April 6, 1965 G. N. GANDY 3,176,805

UNIVERSAL BOOM HEEL SUPPORT

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FIG. 1

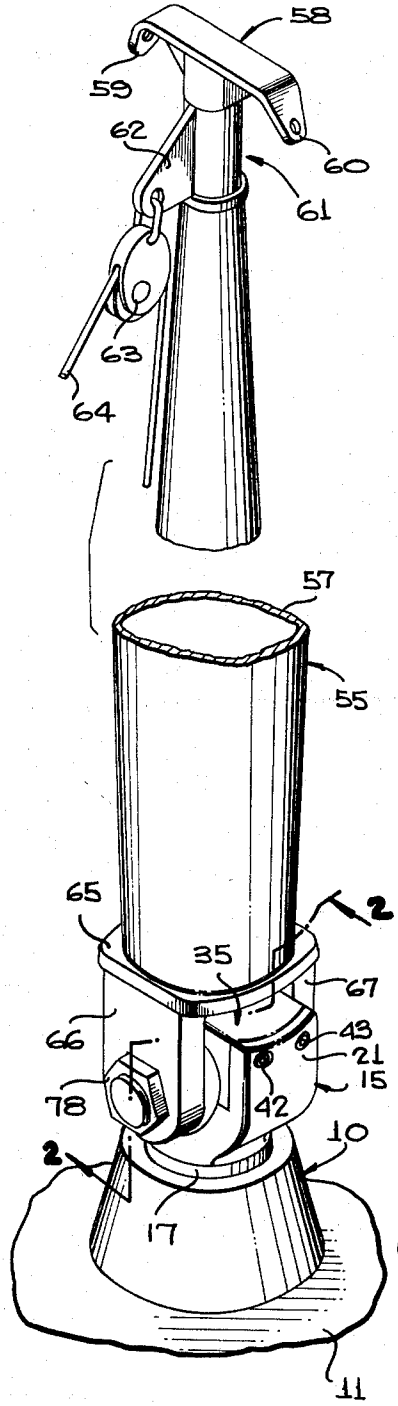
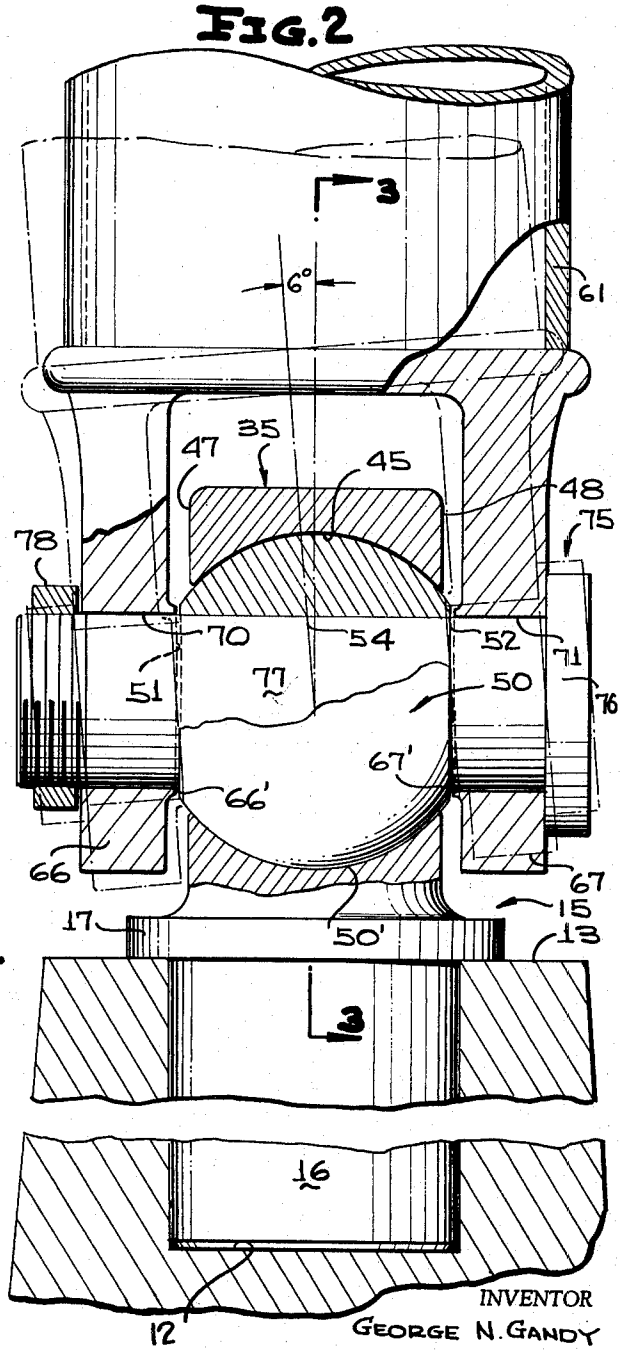


FIG. 2



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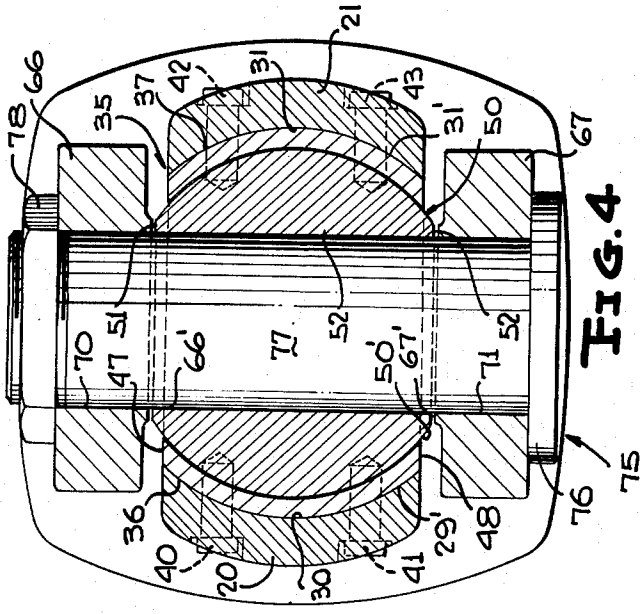


FIG. 4

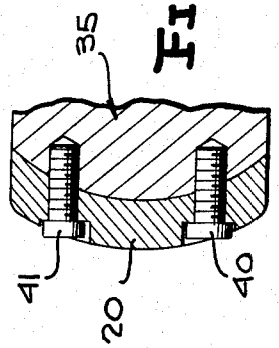


FIG. 5

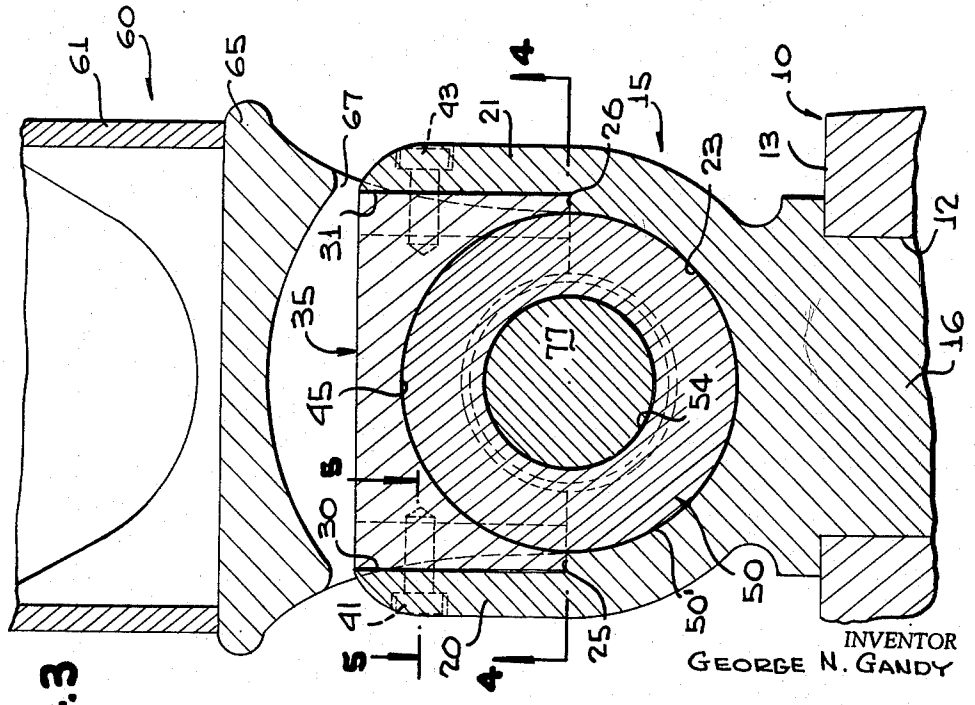


FIG. 3

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United States Patent Office 3,176,805
Patented Apr. 6, 1965

3,176,805

UNIVERSAL BOOM HEEL SUPPORT

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Filed Mar. 25, 1963, Ser. No. 267,641
8 Claims. (Cl. 189—28)

The present invention relates to a new and novel universal boom heel support, and more particularly to a support of this type which allows the boom to swing freely in one plane of movement with respect to the axis of the heel pin of the assembly, while at the same time permitting a limited amount of swinging movement in a plane substantially normal to the last-mentioned plane.

The present invention is particularly directed to an arrangement for supporting the type of boom which is commonly employed for shipboard cargo loading and unloading operations. In certain types of cargo handling systems, it is necessary to support the boom for substantially universal movement, and accordingly, the boom heel support means in such instances must include a rotatably journalled member as well as a pivotally supported means to accomplish the universal movement which is required.

In such installations, a boom support means is first provided which is generally rotatably supported with respect to a suitable base means or pedestal. The heel of the boom usually incorporates a pair of spaced jaws which in turn may be pivotally interconnected with the boom support means.

In the present invention, a novel interconnection is provided between the jaws of the heel portion of the boom and the boom support means. This novel interconnection takes the form of a bearing having an outer surface defining a portion of a spherical surface. The boom support means includes a first boom support member and a bearing retaining means which is removably attached to the boom support member, each of the boom support member and the bearing retaining means having bearing seat means thereon which also defines a portion of a spherical surface such that when the bearing means is properly seated on the bearing seat means, the bearing means is mounted for substantially universal movement with respect to the boom support means.

The jaws of the boom heel portion are pivotally mounted upon a pin which in turn is journalled within a bore extending through the bearing means. With this arrangement, the boom is free to swing about the heel pin in a plane extending substantially normally to the heel pin. In addition, the boom is allowed to swing to a limited degree in a plane which is substantially normal to the aforementioned plane, or in other words, in a plane which extends through the longitudinal axis of the heel pin.

This last-mentioned limited swinging movement of the boom has been found to be very desirable since in actual practice the boom is seldom exactly centered with respect to the load applied thereon, since the boom is swinging through an arc which is exactly perpendicular to the axis of the heel pin which, of course, would be the ideal situation. Actually, the boom often tends to move in its normal pivotal movement about the heel pin along a plane which is slightly inclined with respect to the vertical axis of the boom support member. Also, booms being swung through the vertical position to serve two adjacent hatches may not necessarily be in an exact vertical position, thus imposing bending stresses on the heel fittings and pin.

In other words, let us assume that when the boom is in its exact vertical position, a plane is drawn through the center line of the boom in such vertical position, this plane also passing through the center line of the boom support member which is rotatably journalled in a suitable

base means. The ideal situation would be to perform all moving operations such that the boom would always move in this particular plane. However, as pointed out above, the load is often applied to the boom in such a manner that the boom tends to move to a plane slightly inclined with respect to this theoretical plane. In the present invention, the boom and the heel pin secured to the heel portion thereof are allowed to tilt with respect to the boom support means while still retaining an effective bearing support for the boom which may be of quite large dimensions and which may support large loads.

The universal boom heel support of the present invention accordingly accommodates movement of the boom through an inclined plane as discussed above, while still effectively maintaining a good bearing support for the boom at all times. Furthermore, the boom is mounted for substantially universal movement so as to be positioned in any desired location.

The boom support member of the present invention includes a pair of upwardly extending spaced portions, and a bearing retaining means is detachably secured in position between these spaced portions. Means such as bolts or the like are employed for detachably securing the retaining means in position. With this arrangement of the spaced portions on the boom support member with the bearing retaining means positioned therebetween, the present invention provides the most compact structure for the amount of load applied thereto, and the upper portion of the boom support member is adapted to withstand greater stresses for a given size than if it were of a different configuration. The structure is accordingly very compact for the amount of load applied thereto thereby permitting the jaws at the heel of the boom to be as small as possible so as to minimize bending movements applied thereto.

The boom support member and the bearing retaining means are provided with complementary curved surfaces which serve to guide the bearing retaining means into the operative position discussed above, and further serve to transfer the shear forces which are developed between these members through the interengaging curved surfaces. This reduces any shearing stresses which might otherwise be imposed on the attaching bolts or the like permitting the use of smaller bolts and preventing shearing thereof during operation of the apparatus.

An object of the present invention is to provide a new and novel universal boom heel support which permits the boom to assume an inclined position relative to an associated support member in two mutually perpendicular planes, or in other words, the boom is mounted for free swinging movement in a plane extending perpendicular to the longitudinal axis of the heel pin and is further permitted limited swinging movement in a plane extending through the longitudinal axis of the heel pin. This motion is in addition to the normal rotational movement of the boom heel support.

A further object of the invention is the provision of a universal boom heel support including certain components which are bolted together and means for transferring shear forces between the components to enable the use of smaller bolts and to prevent shearing off of the bolts during operation.

A still further object of the invention is to provide a universal boom heel support which is quite simple and inexpensive in construction, and yet which is quite sturdy and reliable in operation.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawings, wherein:

FIG. 1 is a top perspective view partly broken away of a more or less conventional cargo handling boom mounted

on the universal boom heel support of the present invention;

FIG. 2 is a sectional view taken substantially along line 2—2 of FIG. 1 looking in the direction of the arrows;

FIG. 3 is a sectional view taken substantially along line 3—3 of FIG. 2 looking in the direction of the arrows;

FIG. 4 is a sectional view taken substantially along line 4—4 of FIG. 3 looking in the direction of the arrows; and

FIG. 5 is a sectional view taken substantially along line 5—5 of FIG. 3 looking in the direction of the arrows.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, a base means or boom pedestal is indicated generally by reference numeral 10, this means being mounted on any suitable supporting surface such as the deck 11 of a ship or the like. A substantially cylindrical hole 12 is provided in the upper surface 13 of the base means, hole 12 being adapted to receive a portion of the boom support member and to rotatably journal the boom support member therein, either with or without bearings.

The boom support member itself is indicated generally by reference numeral 15 and includes a depending substantially cylindrical shank portion 16 which is received within the hole 12 of the base means and is adapted to rotate therewithin, such that the entire boom support means including the boom support member and the bearing retaining means described hereinafter will be rotatably supported by the base means. Boom support member 15 also includes a radially outwardly extending annular flange portion 17 which is adapted to rest on the upper surface 13 of the base means.

Boom support member 15 includes a pair of spaced upwardly extending portions 20 and 21, and intermediate these spaced portions there is formed bearing seat means 23 which is of such a configuration to define a portion of a spherical surface. As seen in FIG. 3, a first shoulder 25 is formed between the upstanding portion 20 of the boom support member and the adjacent portion of the bearing seat 23, while a similar shoulder portion 26 is formed between the upstanding portion 21 of the boom support member and the adjacent portion of the bearing seat.

As seen most clearly in FIG. 4, the upstanding spaced portions 20 and 21 are provided with inwardly facing opposed curved surfaces 30 and 31 formed thereon respectively. As seen in FIG. 3, these curved surfaces extend from the shoulders 25 and 26 on member 15 to the top of the associated side portions 20 and 21.

The bearing retaining means of the present invention is indicated generally by reference numeral 35, this bearing retaining means being adapted to fit between the upwardly extending portions 20 and 21 of the boom support member. As seen most clearly in FIG. 4, the opposite outer end walls 36 and 37 of the bearing retaining means 35 are complementary to and snugly fit up against the inner surfaces 30 and 31 of the spaced portions 20 and 21 of the boom support member.

As seen in FIG. 3, the bottom surface of the bearing retaining means rests upon the shoulders 25 and 26 of the boom support member as aforedescribed.

The bearing retaining means is detachably secured to the boom support member by four bolts indicated by reference numerals 40, 41, 42 and 43. These bolts fit through suitable openings provided in the spaced portions 20 and 21 and are threaded into suitable threaded openings provided in opposite ends of the bearing retaining means 35.

The under surface of the bearing retaining means is provided with a bearing seat means 45 which also defines a portion of a spherical surface of the same diameter as the spherical surface previously mentioned in connection with bearing seat means 23.

As seen in FIG. 3, the upper surface of bearing retaining means 35 is substantially coextensive with the upper portions of the spaced side portions 20 and 21 of the boom support member, and as seen in FIG. 4, the side surfaces of the bearing retaining means as indicated by reference numerals 47 and 48 are substantially coextensive with and flush with the corresponding side surfaces of the upwardly extending spaced portions 20 and 21 of the boom support member.

The bearing means of the present invention is indicated generally by reference numeral 50 and this bearing means includes an outer surface 50' which defines a portion of a spherical surface which is adapted to fit snugly on the bearing seat means previously described, each of these surfaces defining a portion of a similar spherical surface. This arrangement permits the bearing means to freely move between the oppositely facing bearing seat means as will be understood.

Bearing means 50 includes opposite flat side portions 51 and 52 which define the limits of the spherical surface portion 50' thereof, and the bearing means is provided with a central substantially cylindrical bore 54 which extends therethrough and which is centered with respect to each of the opposite end faces 51 and 52.

The bearing means is illustrated in operative position in the drawings, and it will be understood that in assembling or disassembling the device, the bearing retaining means 35 is removed from the boom support member whereupon access may be gained to the bearing means as will be understood.

As seen particularly in FIG. 1, the boom means is indicated generally by reference numeral 55 and comprises a tubular substantially frusto-conical portion 57 having a topping lift attachment means indicated generally by reference numeral 58 fixedly secured to the upper end thereof, means 58 having depending ears 59 and 60 adapted to be secured to conventional topping lift lines. Disposed immediately below attachment means 58 is a support means indicated generally by reference numeral 61, support means 61 being held against longitudinal movement relative to the boom but being freely rotatable thereon throughout 360° of rotation in either direction. The support means includes a laterally extending flange portion 62 which supports a block or sheave assembly 63 over which is trained the cargo fall line 64 attached to a cargo hook, or the like as is conventional.

The lower portion of the boom includes a large base portion 65 from which depend a pair of spaced jaws or portions 66 and 67.

As seen most clearly in FIGS. 2 and 4, jaws 66 and 67 have aligned holes 70 and 71 formed therethrough respectively. It will be noted that the jaws are disposed on opposite sides of the bearing means and that the inner faces of the jaws 66 and 67 include inwardly directed bosses 66' and 67' respectively which are disposed adjacent the opposite end faces 51 and 52 respectively of the bearing means.

A heel pin means 75 includes an enlarged head 76 and a substantially cylindrical shank portion 77 which extends through the openings 70, 71 in the jaws 66 and 67 respectively and through the central bore 54 of the bearing means as may be clearly seen in FIGS. 2 and 4. The opposite end portion of the heel pin means is threaded and has a nut 78 threaded thereon for retaining the heel pin means in operative position. It is apparent that any suitable means may be employed for retaining the pin means in the position as shown in the drawings. It is evident that the heel pin means serves to pivotally interconnect the boom with the bearing means which in turn is journalled for universal movement within the boom support member and the bearing retaining means.

The boom support member, the bearing retaining means, and the heel pin means may be formed of a suitable material such as mild steel which is quite strong and capable of taking the relatively large stresses applied thereto. The bearing means 50 may be formed of a suitable bearing material of high strength to absorb the loads applied

thereto and to provide a minimum amount of friction between the bearing means and the shank of the pin rotatably journalled therewithin and the bearing seat means formed on the boom support member and the bearing retaining means.

With the structure as aforedescribed, the boom is mounted for substantially universal movement by virtue of the fact that the boom support member is rotatably supported within the boom pedestal, while the lower end of the boom is pivotally interconnected with the boom support member through the intermediary of the bearing means and the heel pin means.

In addition, the mounting of the bearing means is such that the boom is enabled to move in still a further manner so as to accommodate misalignment of the boom and load as aforedescribed.

Referring to FIG. 2 of the drawings, it is apparent firstly that the boom is mounted for rotary movement about an axis extending vertically through the longitudinal axis of the boom support member 15. Additionally, the boom is mounted for pivotal movement about the longitudinal axis of the elongated pin means 75. Furthermore, the mounting of the bearing means permits the boom to move in a plane which passes substantially through the longitudinal axis of the pin means, or in other words as seen in FIG. 2, the boom along with the pin means and bearing means is adapted to tilt into the position shown in phantom line. The construction is such as to accommodate a tilting through an angle of approximately 6° to either side as indicated on the drawing in FIG. 2 between the center line of the boom in a vertical position and the center line of the boom in an inclined position. This is considered adequate to accommodate any misalignment of the boom as will normally occur during movement of the boom.

It is apparent from the foregoing that there is provided a new and novel universal boom heel support in the present invention which permits the boom to assume an inclined position relative to an associated support member, the boom being adapted to swing about the heel pin so as to move in a plane substantially normal to the longitudinal axis of the heel pin while also having limited movement in a plane extending substantially through the longitudinal axis of the heel pin. The support of the present invention provides a compact arrangement such that the jaws of the heel of the boom are as small and as close together as possible to minimize bending moments which are developed during operation. The universal boom heel support of the present invention includes certain components which are bolted together and means in the form of complementary curved surfaces are provided for transferring shear forces between the boom support member and the bearing retaining means to enable the use of smaller bolts and to prevent shearing of the bolts. The structure is quite simple and inexpensive and yet is at the same time quite sturdy and reliable in operation.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illustrative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. A universal boom heel support comprising boom support means, said boom support means including bearing seat means, bearing means supported by said bearing seat means for movement relative to said boom support means, boom means including a heel portion having spaced depending portions, and connecting means connecting said spaced depending portions with said bearing means to move as a unit relative to said boom support means to mount the boom means for pivotal movement about an axis extending through said connecting means and also for limited movement in a plane extending through said axis.

2. A universal boom heel support comprising a boom support member having bearing seat means thereon, bearing retaining means having bearing seat means thereon, means detachably connecting said bearing retaining means to said boom support member, bearing means supported on said bearing seat means for movement relative to said boom support member and said bearing retaining means, a boom having a heel portion including spaced jaws, and means pivotally interconnecting said spaced jaws with said bearing means to mount the boom means for pivotal movement about an axis and also for limited movement in a plane extending through said axis.

3. A universal boom heel support comprising a boom support member mounted for rotary movement and having bearing seat means formed thereon, bearing retaining means having bearing seat means thereon, means removably securing said bearing retaining means to said boom support member, bearing means journalled on said bearing seat means for substantially universal movement with respect to said boom support member and said bearing retaining means, a boom having a heel portion including spaced depending portions, and means pivotally interconnecting said spaced depending portions with said bearing means to permit substantially universal movement of said boom and to further permit the boom to assume an inclined position relative to said support member in either of two mutually perpendicular planes.

4. A universal boom heel support comprising an elongated boom support member mounted for rotary movement about the longitudinal axis thereof and having bearing seat means formed thereon defining a portion of a spherical surface, bearing retaining means having bearing seat means formed thereon defining a portion of a spherical surface, means detachably securing said bearing retaining means to said boom support member, bearing means having an outer surface defining a portion of a spherical surface, said outer surface being received on said bearing seat means to mount said bearing means for movement relative to said boom support member and said bearing retaining means, a boom having a heel portion including spaced jaws disposed at opposite sides of said bearing means, and means pivotally interconnecting said jaw portions with said bearing means.

5. A universal boom heel support as defined in claim 4, wherein said means for pivotally interconnecting said jaw portions with said bearing means comprises pin means, said bearing means having a bore formed therethrough, said pin means being rotatably journalled within said bore, said jaw portions having openings receiving portions of said pin means, and means for retaining said pin means in operative position whereby said boom is adapted to assume an inclined position in a plane passing along the longitudinal axis of said pin means as well as in a plane perpendicular to said first-mentioned plane.

6. A universal boom heel support comprising a base means, a boom support member including a depending portion, said depending portion being supported for movement by said base means, said boom support member having formed thereon bearing seat means defining a portion of a spherical surface, said boom support member including a pair of spaced upper portions, bearing retaining means received between said spaced upper portions of said boom support member, means detachably securing said bearing retaining means in operative position between said spaced upper portions, said bearing retaining means having bearing seat means formed thereon defining a portion of a spherical surface, bearing means having an outer surface defining a portion of a spherical surface, said outer surface being journalled on said bearing seat means so as to mount said bearing means for substantially universal movement relative to said boom support member and said bearing retaining means, said bearing means having a bore formed therethrough, a boom

including a heel portion having a pair of spaced depending jaws, each of said jaws having an opening formed therethrough, an elongated pin fitting within the openings in each of said jaws and through the bore formed in said bearing means with said jaw portions disposed on opposite sides of said bearing means, and means removably securing said pin means in operative position through said openings and said bore, whereby said boom is mounted for universal movement and further is adapted to tilt with respect to said boom support member and said bearing retaining means in a plane substantially passing through the longitudinal axis of said pin means.

7. A universal boom heel support as defined in claim 6, wherein said pair of spaced upper portions have inwardly facing opposed curved surfaces formed thereon, said bearing retaining means having complementary curved surfaces thereon adapted to engage and cooperate with said first-mentioned curved surfaces so as to guide the bearing retaining means into operative position and to absorb any shear stresses developed between said bearing retaining means and said boom support member.

8. A universal boom heel support comprising base means, an elongated boom support member including a depending portion journalled for rotation relative to said base means about the longitudinal axis of the boom support member, said boom support member having formed thereon bearing seat means defining a portion of a spherical surface, said boom support means also including a pair of upwardly extending spaced portions having inwardly facing opposed curved surfaces formed thereon, bearing retaining means fitting between said upwardly extending spaced portions of said boom support member and having complementary curved surfaces thereon engaging the curved surfaces on the upwardly spaced portions of said boom support member for guiding the bearing retaining means into operative position and for absorbing shear stresses developed between the boom support member and said bearing retaining means, means for detachably securing said bearing retaining means to said boom support member, said bearing retaining means having formed thereon bearing seat means defining a portion of a spherical surface, bearing means having an outer surface defining a portion of a spherical surface and being supported on said seat means such that said bearing means is mounted for substantial universal movement with respect to said boom support member and said bearing retaining means, said bearing means having a substantially cylindrical bore formed therethrough, heel pin means including a substantially cylindrical shank portion, a boom including a heel portion including a pair of spaced jaws, each of said jaws having an opening formed therethrough, said jaws being disposed at opposite sides of said bearing means, said heel pin shank portion extending through the openings in said jaws and the bore in said bearing means to pivotally interconnect said boom heel portion with said pin means, and means for retaining said heel pin means in operative position within said openings in said bore, whereby said boom is mounted for free swinging movement in a plane extending substantially normally to the axis of the shank of said heel pin means, and said boom is also mounted for limited swinging movement in a plane extending substantially through the longitudinal axis of the shank portion of said heel pin means.

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