

- [54] MATERIAL HANDLING ATTACHMENT
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- [56] References Cited
UNITED STATES PATENTS
2,597,086 5/1952 Morrow 214/730
3,080,988 3/1963 Redman 214/147 G
FOREIGN PATENTS OR APPLICATIONS
511,746 1/1955 Italy 214/768

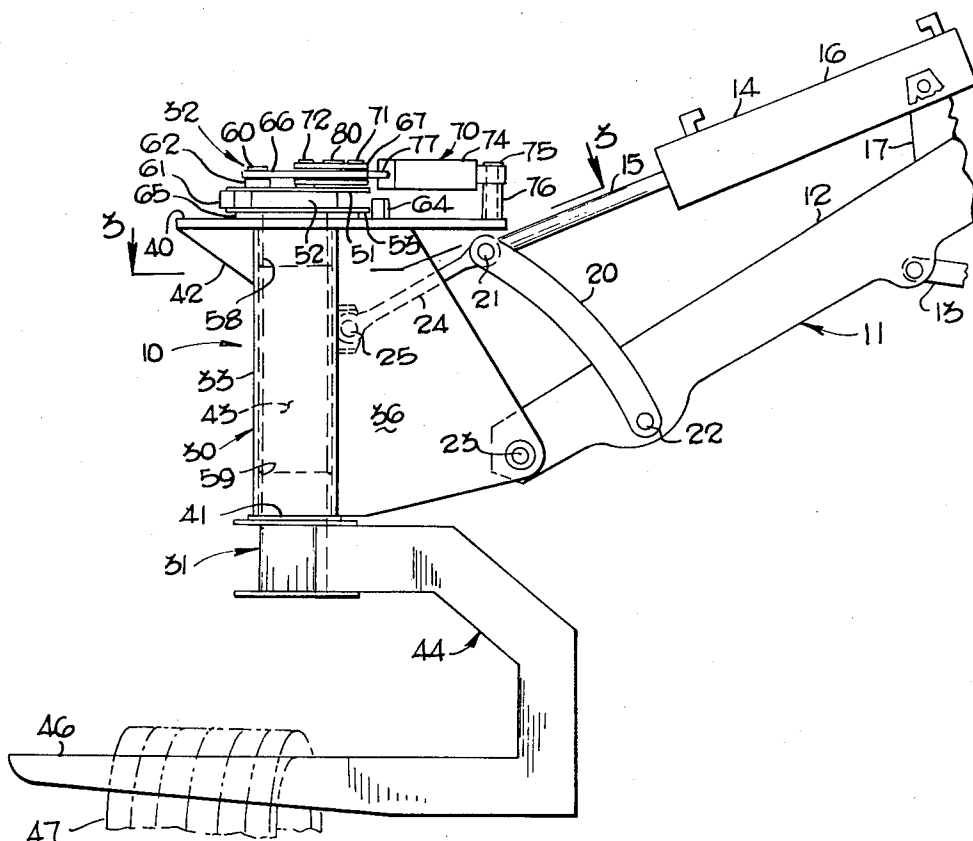
807,950 1/1959 Great Britain 214/768

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[57] ABSTRACT

This material handling attachment is adapted to be mounted to the boom of a backhoe. The attachment includes a base assembly for rotatively mounting a shaft assembly having a tiltable axis of rotation. The shaft assembly includes a hook at the lower end providing a transverse loading arm suitable for manipulating bales of coiled wire. The shaft assembly is rotatable through more than 180° of arc by means of a hydraulic actuating assembly providing a compound linkage, which is connected at one end to the shaft assembly and at the other end to the base assembly.

6 Claims, 5 Drawing Figures



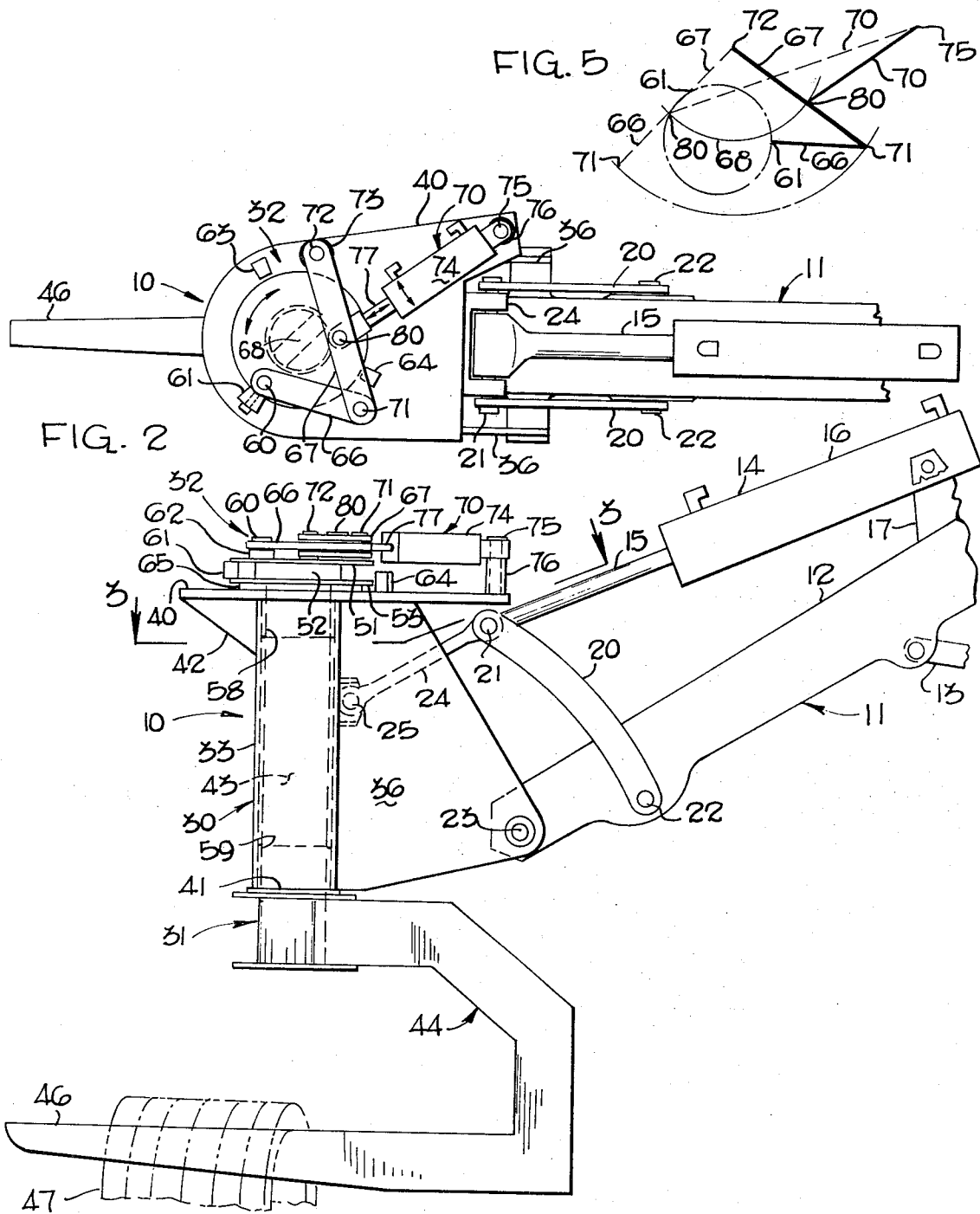


FIG. 1

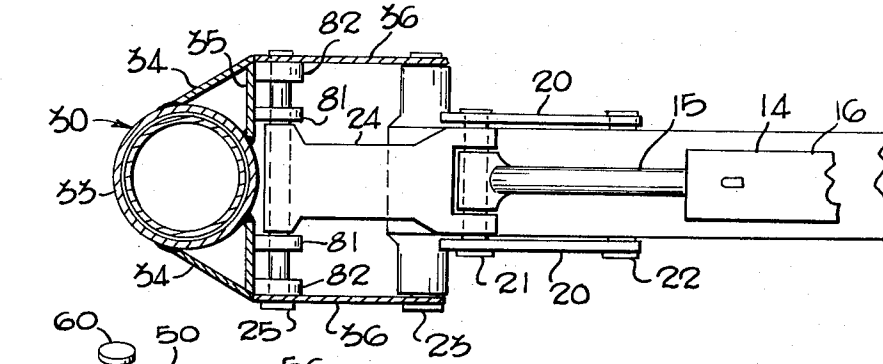


FIG. 3

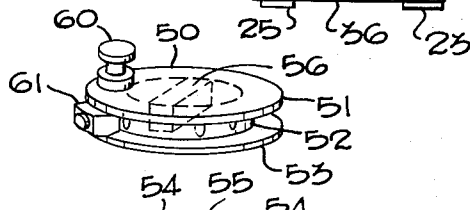
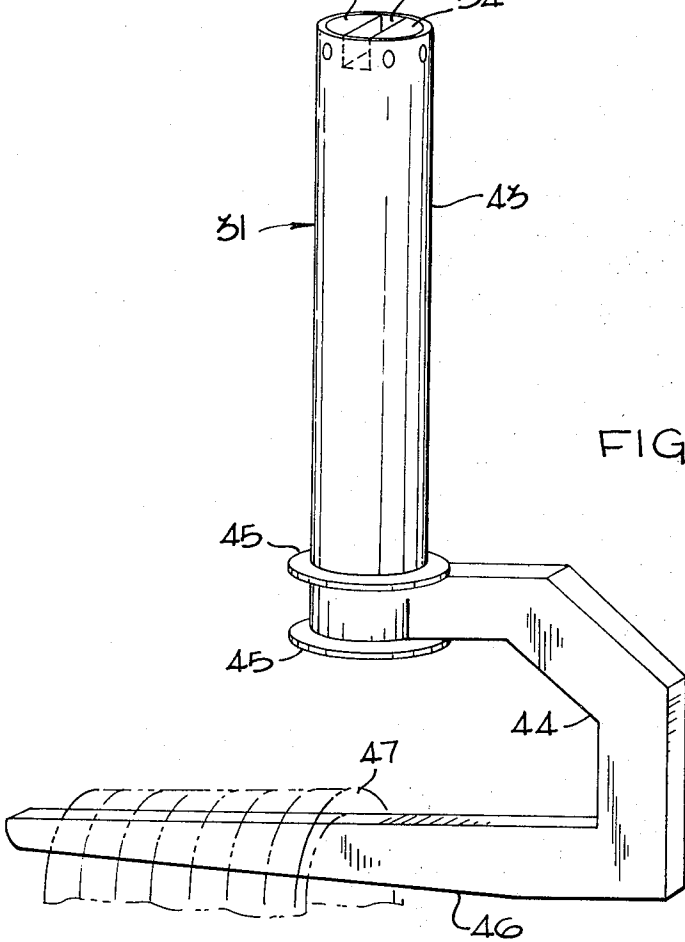


FIG. 4



MATERIAL HANDLING ATTACHMENT

BACKGROUND OF THE INVENTION

This invention relates generally to a material handling attachment and particularly to an attachment which may be used in conjunction with a backhoe boom or the like, to provide a transverse loading arm having a multi-directional movement capability.

Coiled material, such as wire, is difficult to handle in the field and it is generally transported by suspension from a sling attached to a special boom provided on a tractor or the like. This method is unsatisfactory because it is a two-stage operation and cannot be accomplished by the vehicle operator from the vehicle.

Lift trucks are used for many loading and baling jobs and have been provided with specially designed attachments in order to load goods such as cotton bales. One such device includes a plurality of forwardly projecting arms which can be rotated, to a limited extent, as well as elevated. However, devices of this sort are not provided with a tilting capability and are consequently insufficiently versatile in their use. For example, they cannot be articulated to unload coiled materials from a railroad car. Another type of attachment, also used in conjunction with a fork lift truck, provides a pair of hydraulic clamping arms disposed at the end of a fork lift boom. The arms are rotatable about the vertical axis but no tilting feature is provided. Yet another fork lift attachment, which provides a hook attached to a telescopic boom, likewise suffers from the same disability.

Backhoes and similar pieces of equipment, which are provided with an articulated boom, are primarily used, in conjunction with a bucket attachment, for excavating. They have also been adapted for other purposes such as trenching operations in which the boom carries a trenching chain attachment.

Bucket and trenching attachments mounted to the end of backhoe booms can be raised, lowered and manipulated with relative ease. However, while such devices may easily be swung about the center of rotation of the boom they are not provided with a capability of rotation about a vertical axis, and obviously do not have a capability of tilting about a vertical axis of rotation. Attachments having such compound movement capability are not known in the prior art.

SUMMARY OF THE INVENTION

This attachment is particularly useful in connection with the loading and unloading of coiled material such as wire, and manipulation of the coiled wire can be accomplished by the operator of the attachment mounting vehicle from the driving seat.

The attachment provides a shaft assembly having a transverse arm as its lower end and is particularly suitable for mounting to the end of a backhoe boom. The arm can be rotated about the axis of the shaft assembly. Further, the attachment is mounted to the boom in such a manner as to provide the shaft assembly with a tilting capability as well as a rotational capability. By virtue of the boom, the attachment may be easily elevated and swung in a horizontal arc.

In effect, the attachment provides a loading hook having an outstanding finger which may be oriented in virtually any direction and is eminently suitable for handling the loading and unloading of baled and coiled material even from box cars and railroad gondolas and

the like by having the capability of "dipping in" to such containers.

This material handling attachment includes a base means providing a pair of spaced pivotal connections to the tool arm and the ram, respectively, of a backhoe boom. The attachment includes a shaft means rotatively mounted to the base means and having a transverse arm at the lower end. The spaced pivotal connections of the base means are longitudinally spaced relative to the axis of rotation of the shaft means to provide the shaft means with a tilting capability. The shaft means is rotatable through an angle in excess of 180° by an actuating means connected between the base means and the shaft means and the actuating means is connected to the shaft means in offset relation to the axis of rotation of the shaft means to apply an eccentric force for turning said shaft means and thereby rotate the transverse arm.

The shaft means includes a head portion and a body portion having a hook portion at the lower end providing the transverse arm. The base means provides a housing receiving the body portion in journal relation and includes an abutment portion supporting the head portion in bearing relation.

The actuating means includes interconnected first and second link members connected together in a Vee configuration. The first link member is pivotally connected to the head portion of the shaft means and the second link member is pivotally connected to the abutment portion of the base means. A ram, pivotally connected to the abutment portion, is connected to the second link member intermediate the ends thereof to rotate said second link member and thereby apply a shaft-rotating force to the first link member.

The length of the first link member is less than the length of the second link member and the length of the first and second link members are related so as to rotate the body through not less than substantially 180°. The length of the first link member is substantially equal to the distance between the pivot connecting the second link member to the base means and the connection point between said second link member and the actuating ram.

The base means includes angularly spaced stop means engageable with coacting stop means on the head portion to define the limits of rotation of said head portion.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the attachment used in conjunction with the boom of the backhoe;

FIG. 2 is a plan view of the attachment;

FIG. 3 is a view in cross section taken on line 3—3 of FIG. 1;

FIG. 4 is a perspective view, partly exploded, illustrating the rotatable hook, and

FIG. 5 is a schematic representation of the hook rotating linkage.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now by characters of reference to the drawings and first to FIG. 1 it will be understood that the attachment, which is generally indicated by numeral 10, is supported at the end of the boom 11 of a backhoe or similar equipment. The boom 11, which constitutes a support means for the attachment 10,

comprises essentially a tool arm 12, movable by means of a hydraulically actuated arm 13, and a ram 14. The ram 14, which constitutes a movable arm, consists of a plunger 15 and a cylinder 16. The cylinder 16 is pivotally connected to the tool arm 12 by means of a bracket 17. The plunger 15 is connected to the tool arm 12 by means of a pair of cross arms 20 having pivotal connections 21 and 22 respectively at opposite ends.

The attachment 10 is pivotally connected to the boom 11 by means of a direct pivotal connection 23, between said attachment 10 and said tool arm 12, and by means of an arm 24 which is connected to said attachment 10 by means of a pivotal connection 25, pivotal connections 23 and 25 defining spaced pivot points on the attachment 10. Arm 24 is also connected to both the cross arms 20 and the plunger 15 by means of the pivotal connection 21.

The attachment 10 consists essentially of a hollow base assembly 30 providing journal support for a shaft assembly, which is generally indicated by numeral 31 and which is rotated by an actuating assembly, disposed above the base assembly 30 and indicated by numeral 32.

The base assembly 30, as shown in FIGS. 1 and 3 includes a tubular housing 33, which is reinforced by means of welded stiffening plates 34 and 35, and opposed bracket plates 36. A base plate 40 constituting an upper base member and providing an abutment means is welded, or otherwise attached, to the upper end of the tubular housing 33 and bracket plates 36. A stiffening ring 41 is likewise welded, or otherwise attached, to the lower end of the tubular housing 33. One or more triangular stiffening plates 42 are also provided between the upper end of said tubular housing 33 and the base plate 40.

The shaft assembly 31 is best shown in FIG. 4 and includes an elongate tubular body portion 43 having a U-shaped hook member 44 attached, as by welding, to the lower end, stiffening rings 45 providing a reinforcing for the connection. The hook member 44 provides a transverse loading arm 46, suitable for engaging the interior of a bale of coiled material such as wire, generally indicated by numeral 47 in FIG. 4. The shaft assembly 31 also includes a head portion, generally indicated by numeral 50 in FIG. 4 which comprises essentially an upper end plate 51, an intermediate annular side wall plate 52 and a lower bearing plate 53. In the preferred embodiment the head portion 50 is bolted to the body portion 43. A shear connection, which also acts as an alignment means, is provided between the head portion 50 and the body portion 43. This shear connection is provided by spaced blocks 54, welded or otherwise attached to the body portion 43 and defining a groove 55, and a compatible block 56, welded or otherwise attached to the head portion, and defining a co-acting tongue. It will be understood that the shaft assembly body portion 43 is received within the lower end of the base assembly tubular housing 33 and that the head portion 50 is then secured to the upper end of said body portion 43 as by bolting. In effect, the shaft assembly 31 is suspended from the base assembly 30 by said head portion 50. In the preferred embodiment, as shown in FIG. 1, a bearing plate of brass or similar suitable bearing material is interposed between the head portion bearing plate 53 and the base plate 40. In order to facilitate rotation of the shaft assembly body portion 43 within the tubular housing 33, a pair of upper and

lower bearing rings 58 and 59 are disposed between said housing 33 and the body portion 43. The head portion 50 is apertured to receive a pivot bolt 60. The pivot bolt 60 is provided with a spacer 61 and is held in place by a set screw and block assembly, generally indicated by numeral 61. A pair of angularly spaced blocks 63 and 64, welded or otherwise attached to the base plate 40, provide stop means engageable by the block assembly 61 to limit rotation of the shaft assembly 31.

The actuating assembly 32 by which the shaft assembly 31 is rotated within the base assembly 30 is clearly shown in FIGS. 1 and 2. The actuating assembly 32 is mounted to the base plate 40 and comprises a pair of link members 66 and 67, constituting link means, which are connected to a hydraulic ram, generally indicated by numeral 70. The first link member 66 is pivotally connected at one end to the shaft assembly head portion 50 by means of pivot bolt 60. The other end of the first link member 66 is pivotally connected to the second link member 67 by means of a pivot bolt 71, the second link member 67 being formed from a pair of link plates to facilitate this connection. At its other end the second link member 67 is pivotally connected, by means of a pivot bolt 72, through the medium of a pillar block 73, to the base plate 40. The cylinder 74 of the actuating hydraulic ram 70 is pivotally connected by means of a pivot bolt 75, through the medium of a pillar block 76 to the base plate 40. The remote end of the plunger 77 is pivotally connected to the second link member 67, intermediate its ends, as defined by the pivot bolts 71 and 72, by a pivot bolt 80. The hydraulic ram 70 provides an extension arm constituting a movable means by which force may be applied to the second link member 67, whereby to swing said member about its pivotal connection to the base plate 40. The ram 70 is double-acting and is therefore capable of swinging the second link member 67 in both clockwise and counterclockwise directions about the fixed pivot center defined by pivot bolt 72. When the second link member 67 swings in a clockwise direction the force component applied to the head portion of the shaft assembly through the medium of the first link member 66 urges the shaft assembly 31 in a clockwise direction, thereby rotating the lower transverse arm 46 in the same direction. Thus, reciprocal movement of the extension arm provided by the hydraulic ram 70 controls the rotative capability of the transverse arm 46. Stops 62 and 63 provide a means of limiting rotation of the shaft assembly 31 before the stroke limits of the ram 70 are reached. This arrangement avoids severe strain to the ram 70 which would otherwise result from the momentum of the loaded transverse arm 46 carrying, for example, 5,500 pounds of coiled wire.

In FIG. 2 the actuating assembly 32 is in an intermediate position and structural arrangement of shaft assembly 31 relative to the actuating assembly 32 is such that the transverse arm 46 projects forwardly. The actuating assembly 32 provides the arm 46 with a movement capability of over 90° in each direction.

FIG. 5, which is a schematic representation of actuating assembly, illustrates the theoretical range of movement of the link members 66 and 67 and the extension arm represented by the hydraulic ram 70. The disposition of parts when the ram is fully withdrawn is shown in full lines and the disposition of parts when the ram is fully extended is shown in broken outline. The range

of movement of the actuating assembly 32 provides the pivot bolt 61 and hence the shaft assembly 31 with a rotational capability in excess of 180°. When the ram is withdrawn, pivot bolts 71, 61 and the pivot axis 68 of the shaft are aligned. When the ram is extended, pivot bolts 71, 61 and 72 are aligned.

A conventional ram and shaft assembly is incapable of oscillating a shaft through more than 180° and returning the shaft to zero because dead center occurs at 180° intervals. With an actuating assembly as described above the theoretical rotation of the shaft assembly 31 is considerably in excess of 180° and, even when an allowance is made to ensure that the ram 70 does not lock at a linkage dead center condition or reach a reverse rotation position, an effective range of angular rotation in excess of 180° is possible. For example, in the preferred embodiment the stops 63 and 64 are located to provide a range of angular rotation between 185°-190° and therefore comfortably achieve rotation in excess of 90° in each direction. This additional rotational capability improves the control and use of the transverse arm 46.

The compact nature of the actuating assembly 32 permits the assembly to be mounted on top of the relatively small base plate 40. As shown in FIGS. 1 and 2 this is achieved by providing linkage members 66 and 67 which are mounted above the top of the shaft assembly head portion 50 and by providing the connection of the hydraulic ram 70 at a point intermediate the ends of the second link member 67. Small variations in the positioning of the various pivot points and the proportioning of the linkage element will not produce a significant change in the range through which the linkage assembly can operate. However, in the preferred embodiment, good results have been achieved by spacing pivot pin 80, connecting the hydraulic ram 70 to the second link member 67, from the pivot pin 72 a distance substantially equal to the length of the first link member 66. Further, the pivot pin 72 is located so that the locus of the pivot pin 80 passes substantially through the center of rotation of the shaft assembly. The length of the first link member 66, in the preferred embodiment, is approximately 60 percent of the length of the second link member 67. By moving the pivotal connection 80 closer to the pivotal connection 72 a shorter stroke may be achieved but the mechanical advantage of the system is decreased.

The arrangement of parts of the actuating assembly 32 described above permits the pivotal connection of the hydraulic ram 70 to the base plate 40 to be offset so as to avoid substantial interference with the boom.

The spaced pivotal connection between the boom 11 and the attachment 10 permits said attachment to be tilted.

As shown particularly in FIGS. 1 and 3, the tool arm 12 is directly connected to the base assembly bracket plates 36 at pivotal connection 23. The plunger 15 of the ram 14, on the other hand, is indirectly connected to the bracket plates 36 at pivotal connection 25 by means of arm 24 which is connected at its other end to the cross arms 20 and the plunger 15. As shown in FIG. 3 the pivotal connection 25 includes spaced pivotal plates 81 and 82, which provide a journal mounting for the pivot pin 25.

It is thought that the structural and functional advantages of this material handling attachment have become fully apparent from the foregoing description of

parts but for completeness of disclosure the operation of the attachment will be briefly summarized.

Because it is used in conjunction with a backhoe boom or the like the attachment 10, and therefore the transverse arm 46 may be raised and lowered by manipulation of the boom 11 and also swung with the boom. The transverse arm 46, which forms part of the shaft assembly 31, can also be rotated about the axis of said assembly through somewhat more than 180° of arc relative to the base assembly housing 33 by the actuating assembly 32. In addition the transverse arm 46 may be tilted horizontally by virtue of the attachment between the boom and the base assembly 30 which permits the axis of the shaft assembly to be tilted vertically. It will be understood that the arms 20 and 24, in conjunction with the bracket plates 36 provide, in effect, a rectangular linkage system which is controlled by the extension or retraction of the boom plunger 15.

The actuating assembly 32, which rotates the transverse arm 46 is hydraulically independent of the hydraulic rams 13 and 14 controlling boom movements and, therefore, said transverse arm 46 can be rotated independently of any other movement. Further, the mechanism necessary to rotate the transverse arm 46 is exceedingly compact because of the provision of the linkage assembly consisting of first and second link members 66 and 67 which are actuated by the ram 70 attached intermediate the ends of the second link member 67.

The installation of the shaft assembly is accomplished by inserting the shaft assembly body portion 43 into the tubular housing 33 and attaching the head portion 50 to the end of said body portion 43. The head and body portions 50 and 43 are aligned by means of interfitting tongue and groove portions to ensure that the rotational capability of the shaft assembly 31 is in an optimum operative position in which the transverse arm 46 projects forwardly when the actuating assembly is in a substantially median position. In addition, the tongue and groove connection provides a particular strong shear connection between the head and body portions 50 and 43 of the shaft assembly.

I claim as my invention:

1. A material handling assembly, comprising:

a. support means including:

1. an elongate arm,
2. an extension arm pivotally mounted to the elongate arm,

b. a material handling attachment including:

1. base means including abutment means and a pair of spaced pivot points,
2. first connection means connecting the elongate arm to one of said pivot points,
3. second connection means connecting the extension arm to the other of said pivot points,
4. shaft means including a head portion supported by the abutment means, and a body portion rotatively mounted to the base means and providing a transverse arm means,
5. actuating means for rotating the transverse arm means, including link means connected to the head portion in offset relation to the axis of rotation of the body portion and movable means between the base means and the link means,
6. the link means including a first link member pivotally connected to the head portion in offset relation to the axis of rotation of the body portion

and movable across at least part of said head portion, and a second link member operatively extending between the first link member and the base means,

7. the movable means including a hydraulic ram connected between the base means and the second link member intermediate the ends of the second link member, and
8. the length of the first link member being less than the length of the second link member.
2. A material handling assembly as defined in claim 1, in which:
 - c. the lengths of the first and second link members are proportioned to rotate the transverse arm means through more than 180°.
 3. A material handling assembly claim 2, in which:
 - d. stop means between the base means and the shaft means limit the rotation of the transverse arm means said stop means being engageable before the end of the stroke of the hydraulic ram.
 4. A material handling assembly comprising:
 - a. support means,
 - b. a material handling attachment including:
 1. base means carried by said support means and including an upper base member and a depending housing,
 2. shaft means including a head portion supported by the upper base member and a body portion rotatively received within the housing and providing a transverse arm means,
 3. actuating means for rotating the transverse arm means including a first link member pivotally connected to the head portion in offset relation to the axis of rotation of the body portion and movable across at least part of said head portion, a second link member extending between the first link member and the upper base member, and an extension arm connected between the upper base member and the second link member, and

4. the length of the first link member, is less than the length of the second link member and said link members are proportioned to rotate the transverse arm means through more than 180°.
5. A material handling assembly comprising:
 - a. support means,
 - b. a material handling attachment including:
 1. base means carried by said support means and including abutment means,
 2. shaft means including a head portion supported by the abutment means, and a body portion rotatively mounted to the base means and providing a load carrying portion rotatable with said body portion, and
 3. actuating means for rotating the load carrying portion, including link means pivotally connected to the head portion in offset relation to the axis of rotation of the body portion and a hydraulic ram operatively connected between the base means and the link means.
 6. A material handling assembly as defined in claim 5, in which:
 - c. the base means includes an upper base member providing the abutment means and a depending tubular housing,
 - d. the head portion is operatively supported by the base member and the body portion is journal mounted within the tubular housing,
 - e. the link means includes a first link member pivotally connected to the head portion in offset relation to the axis of rotation of the body portion and a second link member operatively extending between the first link member and the upper base member, both of said members being movable across at least part of said head portion, and
 - f. the hydraulic ram is connected between the upper base member and the second link member intermediate the ends of the second link member.

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