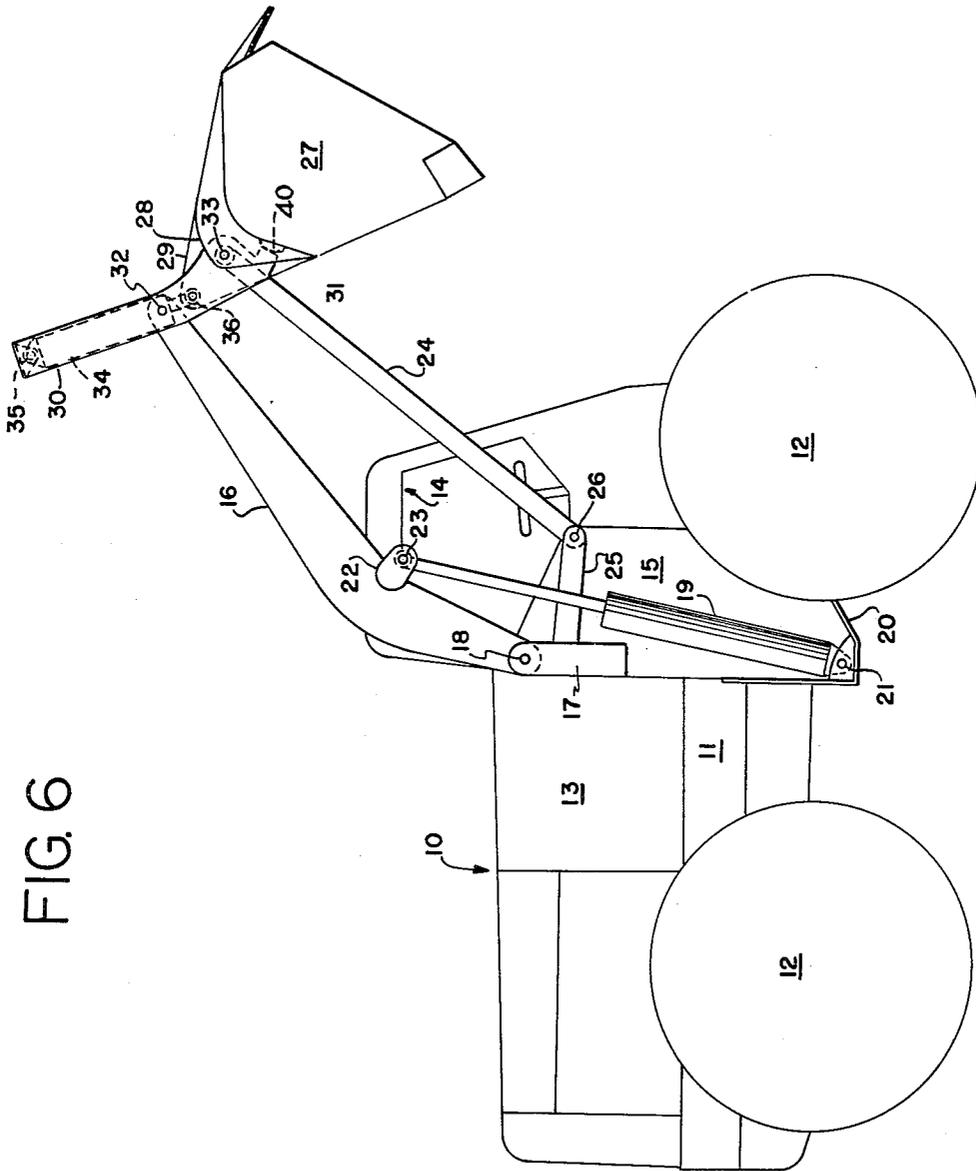


FIG. 6

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TRACTOR LOADERS

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Application October 22, 1954, Serial No. 471,328

11 Claims. (Cl. 214—140)

This invention relates generally to power loaders, and more specifically to improved bucket support and control arrangements for front end type tractor loaders.

In the art of tractor loaders, considerable difficulty has been encountered when attempts have been made to produce a fully versatile loader which could efficiently perform such necessary functions as digging, carrying, and dumping. The difficulty results from the bucket support and control means which does not permit the operator of the loader to tilt the bucket rearwardly at ground level when the bucket has been cut into a compacted material and to then rapidly raise and automatically further tilt the bucket to a carrying position. This difficulty is not resolved by merely providing means for tipping the bucket rearwardly to a load retention position at ground level after the bucket has cut into the material being dug and then raising the bucket through the material as the tractor is continuously urged against the material, as has been attempted in the past. In such a construction the bucket in the load retention position presents a poor digging angle to the material being dug as the bucket is raised in an attempt to completely fill the bucket. This results not only in poor digging, but in such a situation there is a substantial force directed in a horizontal plane against the cutting edge of the bucket tending to twist the bucket against its supporting means to seriously increase the risk of damage to the bucket, bucket supporting means and associated parts. One partial and noteworthy solution to the noted difficulty is Patent No. 2,412,323, issued to M. L. Conrad on December 10, 1946, over which the present invention is an improvement.

A further object of the present invention is to provide a front end tractor loader which may be accurately, rapidly and efficiently operated to dig, carry, and dump any necessary material.

It is a further object of the present invention to provide specific means cooperating with a vehicle to provide control and operating means for a bucket which will accurately and efficiently perform the necessary functions of a front end type tractor loader.

Other objects and the features of the present invention will be apparent upon a reading of the following specification and drawings of which:

Figure 1 is a side plan view of a loader constructed according to the present invention with the bucket in the dig position;

Figure 2 is a side plan view of the structure shown in Figure 1 with the bucket tilted rearwardly at ground level;

Figure 3 is a side plan view of the structure shown in Figure 1 with the bucket in one carrying position;

Figure 4 is a side plan view of the structure shown in Figure 1 with the bucket in the high lift carrying position;

Figure 5 is a rear three quarter perspective view of the structure shown in Figure 4; and

Figure 6 is a side plan view of the structure shown in Figure 4 with the bucket in the high lift dump position.

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The present embodiment is the preferred embodiment but it is to be understood that changes can be made in the present embodiment by one skilled in the art without departing from the spirit and scope of this invention.

5 For a detailed description of the present invention reference is made to the drawings. The loader comprises a vehicle 10 of the four wheel rubber tired type. The vehicle 10 comprises a frame 11 supported by the wheels 12, an engine compartment 13 and an operator's compartment 14. A plate 15 formed in duplicate portions disposed on each side of the vehicle 10 is secured to the frame 11 adjacent the operator's compartment 14 and below the horizontal line of vision of the loader operator. The plate 15 provides the mounting means for the various control and operating means for the bucket 27.

A boom 16 is provided in duplicate portions disposed on each side of the vehicle 10. One end of the boom 16 is pivotally mounted to a bracket 17 by means of pivotal mounting means 18. The bracket 17 which is formed in duplicate portions disposed on each side of the vehicle 10 is secured to the plate 15 substantially at the upper rear marginal edge thereof, and adjacent to the rear wall of the operator's compartment 14. The boom 16 is positioned to extend forwardly of the vehicle 10 as can easily be seen in the drawings. To raise and lower the boom 16, a hydraulic ram 19 formed in duplicate portions positioned on each side of the vehicle 10 is provided. The hydraulic ram 19 is pivotally mounted at the head end thereof to a bracket 20 by means of pivotal mounting means 21. The bracket 20 which is formed in duplicate portions disposed on each side of the vehicle 10 is secured to the plate 15 substantially at the lower rear marginal edge thereof. The rod end of the hydraulic ram 19 is pivotally mounted to the boom 16 intermediate the ends thereof at a point whereat the boom 16 is bowed in a generally downward direction through a bracket 22 and pivotal mounting means 23. The boom 16 is bowed to permit the use of a relatively long hydraulic ram 19 without affecting the overall geometry of the loader. The size of the hydraulic ram must be balanced against the necessary mechanical advantages and moments needed.

A link or motion control member 24 is provided in duplicate portions positioned on each side of the vehicle 10. One end of the link 24 is pivotally mounted to a bracket 25 by means of pivotal mounting means 26. The bracket 25 is formed in duplicate portions positioned on each side of the vehicle 10 and secured to the plate 15. The pivotal mounting means 26 is positioned forwardly and below pivotal mounting means 18 with the horizontal component of displacement substantially greater than the vertical component of displacement. This difference in displacements is to provide for the proper geometry or articulation of related parts in connection with the tilting of the bucket.

The bucket 27 which may be of any type well known in the art, is provided with two pairs of flanges 28 and two pairs of flanges 29. Each pair of flanges 28 is mounted on the rear surface of the bucket 27 in a spaced apart relationship to each other transversely of the rear surface of the bucket 27. Each pair of flanges 29 is mounted between the pairs of flanges 28 in spaced apart relationship to each other transversely of and to the rear surface of the bucket 27, as can easily be seen in Figure 5. A U-shaped yoke 30 is also provided. The U-shaped yoke 30 is formed as a reinforced partial box channel member for rigidity and strength, and the legs thereof are bowed as can easily be seen in the drawings. The U-shaped yoke 30 is further formed to have a stop portion 31 formed on the end of the legs thereof. Each leg of the U-shaped yoke 30 is pivotally mounted intermediate the ends thereof to the forward end of each portion of the boom 16 by means of pivotal mounting means 32.

The position of the pivotal mounting means 32 on the yoke 30 is to provide for the proper geometry of related parts in connection with the tilting of the bucket 27. The yoke 30 is mounted to the boom 16 so that the legs of the yoke 30 are bowed toward the front end of the vehicle 10 to provide clearance for the rear surface of the bucket 27 when the bucket 27 is pivoted rearwardly in all positions of boom 16 travel. The other or forward end of each duplicate portion of the link 24, and each leg of the yoke 30 substantially at the lower end thereof, are pivotally mounted in registry with and between one pair of flanges 28 by means of pivotal mounting means 33. The pivotal mounting means 33 pivotally connects the lower end of each leg 30 and the forward or outer end of each portion of the link or motion control member 24 for the purpose of achieving the proper geometry of related parts in connection with the automatic tilting of the bucket 27. The pivotal mounting means 33 pivotally connects the lower end of each leg of the yoke 30 and the associated flanges 28 for the purpose of conveniently mounting the bucket 27 for pivoting from the yoke 30. The pivotal mounting of the flanges 28 to the yoke 30 can be moved from pivotal mounting means 33 to other positions, however, another pivotal mounting means must then be provided. The flanges 28 are pivotally mounted to the yoke 30, rather than some other element, as the bucket 27 in pivoting from the yoke 30 will then have the same relative position as the yoke 30 or vice versa, and the yoke 30 and the bucket 27 will together continually change position relative to the boom 16 and the link 24 as the boom 16 is raised and lowered by the hydraulic ram 19. The subject loader is further provided with a pair of double acting hydraulic rams 34. The head end of each of the hydraulic rams 34 is pivotally mounted within the cross piece section of the yoke 30 by means of pivotal mounting means 35. The rod end of each of the hydraulic rams 34 is pivotally mounted between one pair of the flanges 29 by means of pivotal mounting means 36. The mounting positions of the hydraulic rams 34 permit proper pivoting of the bucket 27 on the yoke 30 by the hydraulic rams 34. The various described members are of such a length and disposition, that the pivotal mounting means 32 lies above pivotal mounting means 33, that the pivotal mounting means 33 is disposed forwardly and above pivotal mounting means 36, that pivotal mounting means 36 is disposed some distance above ground level, when the bucket 27 is positioned in the dig position at ground level as shown in Figure 1. The positions of pivotal mounting means 32 and 33 on different axes and the pivotal mounting means 18 and 26 on different axes provide for the proper articulation and geometry of related parts in connection with the automatic tilting of the bucket 27. The relative positions of pivotal mounting means 33 and 36 are to provide a suitable lever arm for pivoting of the bucket 27 by the hydraulic rams 34. The relative position of pivotal mounting means 36 with respect to ground level is to provide for the load breakout feature to be described below. Further, the yoke 30 is bowed sufficiently, so that if the hydraulic rams 34 are extended, when the bucket 27 is in the dig position at ground level as shown in Figure 1, the bucket 27 will be tipped back about pivotal mounting means 33 an arc of at least 10 degrees to a breakout position. The importance of this structure will be discussed below.

Suitable hydraulic fluid conduits, pumps and valves (not shown) are supplied for operation of the hydraulic rams 19 and 34.

Turning next to a detailed description of the operation of the instant invention in order that the importance of the structure and the resulting geometry may be more readily understood, reference is again made to the drawings. If the hydraulic rams 19 and 34 are operated to the positions shown in Figure 1, wherein the hydraulic ram 19 is substantially retracted, and wherein the hydraulic rams 34 are at some point short of fully extended,

the bucket 27 will be in the proper dig position at ground level. The vehicle 10 may then be moved to force the bucket 27 into a material to be dug.

If the hydraulic rams 34 are then fully extended, as shown in Figure 2, the bucket 27 will be tipped back about pivotal mounting means 33 through a substantial angle, when the rear surface of the bucket 27 will strike the bowed legs of the yoke 30. This angle is preferably one of not more than twenty to twenty-five degrees so that the bucket sill presents a good cutting angle to the material being dug. This feature which is very important is known as the breakout feature, and prevents the bucket 27 from being locked into the material being dug so that an excessively large force would be required to raise the bucket upwardly through the material. It should be noted that due to the geometry of the various members as shown in Figure 2, the bucket 27 can not be tilted rearwardly to a full load retention position at ground level. It should be further noted that although the breakout feature has been described at ground level, it is not limited thereto, but can be used in digging at any level.

After the breakout or rearward tilt of the bucket 27 as shown in Figure 2, the hydraulic ram 19 may be partially extended to raise the bucket to a normal carrying position. The normal carrying position which is shown in Figure 3, is that position which does not obstruct the forward vision of the loader operator. As can easily be seen in Figure 3, the bucket 27 has been further tipped back automatically to the maximum full load retention position. This condition results from the structure and positioning of that structure or the geometry thereof described previously and in its result fulfills a further important digging function. As the bucket is raised from the breakout position to the carrying position and while the bucket is urged into the material being dug by the forward motion of the tractor, a scooping action takes place to completely fill the bucket with a maximum amount of the material being dug. It should be noted that the full load retention position as shown in Figure 3 is a combination of the breakout feature tilting at ground level and the automatic tip back from ground level during which the noted scooping effect takes place.

If the hydraulic ram 19 is further extended, the bucket 27 will assume the high lift carrying position shown in Figures 4 and 5. As the bucket 27 is moved from the position shown in Figure 3 to that shown in Figures 4 and 5, the bucket 27 will be tipped forwardly considerably with respect to the boom and to a small degree with respect to the ground by the members associated therewith and previously described, sufficiently to compensate for the amount of tip back achieved through the use of the breakout feature plus the automatic tip back features of the noted Conrad patent to maintain the bucket 27 in the full load retention position.

If the hydraulic rams 34 are completely retracted from the position shown in Figures 4 and 5, the bucket 27 will be moved to the dump position as shown in Figure 6 due to the geometry of the previously described members in that position. The maximum degree of forward tilt in the dump position is determined by the stop 31 on the yoke 30 which will abut the stop 40 on the rear surface of the bucket 27 in that position.

It is obvious from the previous description that from the position shown in Figure 6 the bucket may again be moved to a position such as shown in Figure 1 for additional digging, or to any required intermediate position.

Having described the invention what is considered new and desired to be protected by Letters Patent is:

1. In a power loader having a frame, a power-actuated forwardly-extending boom pivoted at its rear to said frame, a forwardly-extending link pivoted at its rear to said frame, a bucket support pivoted to the forward portions of said boom and link at points having different axes, a bucket pivoted to said support, and means con-

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necting said support and bucket for giving said bucket an initial rearward tilt from a digging position to a breakout position to break away the load in the bucket from the material being dug and leaving the bucket at a load scooping angle, said boom and link being pivotally connected to said frame and bucket support and arranged in a manner whereby as said bucket is elevated a predetermined amount and controlled by said boom and link it will be tilted rearwardly an additional amount in a load scooping action to a full load-retaining position, and whereby as said bucket is further elevated and controlled by said boom and link it will be tilted forwardly with respect to the boom to maintain said bucket in substantially full load-retaining position thereby compensating for rearward tilt of said bucket in its breakout action.

2. In a power loader having a frame, a power-actuated boom, a link, a bucket support, a bucket movably mounted on said support, said frame, boom, link and bucket support being articulated with respect to each other at pivotal points having different axes, and means operative between said bucket support and bucket for giving said bucket an initial load breakout tilting action to break away the load in the bucket from the material being dug and leaving the bucket at a load scooping angle, said pivotal points being located in a manner whereby as said bucket is elevated and controlled by said boom and link it will be tilted rearwardly an additional amount in a load scooping action to a full load-retaining position before obstructing the forward vision of the loader operator, and whereby said bucket as it is further elevated and controlled by said boom and link it will be tilted forwardly with respect to said boom to maintain said bucket in substantially full load-retaining position, thereby compensating for the rearward tilt of said bucket in its breakout action.

3. In a power loader having a frame, a power-actuated boom, a motion control member, a bucket support, a bucket movably mounted on said support, said frame, boom, motion control member and bucket support being interconnected for relative movements when said boom is actuated, and power-actuated means interconnecting said bucket support and said bucket for giving said bucket a load breakout tilting action to break away the load from the material being dug and leaving the bucket at a load scooping angle, said frame, boom, motion control member and bucket support being interconnected in a manner whereby as said bucket is being elevated and controlled by said boom and motion control member it is tilted rearwardly additionally to a full load-retaining position through a predetermined swing of the boom, and whereby when said bucket is further elevated it is tilted forwardly with respect to said boom to maintain said bucket in substantially full load-retaining position, in compensating for the rearward tilt of said bucket in its breakout action.

4. In a power loader, a vehicle, a boom pivotally mounted at one end to said vehicle, a bucket, support means pivotally interconnecting the other end of said boom and said bucket, link means, pivot means pivotally connecting one end of said link means on said vehicle, second pivot means pivotally connecting the other end of said link means and said support means, power means pivotally mounted between said support means and said bucket, said support means and said power means arranged to permit operation of said power means to tilt said bucket rearwardly from a dig position at ground level to a breakout position, said support means, said link means, the pivotal mountings of said boom and link means to said vehicle, and said first and second pivot means arranged to automatically tilt said bucket rearwardly to a full load retention position before obstructing the forward vision of the loader operator after said power means has operated and when said boom is raised, and to thereafter in the further raising of said boom automatically tilt said bucket forwardly with respect to said boom sufficiently to compensate approximately for the rearward tilt resulting from operation of said power means and the

automatic rearward tilt to maintain said bucket in said full load retention position.

5. In a power loader, a vehicle, a boom pivotally mounted at one end thereof on said vehicle, a U-shaped yoke, means pivotally interconnecting the other end of said boom and said yoke, a bucket, means pivotally mounting said bucket to said yoke, link means, means pivotally mounting said link means at one end thereof on said vehicle, means pivotally connecting the other end of said link means to said yoke, power means pivotally mounted between said yoke and said bucket, said yoke and said power means and the axes of pivoting thereof arranged to permit operation of said power means to tilt said bucket rearwardly from a dig position at ground level to a breakout position, said yoke and said link means and the axes of pivoting thereof arranged to automatically tilt said bucket rearwardly to a full load retention position before obstructing the forward vision of the loader operator after said power means has operated and when said boom is raised, and to thereafter in the further raising of said boom automatically tilt said bucket forwardly with respect to said boom sufficiently to compensate approximately for the rearward tilt resulting from the operation of said power means and the automatic rearward tilt to maintain said bucket in said full load retention position.

6. In a power loader as claimed in claim 5 said power means comprising a double acting hydraulic ram pivotally mounted between said yoke and said bucket.

7. In a power loader, a vehicle, a boom comprising duplicate portions disposed on each side of said vehicle and pivotally mounted at one end of each of said duplicate portions on said vehicle, a U-shaped yoke comprising a pair of legs interconnected by a crosspiece, means pivotally mounting the other end of each of said duplicate portions of said boom to the legs of said U-shaped yoke intermediate the ends thereof, a link comprising duplicate portions disposed on each side of said vehicle, means pivotally mounting one end of each of said duplicate portions of said link on said vehicle substantially forwardly of the axis of pivoting of said boom on said vehicle, a bucket pivotally connected to the legs of said yoke, means pivotally connecting the other end of each of said duplicate portions of said link and the ends of the legs of said U-shaped yoke, the axes of pivoting of said U-shaped yoke on said boom being spaced substantially above the axes of pivoting of said yoke on said link when said bucket is in the dig position at ground level, a double-acting hydraulic ram pivotally mounted between said crosspiece of said U-shaped yoke and said bucket, said U-shaped yoke and said hydraulic ram and the axes of pivoting of said yoke, said bucket and said double-acting hydraulic ram arranged to permit extension of said double-acting hydraulic ram to tilt said bucket rearwardly from a dig position at ground level to a breakout position, said yoke and said link and the axes of pivoting of said boom, said yoke and said link arranged to automatically tilt said bucket rearwardly to full load retention position before obstructing the forward vision of the loader operator after extension of said hydraulic ram and when said boom is raised and to thereafter in the further raising of said boom automatically tilt said bucket forwardly with respect to said boom sufficiently to compensate approximately for the rearward tilt resulting from the operation of said double-acting hydraulic ram and the automatic rearward tilt to maintain said bucket in said full load retention position.

8. In a power loader, a vehicle, a boom comprising duplicate portions disposed on each side of said vehicle and pivotally mounted at one end of each of said duplicate portions to said vehicle, a U-shaped yoke comprising a pair of legs interconnected by a crosspiece, means pivotally mounting the other end of each of said duplicate portions of said boom to the legs of said U-shaped yoke intermediate the ends thereof, a link comprising duplicate

portions disposed on each side of said vehicle and pivotally mounted at one end of each of said duplicate portions on said vehicle, a bucket pivotally connected to the legs of said yoke, means pivotally connecting the other end of each of said duplicate portions of said link and the ends of the legs of said U-shaped yoke so that a plane through the front and rear pivot axes of the boom intersects a plane through the front and rear pivot axes of said link between said pivot axes when said bucket is in the dig position at ground level, a double-acting hydraulic ram pivotally mounted between said crosspiece of said U-shaped yoke and said bucket, said U-shaped yoke and said hydraulic ram and the axes of pivoting of said yoke, said bucket and said double-acting hydraulic ram arranged to permit extension of said double-acting hydraulic ram to tilt said bucket rearwardly from a dig position at ground level to a breakout position, said yoke and said link and the axes of pivoting of said boom, said yoke and said link arranged to automatically tilt said bucket rearwardly to a full load retention position before obstructing the forward vision of the loader operator after extension of said hydraulic ram and when said boom is raised, and to thereafter in the further raising of said boom automatically tilt said bucket forwardly with respect to said boom sufficiently to compensate approximately for the rearward tilt resulting from the operation of said double-acting hydraulic ram and the automatic rearward tilt to maintain said bucket in said full load retention position.

9. In a power loader having a vehicle, a power actuated forwardly extending boom, means pivotally mounting said boom at its rear portion on the vehicle below the horizontal line of vision of the loader operator, a forwardly facing bucket, support means pivotally supporting said bucket on the front portion of said boom to elevate and lower the bucket with the upward and downward swinging of said boom, link means, means pivotally mounting said link means at its rear portion on the vehicle substantially forwardly of the pivot axis of the boom on the vehicle and at its front portion of said support means in such relation to the boom pivot axes that a plane through the rear and front axes of pivoting of the boom intersects between said pivot axes a plane through the rear and front axes of pivoting of the link means when the bucket is in the dig position at ground level, power means pivotally interconnecting said bucket and said sup-

port means for pivoting said bucket relative to said boom, said support means and said power means and the relative locations of the pivot axes of said support means and said power means arranged to permit said bucket to tilt rearwardly from a dig position at ground level to a breakout position when said power means is operated, said support means and said link means and the axes of pivoting of said boom, said support means and said link means arranged to automatically tilt said bucket rearwardly to a full load retention position before obstructing the forward vision of the loader operator after operation of said power means and when said boom is raised, and to thereafter in the further raising of said boom automatically tilt said bucket forwardly with respect to said boom sufficiently to compensate approximately for the rearward tilt resulting from the operation of said power means and the automatic rearward tilt to maintain said bucket in said full load retention position.

10. In a power loader as claimed in claim 9 said support means comprising a U-shaped yoke, said U-shaped yoke being pivotally connected to the front portion of said boom, said bucket being pivotally connected to said yoke.

11. In a power loader as claimed in claim 10 said power means comprising a pair of double-acting hydraulic rams, said pair of double-acting hydraulic rams being pivotally connected between said yoke and said bucket in a spaced apart relationship to each other.

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