HYDRAULIC ATTACHMENT FOR SKID STEER LOADERS

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ABSTRACT
An hydraulic attachment (10) adapted to be mounted to machinery or a vehicle such as a skid-steer loader (35) and having a telescopic mast assembly (11) including a first lower mast member (12) and at least one second upper mast member (13) telescopically engaged with the lower mast member (12) and at least one hydraulic actuator (15) for extending or retracting the upper mast member (13) relative to the lower mast member (12). Mounting means (34) are provided for mounting the mast assembly (11) to the loader (35) so as to be supported in use in a substantially upstanding attitude and the mast assembly (12) includes support means (22) at its upper end for supporting or carrying a tool such as an impact applying tool (23).
HYDRAULIC ATTACHMENT FOR SKID STEER LOADERS

TECHNICAL FIELD

[0001] This invention relates to an attachment, in particular to a hydraulic attachment which is particularly suited for use with skid steer loaders including small mechanical loaders such as stand on min-skid steer loaders. The attachment of the invention however is suitable for attachment to any form or size of machinery or vehicles. In a particular aspect, the present invention relates to an attachment which serves as a post driver for use in driving posts such as fence posts or guard rail posts into the ground.

BACKGROUND ART

[0002] Where it is desired to install posts into the ground such as fence posts or guard rails posts, the common procedure is to use a earth drilling device to form a hole in the ground and thereafter install a post in the hole in which is backfilled with concrete to hold the post firmly in position. Alternatively the hole can be made manually. In either situation, the procedure is relatively time consuming and tedious where a large number of posts are to be installed. Removal of posts from the ground can also prove difficult.

[0003] Some of the large earth working machines such as backhoes can be provided with pile driving attachments which are mounted on an articulated arm at the rear of the machine. It is difficult to manipulate the pile driver close to the post to be driven into the ground in these machines and hold the pile driver attachment in position during the pile driving operation.

[0004] Current skid-steer loaders including mini-loaders have a limited range of attachments usually related to the form of bucket attached to the loader. It would be desirable to provide an attachment which is suitable for use with a range of different devices or tools or for use for a range of different purposes for example for the purpose of post driving, post pulling or post hole drilling.

SUMMARY OF THE INVENTION

[0005] The present invention aims to provide an attachment and in particular an hydraulic attachment which is particularly suited to use with a skid-steer loader and which may be used for a number of different purposes. The hydraulic attachment of the invention however may be used with other machinery such as other forms of loaders such as front end loaders or with or in association with other forms of vehicle. Other objects and advantages of the invention will become apparent from the following description.

[0006] The present invention thus provides in one aspect a hydraulic attachment adapted to be mounted to machinery or a vehicle such as earth working machinery, said attachment including a telescopic mast assembly, said mast assembly including a first lower mast member and at least one second upper mast member, said lower mast member, at least one hydraulic actuator for extending or retracting said upper mast member relative to said lower mast member, mounting means for mounting said mast assembly to said machinery so as to be supported in use in a substantially uprighted attitude, and support means at the upper end of said mast assembly for supporting or carrying a tool.

[0007] The tool may comprise a post driver tool, an earth drilling tool or a post or tree extraction tool. Suitably the support means is adapted to support the tool such that the tool depends from the support means. The post driver tool for example may comprise reciprocative driving means for applying a reciprocative impact force to a post to be driven into the ground. Preferably the driving means comprise fluid driven driving means suitably pneumatically driven means. Preferably the driving means comprises a pneumatically reciprocative member which carries a weighted anvil or driving head.

[0008] The earth drilling tool may comprise an auger drivable by any suitable driving means for applying rotation to the auger. The driving means may comprise an hydraulic motor.

[0009] Preferably the tools are detachably engageable with the support means. Preferably the upper ends of the tools are detachably engageable with the support means. Preferably the support means at the upper end of the mast assembly comprises an outwardly extending arm for supporting or carrying a tool. Preferably the respective tools are detachably engaged with the arm such that respective tools may be interchanged. If necessary the arm may be braced to the mast assembly. The mast assembly may have a foot at its lower end which may be engaged with the ground to stabilize the mast assembly in use. The foot may be adjustable from the lower end of the mast assembly for example by being telescopically extendable from the mast assembly. Preferably the foot comprises a planar member adapted to seat on a ground surface.

[0010] The mounting means is suitably provided on the side of the post assembly opposite the support means for the tool. The mounting means suitably includes a first part fixed to the mast assembly and a second part mountable to the machinery. The mounting means may include means for adjusting the upright attitude of the mast assembly in a transverse vertical plane. The first and second parts are preferably pivotally mounted to each other pivotally relative to each other about an axis extending substantially normal to the mast assembly which in use comprises a generally horizontal axis. The means for adjusting the upright attitude of the post assembly suitably comprises means for pivoting the second part relative to the first part. The means for pivoting the second part relative to the first part suitably comprises at least one actuator. The actuator suitably is provided between the second part and the mast assembly. The at least one actuator suitably comprises at least one hydraulic ram. Preferably the second part extends laterally of the post assembly. Preferably the second part extends laterally to opposite sides of the post assembly and a pair of hydraulic rams is provided, respective rams being located on opposite sides of the mast assembly and extending between the laterally extending portions of the second part and the mast assembly.

[0011] Means are suitably provided for holding the second part against, or in substantial juxtaposition with, the first part. The holding means suitably comprises at least one connector. The at least one connector suitably extends through at least one slot, suitably an arcuate slot in the first part which can accommodate limited pivotal movement of the first part relative to the second part. Preferably a pair of connectors are provided on opposite sides of the mast assembly and extend from the second part and through respective slots in the first part. Alternatively the second part may include at least one slot and at least one connector may extend from the first part
and through the at least one arcuate slot in the second part. The connector or connectors suitable comprise bolts.

[0012] Preferably the second part includes coupling means for coupling to a complementary coupling means carried by the machinery. Preferably the coupling means carried by the second part and machinery comprise male-female coupling means. Preferably the coupling means comprises attachment means for releasably attaching the second part to the complementary coupling means carried by the machinery.

[0013] Preferably the second member of the mast assembly is received telescopically within the first member of the mast assembly. Preferably the second mast member is received non-rotatably within the first mast member. Preferably the first and second mast members comprise hollow sections preferably a rectangular or square cross section, the sections being such that the second mast member has an external configuration of dimensions slightly less than the internal dimensions of the first mast member so as to be receivable in the first mast member for sliding movement relative thereto.

[0014] The mast assembly suitably also includes a third mast member telescopically received within the second mast member. Preferably the third mast member is received non-rotatably within the mast member. Preferably the third mast member comprises a hollow section preferably of a rectangular or square cross section with an external configuration of dimensions slightly less than the internal dimensions of the second mast member such that the third mast member is receivable in the second mast member for sliding movement relative thereto.

[0015] Preferably the support means for the tool such as an arm is rigidly connected to the third mast member. Preferably the arm extends substantially at right angles to the third mast member. Preferably means are provided to extend and retract the third mast member relative to the second mast member. Such means preferably comprise an hydraulic ram between the third mast member and second mast member. Preferably the hydraulic ram is connected between a bracket secured to the second mast member and third mast member. The bracket suitably comprises an elongated bracket secured at one end to the second mast member and extending longitudinally of the mast members and externally of the main mast member towards the normally lower end of the second and main mast members.

[0016] In a further aspect, the present invention comprises machinery or a vehicle having an attachment described above mounted thereto. The machinery suitably comprises hydraulically operated machinery such as earth working machinery. Preferably the earth working machinery comprises a skid-steer loader or front-end loader and the mounting means mounts the attachment to the loader.

[0017] According to a further aspect, the present invention provides an impact applying attachment adapted to be mounted to machinery such as earth working or loading machinery, said attachment including a telescopic mast assembly, mounting means for releasably mounting said post assembly to said machinery so as to be arranged in a substantially upstanding attitude, and support means from the upper end of said post assembly and extending therefrom, said support means carrying impact applying means.

[0018] Preferably the impact applying means depends from the support means. Suitably the impact applying means is provided on the side of the mast assembly opposite the mounting means. Preferably the impact applying means is associated with a weighted driving head or anvil.

[0019] The mast assembly and mounting means may be substantially of the same configuration as those described above.

[0020] Whilst the impact applying attachment is particularly designed for driving posts or piles into the ground, the attachment may also be used in other applications by replacing the anvil or driving head with another form of tool. Thus the driving head may be replaced with a rock or concrete breaking head.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] In order that the invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate a preferred embodiment of the invention and wherein:

[0022] FIG. 1 illustrates in side elevation a hydraulic attachment according to an embodiment of the invention supporting a post driver;

[0023] FIG. 2 is an opposite side elevation of the post driver of FIG. 1;

[0024] FIG. 3 is a partly cut-away sectional view of the mast assembly along line A-A of FIG. 1 (excluding the hydraulic extension rams);

[0025] FIG. 4 illustrates the attachment fitted to a skid-steer loader for driving a post into the ground;

[0026] FIG. 5 illustrates an auger assembly for mounting to the attachment;

[0027] FIG. 6 illustrates a post gripper for mounting to the attachment; and

[0028] FIG. 7 illustrates the manner in which a chain puller is used with the attachment for removing a post from the ground.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0029] Referring to the drawings and firstly to FIGS. 1 to 3, there is illustrated an attachment 10 typically for small size earth-working machinery according to an embodiment of the invention, the attachment 10 comprising an elongated telescopic mast assembly 11 comprising an outer elongated main hollow mast member 12 of square cross section, a second inner elongated hollow mast member 13 of complementary square cross section to and within the main mast member 12 and a third inner elongated hollow mast member 14 of complementary square cross section and to within the second inner hollow mast member 13. The members 12, 13 and 14 may thus be extended telescopically relative to each other to extend the length of the mast assembly 11. Slides 10 (shown in dotted outline in FIGS. 1 and 2) are provided within the upper ends of the main hollow member 12 and second inner hollow member 13 and at the lower end and on the outside of the second inner hollow member 13 and third inner hollow member 14. The slides 10 are provided on each of the faces of the respective members so as to occupy the space between the respective members 12 and 13 and 13 and 14 to facilitate smooth movement of the members 12, 13 and 14 during telescopic extension and retraction of the post assembly 11.

[0030] A first hydraulic ram 15 which extends longitudinally of the mast assembly 11 is mounted at opposite ends via mounting brackets 16 and 17 to a lower part of the main hollow member 12 and an upper part of the second member 13 respectively on one side of the mast assembly 11. A second hydraulic ram 18 which also extends longitudinally of the
mast assembly 11 is provided on the opposite side of the mast assembly 11 to the ram 15 and is mounted at its opposite ends 19 and 20 respectively to a bracket at an upper part of the third member 14 and a bracket 21 which is attached at 21 such as by welding to an upper part of the second member 13, the bracket 21 being of a generally elongated U-shape configuration and extending from its attachment point 21 downwardly along and on the outside of the mast assembly 11 towards a lower end of the main member 12 so that the lower end of the bracket 21 to which the lower end of the ram 18 is attached is free.  

[0031] Extension of the first ram 15 will extend the second and third members 13 and 14 together and simultaneously from the main member 12 whilst extension of the second ram 18 will extend the third member 14 from the second member 13. Similarly retraction of the ram 18 will retract the third member 14 into the second member 13 and retraction of the ram 15 will retract the third member 14 and second member simultaneously into the main member 12.  

[0032] Extending substantially at right angles from and rigidly fixed to the third member 14 is a tool support in the form of a boom arm 22. The boom arm 22 carries in this case an impact hammer 23 which is mounted at its upper end to the arm 22 to depend therefrom so as to be substantially parallel to the mast assembly 11. The hammer 23 comprises a pneumatically driven impact hammer provided with a weighted impact head or anvil 24. Pressurized air applied to the impact hammer 23 will cause reciprocation of the driving mechanism of the impact head 24 in a substantially vertical direction. Typically the impact hammer 23 comprises a rock breaker with the drive pin thereof being connected to the impact head 24.  

[0033] The attachment 10 additionally includes a mounting assembly 25 on the side of the mast assembly 11 opposite the arm 22 and impact hammer 23 for mounting the attachment 10 to a suitable prime mover. The mounting assembly 25 comprises a first plate 26 which is fixed rigidly to the main member 12 and extends laterally on opposite sides thereof and a second similar plate 27 which is pivotally mounted to the first plate 26 by a pivot pin 28 (shown in dotted outline) extending through aligned openings in the plates 26 and 27 whereby the plate 27 is mounted for rotation relative to the plate 26 about an axis extending normal to the longitudinal axis of the mast assembly 11. The second plate 27 is retained to the first plate 26 by a pair of bolts 29 on opposite sides of the post assembly 11, the bolts 29 passing through arcuate slots 30 in the first plate 26 which allow for limited pivotal movement of the second plate 27 and bolts 29 relative to the first plate 26. The bolts 29 at the same time maintain the plates 26 and 27 in substantial face-to-face contact.  

[0034] A pair of hydraulic rams 31 are provided on opposite sides of the mast assembly 10 respectively and extend between lugs 32 on the opposite outer sides of the second plate 27 and lugs 33 on opposite side of the main member 12. Corresponding retraction and extension of the rams 31 on opposite sides of the mast assembly 11 will thus cause pivotal movement of the first plate 26 and thus mast assembly 11 relative to the second plate 27 in a transverse vertical plane as indicated by the arrows in FIG. 3.  

[0035] The second plate 27 also carries a coupling 34 to enable the attachment 10 to be mounted to a prime mover such as a stand-on mini skid-steer loader 35 (see FIG. 4). Thus a loader 35 provided with a complementary coupling 36 to the coupling 34 can engage and support the attachment 10, the coupling 36 being provided at the end of link arms 37 of the loader 35 which can be hydraulically elevated or lowered. The coupling 36 is provided with spring-loaded pins 38 to enable positive connection between the couplings 34 and 36 when arranged in a mating complementary relationship with each other, the pins 38 being adapted to locate in corresponding holes 38 in the coupling 34.  

[0036] When the attachment 10 is mounted to a loader 35 as in FIG. 4 and the attachment 10 is to be used to drive a fence post 39 or the like into the ground, the impact hammer 23 is mounted to the arm 22 and the loader 35 is used to position the mast assembly 11 adjacent to the post 39 and the ram and/or rams 15 and/or 18 are used to extend the mast assembly 11 and elevate the impact hammer 23 above the post 39. The loader 35 can be manipulated towards and away from the post 39 so that the impact head 24 is substantially vertically above the post 39. The hydraulic rams 31 are actuated if required to pivot the mast assembly 11 about a substantially horizontal axis as indicated by the arrows in FIG. 3 until it is in a substantially vertical position and hydraulic rams which are on the loader 35 and which control the arms 37 can also be adjusted to ensure that the mast assembly 10 is substantially upright. Pressurized air can then be applied to the impact hammer 23 so that the impact head 24 will reciprocate and apply an impact force to the upper end of the post 39 to drive it into the ground. As the post 39 is forced into the ground, the ram and/or rams 15 and/or 18 may be retracted to lower the boom arm 22 for example from the dotted outline position of FIG. 4 to maintain the impact hammer 23 in a position such that the impact head 24 will continue to apply an impact to the post 39. This procedure is repeated until die post 39 is driven to the required depth into the ground.  

[0037] Whilst in the embodiment shown in FIG. 4, the mast assembly 10 is raised above the ground, the loader 35 can lower the mast assembly 10 onto the ground so that it is supported during the post driving operation. To support the mast assembly 10, the lower end of the mast member 12 may be provided with a foot 40 shown in dotted outline in FIG. 4 which may comprise a flat plate for seating flat on the ground. The foot 40 may be mounted for telescopic extension from the mast assembly 10.  

[0038] All hydraulic fluid for supplying the rams 15, 18 and 31 is supplied from the hydraulic supply of the loader 35 and under the control of hydraulic valves on the loader 35 controllable by the operator of the loader 35. An auxiliary hydraulic supply however may be used to supply fluid to the rams.  

[0039] The impact hammer 23 most suitably is detachable mounted to the arm 22 through a detachable coupling 41 which comprises complementary coupling parts on the arm 22 and hammer 23. Thus the hammer 23 may be removed and replaced with other forms of tool for example an hydraulically operated auger assembly 42 as shown in FIG. 5. The hydraulic attachment 10 may also carry a drilling device used for deep hole drilling where a series of drill rods may be interconnected one above the other. Thus the hydraulic attachment 10 carrying such a drilling device may be extended for attachment of the drilling rods to the drilling motor and then lowered to urge the drill rods into the ground. At the retracted position of the hydraulic attachment 10, the drill rods may be disconnected from the drilling motor and the attachment 10 then extended to enable attachment of a further
drill rods between the drilling motor and drill rod in the ground and the procedure repeated until the required depth is achieved.

[0040] Where the attachment 10 is to be used for extracting a member from the ground such as the post 39, a post gripper 43 as shown in FIG. 6 may be attached to the arm 22 and lowered such that the jaws 44 of the gripper 43 can locate about the post 39 for gripping the post 39 (shown in dotted outline). For post extraction, to support the hydraulic attachment 10, the member 12 is lowered by the loader 35 such that the foot 40 seats on the surface of the ground. Alternatively, the foot 40 may be extended from the lower end of the member 12 to engage the ground. The post gripper 43 may then be actuated such that the jaws 44 grip the post 39 after which the rams 18 and/or 15 may be extended to elevate the mast assembly 11 and arm 22 and extract the post 39.

[0041] In a simplified arrangement, the attachment 10 may include one or more attachment points 45 to which a chain may be connected. Preferably and as illustrated in FIG. 7, one attachment point 45 may be provided on top of the mast assembly and another attachment point 45' at or adjacent the outer end of the arm 22. For removal of a post 39 or other member in the ground such as a tree or tree stump, the chain 46 is wrapped around the post 39 or tree and secured to one or both attachment points 45 (an/or 45'). The attachment 10 may then again be elevated by means of the rams 15 and/or 18 such as to the position shown in dotted outline in FIG. 7 to lift the arm 22 and the chain 46 and thus lift the post 39 (or other member) from the ground.

[0042] Whilst the attachment 10 is shown and described in association with a mini skid steer loader, it may be used with other forms of machinery such as earth working machinery or attached to a vehicle. Furthermore whilst the embodiment of FIG. 4 is described as a post driver, a substitute head may be used in place of the impact applying head 24 for other applications such as for jack hammer or rock breaking operations. Whilst the impact hammer 23 suitably comprises a pneumatically operated hammer, it may be any other form of impact applying tool such as a hydraulically operated hammer or tool.

[0043] It will also be appreciated that may different forms of tool may be coupled to the arm 22 through the complementary coupling 41. The coupling 41 may be of many different configurations which will permit secure but releasable attachment of a tool to the arm 22.

[0044] Where the hydraulic attachment 10 is to be used for post removal applications, it may not be necessary to include the mounting assembly 25 to provide for vertical adjustment of the attachment 10.

[0045] It also may be desirable to brace the arm 22 in some applications and for this purpose a bracing member 47 shown in dotted outline in FIG. 1 may be provided between and connected to the arm 22 and member 14. To accommodate movement of the member 14 relative to the member 12 and/or 13, the members 12 and 13 are provided with longitudinally extending aligned slots 48 and 49 through which the bracing member 47 passes (see FIG. 3) for attachment to the member 14.

[0046] The term “comprising” or “comprises” as used throughout the specification are taken to specify the presence of the stated features, integers and components referred to but not preclude the presence or addition of one or more other feature/s, integer/s, component/s or group thereof.

[0047] The above has been given by way of illustrative embodiment of the invention. It will be appreciated however that all variations and modifications to the invention as would be apparent to persons skilled in the art are deemed to fall within the broad scope and ambit of the invention as defined in the appended claims.

1.33. (canceled)

34. An hydraulic attachment adapted to be mounted to earth moving machinery having forwardly extending link arms, said attachment comprising a telescopic mast assembly, said mast assembly including a first lower mast member and at least one second upper mast member telescopically engaged with said lower mast member, at least one hydraulic actuator for extending or retracting said upper mast member relative to said lower mast member, mounting means for mounting said mast assembly to said link arms of said skid steer loader so as to be supported in use in a substantially upright attitude, and tool support means at the upper end of said mast assembly and on the side of said mast assembly opposite said mounting means, said support means being adapted to support one of a post driver tool, an earth drilling tool or a post or tree extraction tool.

35. An attachment as claimed in claim 34 wherein said tool comprises a post driver tool comprising reciprocative driving means for applying a reciprocative impact force to a post to be driven into the ground.

36. An attachment as claimed in claim 35 wherein said driving means comprises fluid driven driving means adapted to cooperate with a weighted anvil or driving head.

37. An attachment as claimed in claim 34 wherein said tool comprises an earth drilling tool and wherein said earth drilling tool comprise an auger drivable by driving means.

38. An attachment as claimed in claim 34 wherein said tool comprises a post or tree extraction tool, said post or tree extraction tool including means to grip a post or tree trunk.

39. An attachment as claimed in claim 34 wherein said means to grip a post or tree trunk comprises a chain adapted to be wrapped around a post or tree and secured to the mast assembly.

40. An attachment as claimed in claim 34 wherein said support means includes an outwardly extending arm and wherein said tool is mounted to said arm to extend downwardly therefrom.

41. An attachment as claimed in claim 34 wherein said mast assembly has a foot at its lower end adapted to be engaged with the ground to stabilize the mast assembly in use.

42. An attachment as claimed in claim 34 wherein said mounting means includes a first part fixed to the mast assembly and a second part mountable to said link arms.

43. An attachment as claimed in claim 42 and wherein said mounting means includes means for selectively adjusting the upright attitude of the mast assembly.

44. An attachment as claimed in claim 43 wherein said second part is pivotally mounted to the first part for pivotal movement about an axis extending substantially normal to said mast assembly and wherein said means for adjusting the upright attitude of the post assembly comprises means for pivoting the second part relative to the first part.
45. An attachment as claimed in claim 44 wherein said means for pivoting the second part relative to the first part comprises at least one actuator between the second part and the mast assembly.

46. An attachment as claimed in claim 42 and including means for holding the second part against or in substantial juxtaposition with the first part, said holding means comprising at least one connector extending through at least one slot in said first or second part.

47. An attachment as claimed in claim 34 wherein said second member of the mast assembly is receivable telescopically and non-rotatably within the first member of the mast assembly.

48. An attachment as claimed in claim 34 wherein said mast assembly includes a third mast member telescopically receivable non-rotatably within the second mast member and wherein said tool support means is rigidly connected to the third mast member.

49. An attachment as claimed in claim 48 and including an hydraulic ram between the third mast member and second mast member for selectively extending and retracting said third mast member relative to the second mast member.

50. An attachment as claimed in claim 49 wherein said hydraulic ram is connected between a bracket secured to the second mast member and third mast member.

51. An attachment as claimed in claim 50 wherein said bracket comprises an elongated bracket secured at one end to the second mast member and extending longitudinally of and externally of the mast members towards the lower end of the first mast member.

52. A skid steer loader having a pair of forwardly extending link arms and an attachment comprising:
   a telescopic mast assembly, said mast assembly including a first lower mast member, a second upper mast member telescopically engaged with said first mast member, and a third upper mast member telescopically engaged with said second mast member.
   a first hydraulic actuator for extending or retracting said second upper mast member relative to said lower mast member,
   a second hydraulic actuator for extending or retracting said third upper mast member relative to said second mast member,
   mounting means for mounting said first lower mast member to said link arms to supported said mast assembly in a substantially upstanding attitude, and
   tool support means on said third upper mast member, said support means being adapted to support one of a post driver tool, an earth drilling tool or a post or tree extraction tool.

53. A skid steer loader as claimed in claim 52 wherein said mounting means including a first mounting part fixed to said lower mast member and a second mounting part fixed to said link arms and mounted to said first mounting part for pivotal movement about a substantially horizontal axis and at least one hydraulic actuator for selectively pivoting the first part relative to said second part.

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