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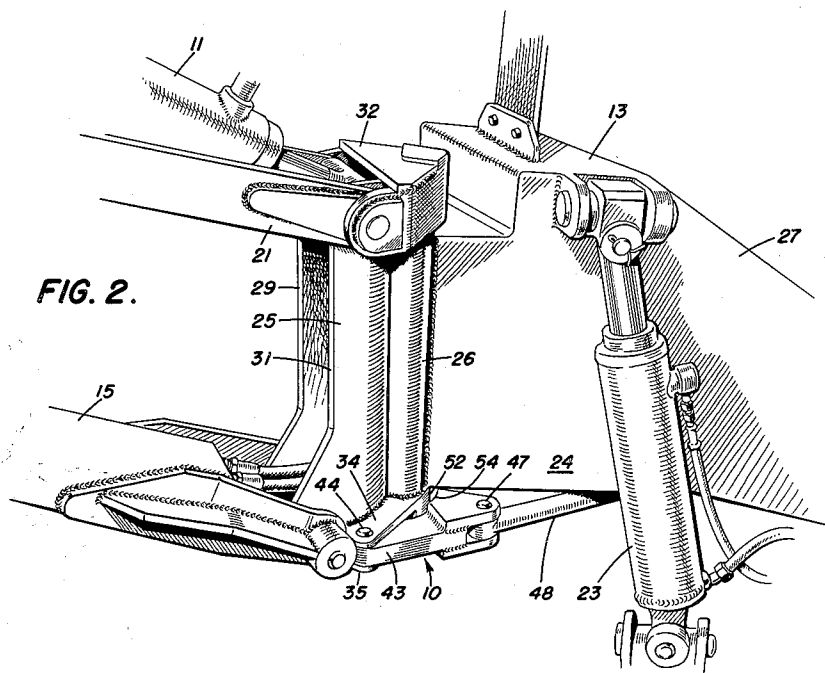
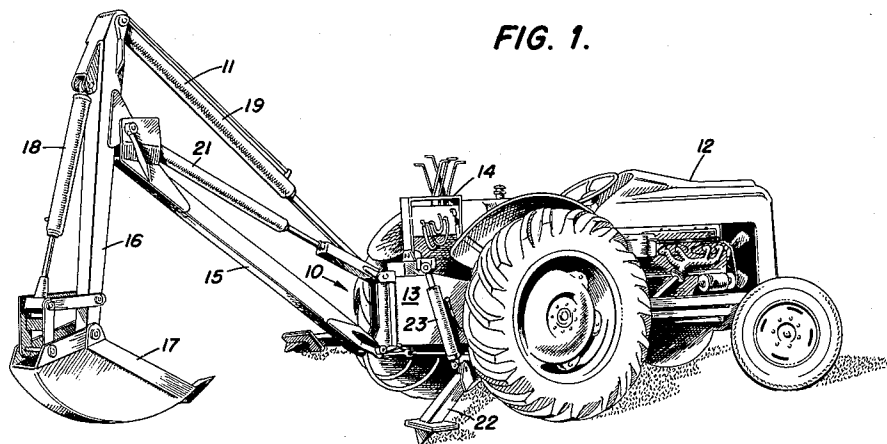
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2,973,874

SWING SYSTEM FOR DIGGING ATTACHMENT

Original Filed April 8, 1958

2 Sheets-Sheet 1



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FIG. 3.

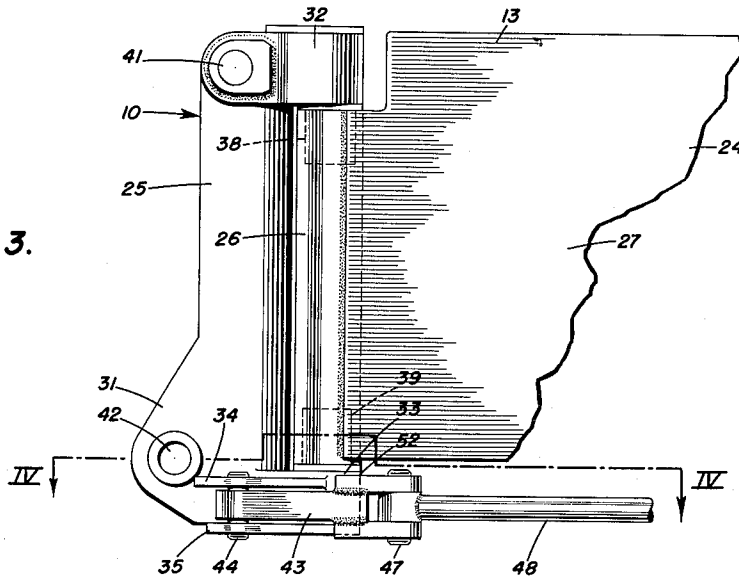
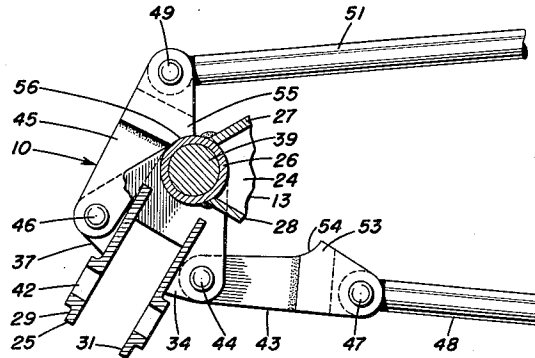


FIG. 4.



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## SWING SYSTEM FOR DIGGING ATTACHMENT

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Continuation of application Ser. No. 651,229, Apr. 8, 1958. This application July 13, 1959, Ser. No. 826,882

7 Claims. (Cl. 214—132)

This invention relates to a swing system for a digging attachment and more particularly to an arrangement for improved side-to-side swinging movement of a hydraulic backhoe attachment or the like for a vehicle. This application is a continuation of application Serial #651,229, filed April 8, 1958, now abandoned.

In Patent No. 2,698,697 was shown and described a novel hydraulic digging attachment for tractors and the like. The attachment consists of a boom and a dipper stick having a digging bucket connected thereto; the boom and dipper stick are movable from side to side about a vertical axis under the action of a pair of hydraulic cylinders. However, the known constructions have certain disabilities among which is the fact that the angle through which the boom can be moved is very much limited when a cylinder of a practical size is used. In addition, the speed of swinging increases very rapidly as the extreme side positions are approached and swinging in the central positions is very slow. These and other deficiencies of the prior art have been obviated in a novel manner by the present invention.

It is, therefore, an outstanding object of the invention to provide a swing system for a hydraulic digging attachment that is capable of a wide angle of swinging.

Another object of this invention is the provision of a swing system for a backhoe or the like in which the speed of rotation at the extreme side positions is substantially the same as at the intermediate positions.

A further object of the instant invention is the provision of a hydraulic digging attachment capable of 180° swinging motion with approximately the same speed of rotation in all positions.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawings in which:

Figure 1 is a perspective view of a tractor carrying a hydraulic digging attachment incorporating the principles of the present invention,

Figure 2 is an enlarged perspective view of a portion of the attachment showing the swing system,

Figure 3 is a side elevational view of the swing system, and

Figure 4 is a horizontal sectional view of the invention taken on the line IV—IV of Figure 3, but with the parts in a slightly different position.

Referring first to Figure 1, wherein are best shown the general features of the invention, the swing system, designated generally by the reference numeral 10, is shown in use in a hydraulic digging attachment 11 which is mounted on a tractor 12. The attachment 11 includes a support member 13 which is rigidly bolted to the tractor frame and has mounted thereon a valving arrangement 14. The attachment makes use of the conventional hydraulic system of the tractor and the valving

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arrangement is connected to this system for the control of fluid flow to and from the attachment elements. The attachment 11 also includes a boom 15 which is connected at one end to the lower part of the support member 13 for swinging motion about a horizontal axis. The other end of the boom is hingedly attached to an intermediate portion of a dipper stick 16 for relative rotation about a horizontal axis. A bucket 17 is connected to the lower end of the dipper stick for hinged motion about a horizontal axis. A hydraulic cylinder 18 connects the bucket to the upper part of the dipper stick for rotation of the bucket. A hydraulic cylinder 19 connects the upper end of the dipper stick to the support member 13, while a hydraulic cylinder 21 connects the boom 15 at a point close to its attachment to the dipper stick and to the support member 13 at a point adjacent its connection to the cylinder 19. The connections of the cylinders 18, 19 and 21 to the respective bucket 17, dipper stick 16, boom 15 and support member 13 are all for hinged movement about horizontal axes. Suitable stabilizers 22 actuated by cylinders 23 are provided.

Referring next to Figures 2, 3 and 4, it can be seen that the support member 13 consists of two parts connected together for hinged movement about a vertical axis, i.e., a base member 24 and a hinge member 25. The base member 24, which is fixed to the tractor frame, is a welded structure made up of a vertical tube 26 to which are welded side plates 27 and 28 with suitable top and bottom plates. In plan view, the base member has the appearance of a triangle with the tube 26 at its apex and with the opposite base of the triangle fastened to the tractor frame.

The hinge member 25 is also a weldment and is made up of two parallel vertical plates 29 and 31, a horizontal leg 32 at the upper portion and another horizontal leg 33 at the bottom. Horizontal parallel flanges 34 and 35 extend from one side of the leg 33 and the plate 31, while similar horizontal parallel flanges, including a lower flange 37, extends from the other side of the leg and the plate 29. Extending downwardly from the upper leg 32 is a pintle 38 which fits snugly in the upper end of the tube 26, while a similar pintle 39 extends upwardly from the lower leg 33, is aligned with the pintle 38, and resides in the lower end of the tube 26. The hinge member 25 is, therefore, capable of swinging movement relative to the base member 24 about a generally vertical axis defined by the pintles 38 and 39. A suitable aperture 41 is provided in the upper part of the hinge member to provide for the pivotal attachment of the cylinders 19 and 21 thereto, while bores 42 through the lower portion permit the pivotal connection of the boom 15.

Between the flanges 34 and 35 resides one end of a link 43 and a pin 44 joins the link to the flanges for hinged relative movement; a similar link 45 is pivotally attached to the flange 37 and its mate by means of a pin 46. The other end of the link 43 is bifurcated and is pivotally attached, by means of a pin 47, to the end of the piston rod of a hydraulic cylinder 48; the other end of the cylinder is pivotally connected, in a manner not shown, to the underside of the base member 24. In a similar way, the other end of the link 45 is pivotally connected by means of a pin 49 to one end of a cylinder 51, the other end of which is pivotally attached to the underside of the base member 24.

A study of Figures 3 and 4 will show that the lower leg 33 of the hinge member 25 is provided with a cylindrical surface 52 which is an extension of the outer surface of the tube 26, and, therefore, is coaxial with the axis of swinging of the hinge member 25. This surface is on the same general level as the links 43 and 45.

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The link 43 is provided with a protuberance 53 defining a pressure portion 54 which has a concave circular segmental shape. The portion 54 is of such a configuration and is so situated on the link that, when the link is moved about the pin 44, the portion engages snugly the cylindrical surface 52 of the hinge member. The link 45 also has a protuberance 55 which provides for a circular segmental pressure portion 56 adapted to engage the surface 52 when the link is pivoted toward the hinge member about the pin 46.

The operation of the invention will be readily understood in view of the above description. The motor of the tractor 12 is placed in idling condition and pressure oil appears in the hydraulic system. By means of the valving arrangement 14, oil under pressure is admitted or drained from the various cylinders as is desired to perform the digging operations. For instance, oil admitted to the cylinders 23 serves to depress the stabilizers 22 and force them into the ground. Oil to the cylinder 18 rotates the bucket 17, oil to the cylinder 19 rotates the dipper stick 16, and oil to the cylinder 21 rotates the boom 15, all rotations taking place, of course, in vertical planes. Admitting oil to the cylinder 51 while removing oil from the cylinder 48 causes rotation of the hinge member 25 about the axis defined by the pintles 38 and 39; this movement of the hinge member brings about a similar movement of the boom, dipper stick and allied elements. This swinging motion would be used, for instance, in removing dirt from an excavation at the rear of the tractor and loading it into a truck parked at the side.

In Figure 4 is shown the position of the elements at the end of a swing close to the extreme position at one side. The absolute extreme position, of course, would be that in which the boom extends at a right angle to the centerline of the tractor. In the position shown, the pressure surface 56 of the link 45 engages and presses against the cylindrical surface 52 of the hinge member. To swing in the opposite direction, the valving assembly 14 is actuated to introduce oil into the cylinder 51 and to allow it to drain from the cylinder 48. As the force is transmitted to the pin 49 from the cylinder 51, the hinge member 25 is rotated about the axis of the pintles; the force is transmitted, in effect, through a first degree lever of which the pin 49 is the end to which force is applied, the pin 46 is the end from which force is taken and the fulcrum is the contact between the portion 56 of the link and the surface 52 of the hinge member. The link 43 and the cylinder 48 are dragged in a straight line behind the pin 44, thus forcing oil out of the cylinder. Eventually, as the swinging motion continues, the pin 46 comes into line with the line of action of the cylinder 51 and the pin 49. Further motion in this direction will cause the portion 56 of the link 45 to leave the surface 52 of the hinge member, as shown in Figure 2, whereupon the link 45 becomes merely a connection between the cylinder and the hinge member, like a link in a chain which is in tension. The force due to the cylinder acts on the pin 46 and the hinge member becomes a bell crank producing a force couple about the axis of the pintles. The net effect of this mode of operation is that a swing through 90° from the center or directly rearward position involves two phases: a first phase in which the moment arm is between the pin 49 and the pintle axis and a second phase in which the moment arm exists between the pin 46 and the pintle axis. At all times a substantial moment arm exists between the pin to which the force is transmitted and the pintle axis; this means that at all times movement of the piston in the cylinder produces a substantial movement of the boom and associated apparatus and, furthermore, the effective bell crank is well along from dead center. In other words, small cylinder movements produce large angular movements of the hinge member at all parts of the swinging radius. In the prior

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art devices, there were positions in which the lever arm was close to dead center and large cylinder movements produced only small angular swinging movements.

It is important to note that the elements must be constructed so that the circular segmental portion of a given link does not contact the cylindrical surface 52 of the hinge member until well after the corresponding portion of the other link has left the surface 52. Failure to observe this precaution will result in a jamming action that would be injurious to the equipment.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described, what is claimed as new and desired to secure by Letters Patent is:

1. A hydraulic digging attachment for use with a vehicle, comprising a base member adapted to be secured to a vehicle, a hinge member attached to the base member for pivotal movement relative thereto about a vertical axis, the hinge member having a cylindrical surface which is co-axial with the said vertical axis, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having a circular segmental intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

2. A hydraulic digging attachment for use with a vehicle, comprising a base member having a vertical tube at one extremity and adapted to be secured to a vehicle, a hinge member attached to the base member by means of pintles lying within the tube for pivotal movement relative thereto about a vertical axis, the hinge member having a cylindrical surface which is co-axial with the said vertical axis and which underlies the said tube, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having an intermediate pressure portion which engages a conforming portion of the hinge member at a certain part of a swinging cycle of the hinge member about the pintle axis.

3. A hydraulic digging attachment for use with a vehicle, comprising a base member having a vertical tube at an extremity and adapted to be secured to a vehicle, a hinge member attached to the base member by means of pintles lying within the tube for pivotal movement relative thereto about a vertical axis, the hinge member having a cylindrical surface which is coaxial with the said vertical axis and which underlies the said tube,

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a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having a circular segmental intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

4. A hydraulic digging attachment, comprising a base member adapted to be secured to a vehicle, a hinge member attached to the base member by means of a pintle and tube connection for pivotal movement relative thereto about a vertical axis, a hinge member having a cylindrical surface which is co-axial with the said vertical axis and which underlies the said pintle and tube connection, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having a circular segmental intermediate pressure portion, the links being located on a level for engagement with the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

5. A hydraulic digging attachment, comprising a base member having a vertical tube at an extremity and being adapted to be secured to a vehicle, a hinge member attached to the base member by means of pintles lying within the tube for pivotal movement relative thereto about a vertical axis, the hinge member having a cylindrical surface which is co-axial with the said vertical axis and which underlies the said tube, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having a circular segmental intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

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vertical axis, each link having a circular segmental intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

6. A hydraulic digging attachment, comprising a base member having a vertical tube at an extremity and being adapted to be secured to a vehicle, a hinge member attached to the base member by means of pintles lying within the tube for pivotal movement relative thereto about a vertical axis, the hinge member having a cylindrical surface which is co-axial with the said vertical axis and which underlies the said tube, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having an intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said cylindrical surface during certain portions of the swinging cycle of the hinge member about the vertical axis.

7. A hydraulic digging attachment, comprising a base member adapted to be secured to a vehicle, a hinge member attached to the base member by means of a hinge connection for pivotal movement relative thereto about a generally vertical axis, a boom connected to the hinge member for pivotal movement relative thereto about a horizontal axis, a boom-actuating hydraulic cylinder connected to the hinge member for pivotal movement relative thereto about a horizontal axis, the connection being at a point spaced vertically from the point of connection of the boom thereto, a pair of hydraulic cylinders each having one end connected to the base member, a link located adjacent each side of the hinge member, each link being pivotally connected at one end to the other end of one of said pair of hydraulic cylinders and at its other end to the hinge member at a point considerably spaced from the said vertical axis, each link having an intermediate pressure portion, the links being located on a level for engagement of the said pressure portion with the said hinge member during certain portions of the swinging cycle of the hinge member about the vertical axis.

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