(12) UK Patent Application (19) GB (11) 2 439 302 (13) A

(43) Date of A Publication 27.12.2007

(21) Application No: 0619129.0

(22) Date of Filing: 29.09.2006

(30) Priority Data:
(31) 0612152 (32) 20.06.2006 (33) GB

(71) Applicant(s):
J.C.Bamford Excavators Limited
(Incorporated in the United Kingdom)
Rocester, UTTOXETER, Staffordshire,
ST14 5JP, United Kingdom

(72) Inventor(s):
Richard Francis Way
Mark Alan Carson

(74) Agent and/or Address for Service:
Forrester Ketley & Co
Chamberlain House, Paradise Place,
BIRMINGHAM, B3 3HP, United Kingdom

(51) INT CL:
B66F 9/065 (2006.01) ***B60T 8/32*** (2006.01)
B60T 13/38 (2006.01) ***B66F 9/075*** (2006.01)

(52) UK CL (Edition X):
B8H HFA H300 H402 H557
B8B BGA
F2E ENH
F2F FC F611 F686

(56) Documents Cited:
EP 0346292 A1 **DE 002128073 A1**
JP 2006044877 A **US 6047791 A**
US 4289442 A

(58) Field of Search:
INT CL **B66F**
Other: **WPI, EPODOC**

(54) Abstract Title: **Arm with ground engaging rolling member for a loading machine**

(57) A wheeled loading machine 10 includes a body 11 mounting a loading arm 25 and wheels 15 and 16, the loading arm 25 being mounted at a position 22 towards a rear of the machine for movement about a generally horizontal axis A and extending forwardly beside a cab 9 mounted at one side of the body, to an outermost end beyond the front of the body, where a loading implement 32 is provided, and the arm 25 being extendible and provided at its outermost end with at least one rolling member 27 which engages the ground when the loading arm 25 in a lowered position. The rolling member 27 may be one or more wheels and may be mounted on a carriage 28. A fitting may be provided at the rear of the body for a detachable counterweight 33. A non-reactive suspension system and a braking system are disclosed (figs 1a and 2).

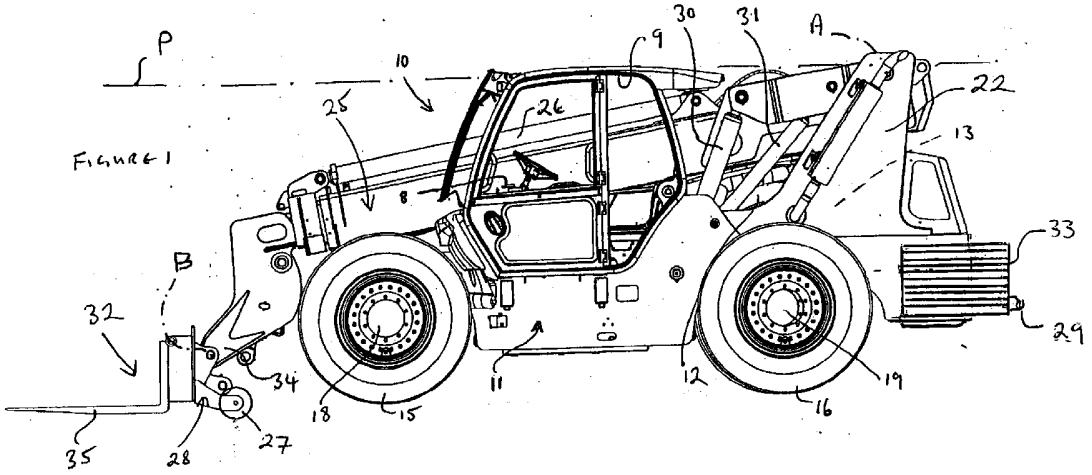

Figure 1

GB 2 439 302 A

Original Printed on Recycled Paper

1/4

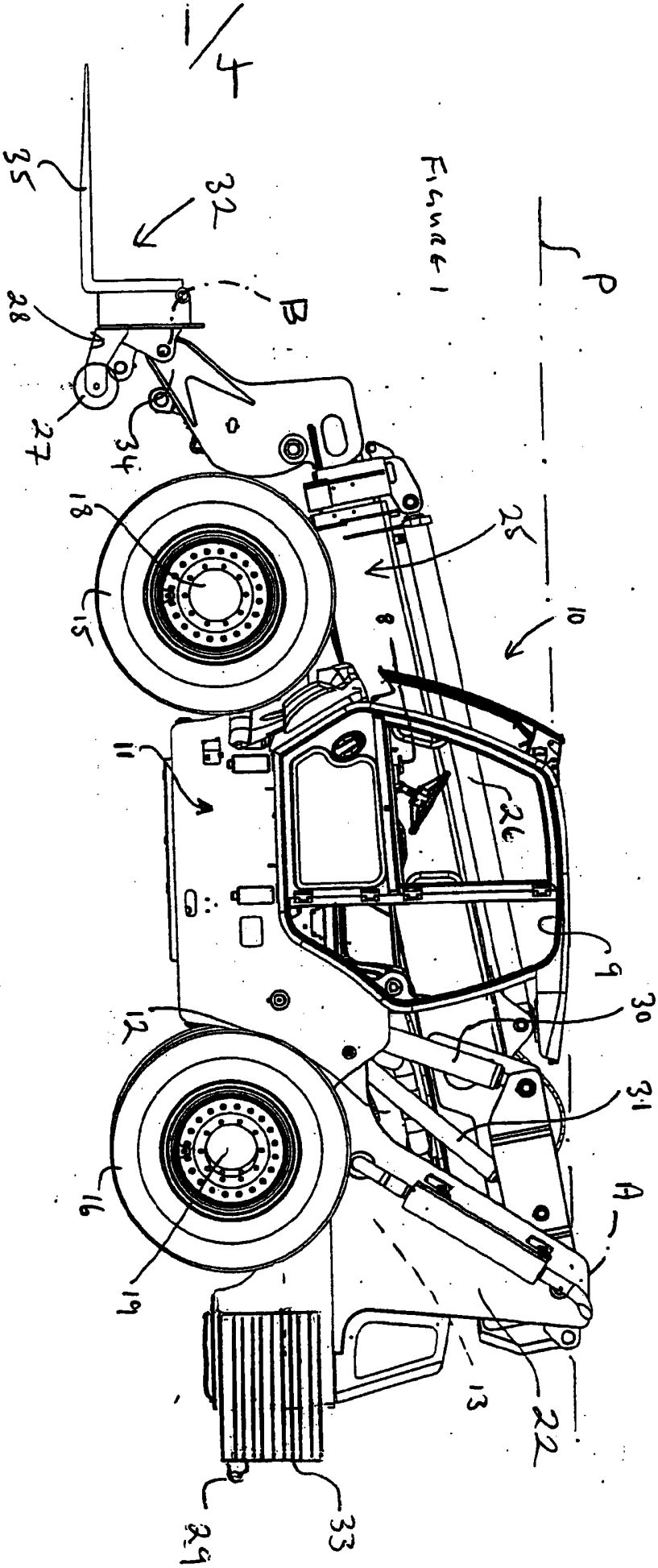

FIGURE 1

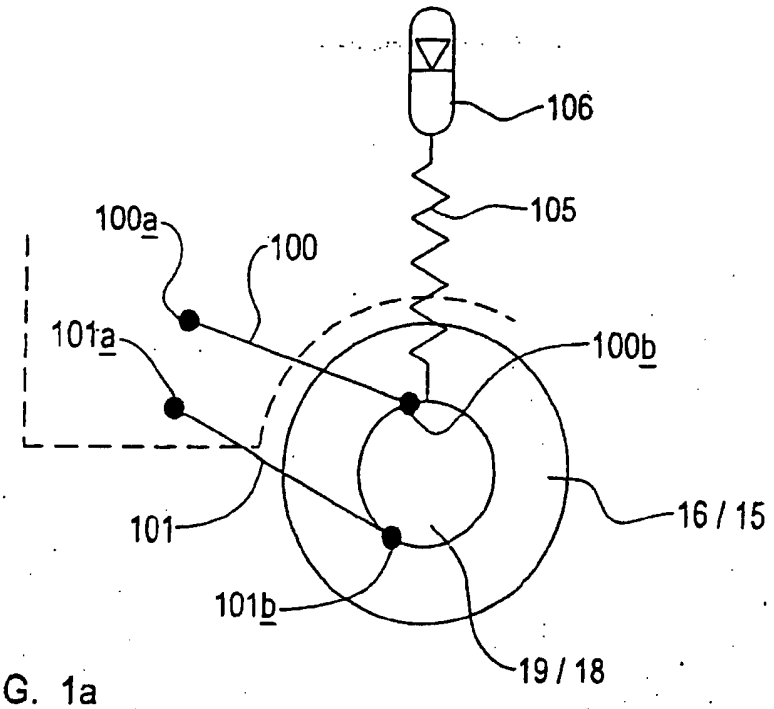

FIG. 1a

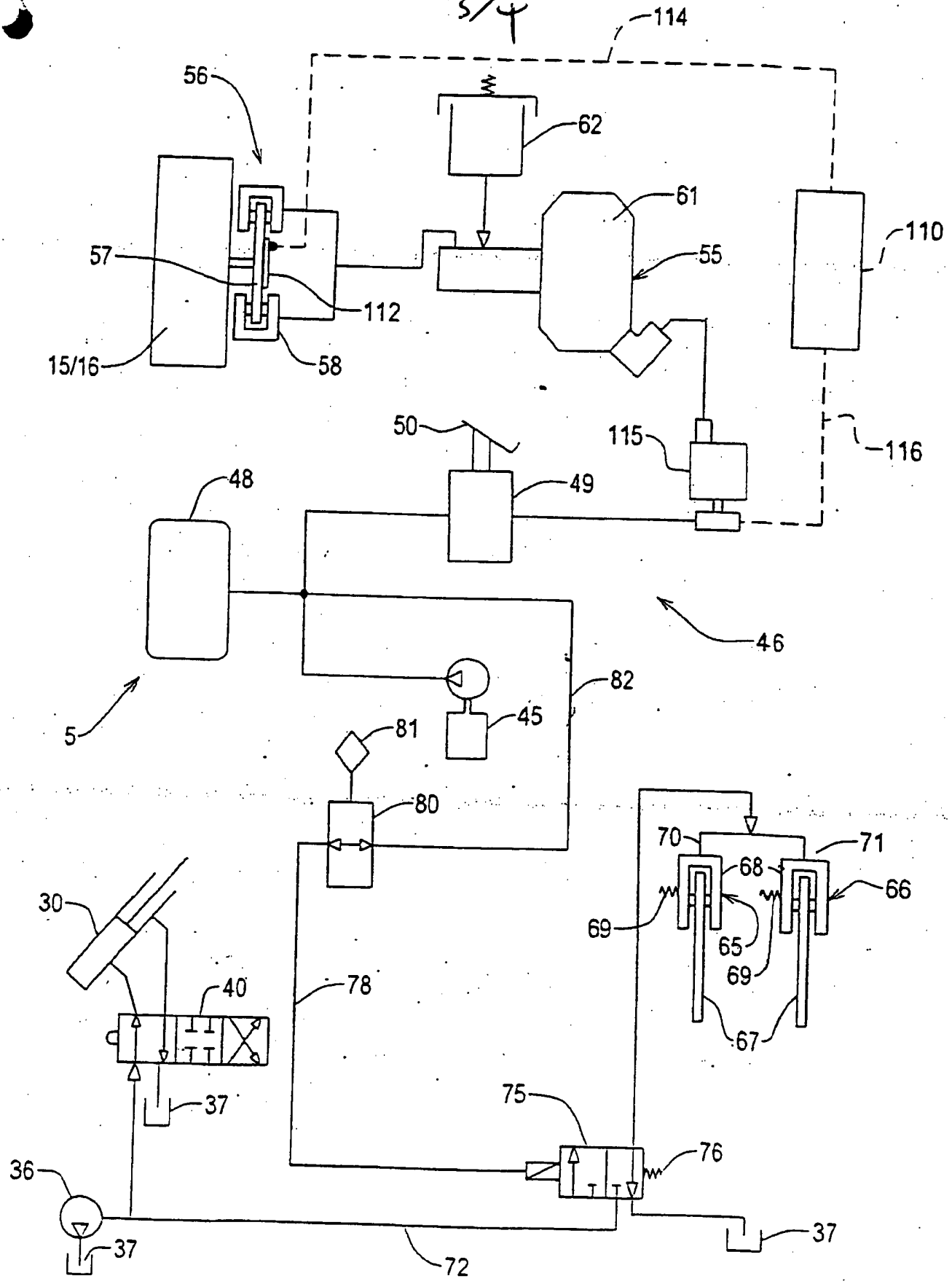
114
56
62
61
110
57
55
112
15/16
58
50
115
116
48
49
46
5
82
81
45
80
70
71
68
66
30
69
65
69
40
78
67
75
76
37
36
37
72
37

FIG. 2

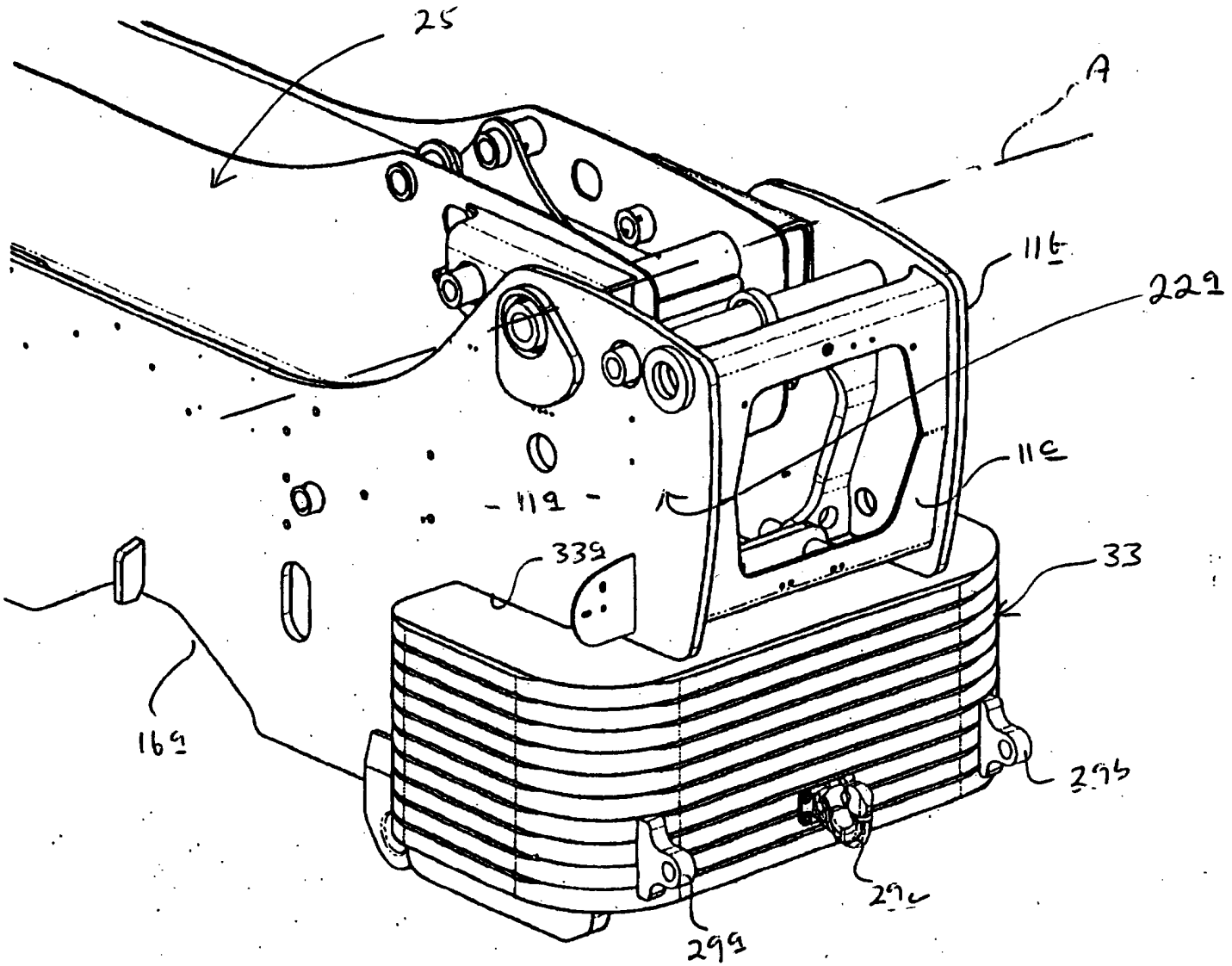

Figure 2

Title: Loading Machine

Description of Invention

This invention relates to a loading machine for performing loading operations and more particularly to a loading machine having a loading arm mounted at a position towards a rear of the machine and which extends forwardly.

Such machines conventionally may only be driven over the ground at relatively slow speeds, for example around 30 km per hour. Whereas this speed is adequate when such a machine is performing loading operations, it is overly slow for road travel, for example for driving the machine from one work location to another. Accordingly it is usual to transport such machines on a transporter vehicle between work locations. A machine for military use might be transported by a transporter vehicle such as a helicopter.

Machines which include a substantial counterweight to balance the load handled by the machine, can be over heavy for efficient transport, at least by air.

According to a first aspect of the invention we provide a wheeled loading machine including a body mounting a loading arm, a ground engaging structure including front and rear ground engaging wheels, the loading arm being mounted at a position towards a rear of the machine for up and down movement about a generally horizontal axis, and the loading arm extending forwardly beside a cab which is mounted at one side of the body, to an outermost end which is beyond a front of the body, where a loading implement is provided, and the arm being extendible to vary the length of the loading arm, and wherein at the outermost end of the loading arm there is provided at least

one ground engaging rolling member which engages the ground when the loading arm in a lowered position.

The provision of the ground engaging rolling member enables the machine to be used at least to a limited extent, with the loading arm extended and handling a heavy load, without requiring at least a large counterweight.

The loading implement provided at the outermost end of the loading arm, may be any desired kind of loading implement, such as a pair of forks, which may be provided on a carriage which is mounted at the outermost end of the loading arm.

The carriage may include the at least one ground engaging rolling member which most conveniently is one or more wheels, e.g. a pair of wheels on a spindle.

Desirably, to aid stability when the machine is performing loading operations, the body includes, at the rear end, a fitting for a counterweight e.g. at a low position, which counterweight when fitted to the body extends rearwardly of the body beyond the horizontal axis about which the loading arm is moveable. Desirably, the fitting enables the counterweight readily to be removed from the body. For one example, the fitting is a housing into which the counterweight may be fitted by sliding the counterweight into the housing, for example from a rear of the machine.

Particularly where the loading arm is extended to a great extent and/or when the loading arm is handling a heavy load, and the arm is in a lowered position, where maximum machine overturning forces are experienced, the provision of the at least one ground engaging rolling member may enable the machine to be operated to perform some loading and unloading operations without the counterweight fitted.

With the counterweight removed from the machine, the machine may be more readily transportable or drivable, to a work location at a destination, than a comparable machine with a fixed counterweight. The removed counterweight may be transported separately to the destination and fitted to the machine, or because of the provision of the ground engaging rolling member, the machine may perform some loading and unloading operations, without the counterweight fitted, or an alternative counterweight to that which was removed, may be fitted to the body of the machine at the destination.

The counterweight may include at least one formation, such as an eye formation or a hook, by means of which the counterweight may be handled by a lifting machine, to facilitate fitting and removing the counterweight from the body of the machine.

The front and rear wheels of the machine may be mounted on respective front the rear axles, and each axle may be suspended from the body by a respective suspension. Each of the ground engaging wheels may be drivable by an engine of the machine through a mechanical transmission, and the machine may include a braking system for braking each wheel, the braking system including a brake control system which provides a brake anti-locking function to resist any braked ground engaging wheel skidding relative to the ground as a result of becoming locked during braking when a low friction condition exists between the wheel and the ground.

A loading machine with a suspension and four wheel anti-locking brakes, may safely be driven at high speeds over the ground reducing the requirement for transporting the machine between work locations.

Whereas the engine could be mounted by the body at a side of the body opposite to the position of the cab, preferably the engine is mounted by the

body above the level of the rear axle and below a rear portion of the loading arm, so as to provide some counterweighting during loading operations, even where the counterweight may be removed, and to minimise the body width.

According to a second aspect of the invention we provide a method of operating a wheeled loading machine which includes a body mounting a loading arm, a ground engaging structure including front and rear ground engaging wheels, the loading arm being mounted at a position towards a rear of the machine for up and down movement about a generally horizontal axis, and the loading arm extending forwardly beside a cab which is mounted at one side of the body, to an outermost end which is beyond a front of the body, and the loading arm having at its outermost end a mounting for a loading implement and the arm being extendible to vary the length of the loading arm, and at the outermost end of the loading arm there is provided at least one ground engaging rolling member which engages the ground when the loading arm is in a lowered position, and the body includes, at the rear end, a fitting for a counterweight which enables the counterweight readily to be removed from the body, and the method including at a first work location, removing the counterweight from the body, transporting the machine with the counterweight removed, to a destination where further work operations are to be carried out using the machine, and one of

a) transporting the counterweight to the destination separately from the machine, and at the destination, fitting the counterweight to the machine and performing the further work operations, or

b) fitting an alternative counterweight to the body of the machine at the destination and performing the further work operations with the alternative counterweight fitted, or

c) operating the machine at the destination to perform the further work operations without any counterweight fitted to the fitting of the body, which further work operations include extending the loading arm and handling a load

with the load handling implement, with the ground engaging rolling member in contact with the ground.

Embodiments of the invention will now be described with the aid of the accompanying drawings in which:-

FIGURE 1 is a side illustrative view of a loading machine in accordance with the present invention;

FIGURE 1a is an illustrative view of part of the machine of figure 1, showing a non-reactive suspension;

FIGURE 2 is a schematic diagram of a braking system of the machine of figure 1;

FIGURE 3 is an illustrative perspective view of part of an alternative loading machine in accordance with the present invention.

Referring to figure 1 of the drawings there is shown a loading machine 10 which includes a body 11 including a housing 12 for an engine which provides power for the machine 10. The position of the engine is indicated at 13. The machine 10 further includes a ground engaging structure including a front pair of wheels 15 and a rear pair of wheels 16, the front pair of wheels 15 being carried on a front axle 18 and the rear pair of wheels 16 being carried on a rear axle 19.

Both pairs of wheels 15, 16 in this example are driven wheels, being driven by their respective axles 18, 19 from respective transmission members (not seen) of a mechanical machine transmission to which drive is provided from the engine 13. All four wheels 15, 16 are braked by a braking system.

The body 11 of the loading machine 10 mounts the engine 13 at or towards a rear end thereof.

In this example, the body 11 also includes at or towards the rear end thereof, a tower mounting structure 22 which includes a pair of plates between which is mounted a telescopic or otherwise extendible loading arm 25. The loading arm 25 is mounted by mounting structure 22 of the body 11, at an inboard end, for pivotal up and down movement about a first generally horizontal axis A, under the control of one or more hydraulically powered lifting actuators 30.

The loading arm 25 extends forwardly from its mounting 22, beyond a front end of the body 11 to an outermost end, where the loading arm 25 has a mounting 34 for a loading implement 32, which in this example is a loading device i.e. a pair of forks 35, carried on a carriage 28.

The loading implement 32 is pivotal relative to the loading arm 25 about a second generally horizontal axis B, by a hydraulically operated actuator (not shown).

The first horizontal axis A about which the loading arm 25 is moveable, is in this example, provided at a relatively high position, in a generally horizontal plane P which contains or is spaced above or at least close to an upper level of an operator's cab 9 where controls for operating the loading arm 25, and for driving the machine 10 over the ground, are located.

To aid stability when the machine 10 is performing loading operations, the body 11, at the rear end, is fitted with a counterweight 33 at a low position, which counterweight 33 extends rearwardly of the body 11 beyond the horizontal axis A about which the loading arm 25 is moveable. Whereas the engine 13 could in another example, be mounted by the body 11 at a side of the body 11 opposite to the position of the cab 9, in this example the engine 13 is mounted by the body 11 above the rear axle 19 and below a rear portion of the loading arm 25 where the arm 25 is mounted to the tower mounting

structure 22, so as to provide some additional counterweighting during loading operations, and to minimise the body width.

The operator's cab 9 is mounted at a side of the body 11 opposite to the loading arm 25 so that the loading arm 25 extends to the side of the cab 9.

The loading machine 10 is capable of high speed travel, for example well in excess of 30 km per hour.

To enable this, and referring now particularly to figure 1a, it can be seen that the rear axle 19 carrying the pair of rear wheels 16, is suspended from the body 11 of the machine 10, in this case by a non-reactive suspension.

At each side of the machine 10, the rear axle 19 is pivotally connected to a pair of links 100, 101, one of which i.e. the link indicated at 100, being above the other 101 relative to the ground, the links 100, 101 of each pair being pivotally connected at their one ends 100a; 101a relative to the body 11 and at their other ends 100b; 101b to the rear axle 19.

Damping struts 105, one at each side of the body 11, are provided to damp axle 19 movements, between the axle 19 and the body 11, the struts in this example being hydraulic devices (e.g. pistons within cylinders), with gas springs 106, but other damping strut arrangements are possible.

In figure 1a it can be seen that the links 100, 101 are leading links, i.e. they extend forwardly from the rear axle 19, but in another construction may be trailing links.

The front axle 18 is suspended from the body 11 by a non-reactive suspension substantially similar to that shown in figure 1a although the pivoted links 100, 101 at each side of the body 11, are preferably trailing links.

Although it is preferred for each of the front and rear axles 18, 19 to be suspended from the body 11 by a non-reactive suspension as described, other suspension arrangements are possible.

It will be appreciated that the counterweight 33 adds significant weight to the overall weight of the machine 10, and as can be seen from figure 1 of the drawings, the counterweight 33 necessarily is sizeable. Accordingly, although the counterweight 33 is desirable for stabilising the machine 10 when performing working operations, the counterweight 33, when the machine 10 is driven at high speed, can de-stabilise the machine 10, and reduce the high speed attainable.

In accordance with the present invention, the counterweight 33 is removable from the body 11 of the machine 10. In this example, the counterweight 33 is fitted to the body 11 by being received in a housing 33a, and from which housing 33a, the counterweight 33 is slidable rearwardly of the machine 10 for removal. The counterweight 33 includes an integral handling device 29 being in this example a towing eye, to facilitate removal of the counterweight 33, for example by a lifting machine such as another load handling machine, or another kind of lifting machine as required.

With the counterweight 33 removed, the machine 10 may be transported, e.g. by an aircraft such as a helicopter, and/or driven at high speed from one work location, to a desired destination. The counterweight 33 may be transported to the destination separately by a special transporting vehicle, e.g. another aircraft, such as a helicopter, although in order to benefit from the rapid transportation of the machine 10 to the destination, at the destination, an alternative counterweight 33 may be fitted which has been transported to the destination, or as described below, the machine 10 may be operated to perform at least some loading/unloading operations without any counterweight 33 fitted.

The carriage 28 of the loading device 35 includes a ground engaging rolling member which in this example is a pair of wheels 27 on a spindle, but may be one wheel 27 or wheels carried on their own axles, or rollers or any other rolling member, which when the loading arm 25 is in a lowered position as shown in figure 1, engages the ground. Particularly where the loading arm 25 is extended to a great extent and the arm 25 is in a lowered position, where maximum machine 10 overturning forces are experienced, the provision of the ground engaging rolling member 27 on the carriage 28, enables the machine 10 to be operated to perform at least some loading and unloading operations without any counterweight 33, because the overturning forces when the loading arm 25 is extended and/or a heavy load is being handled, are counter-balanced by the wheel or wheels 27 engaging the ground.

The loading arm 25 is in this example, extendible by the operation of a telescoping hydraulic actuator 26 which in this example is mounted exteriorly of the loading arm 25 along a top thereof but in another example may be mounted internally of the loading arm 25 as required. The loading arm 25 is a multi-stage arm 25, in this example a two or three stage telescoping arm 25. The machine 10 is capable of relatively low level loading work as described below. In another example, a three or more stage loading arm 25 could be provided where greater reach is required.

The loading machine 10 is capable for relatively low level loading at a work location. For example, the machine 10 may enter shipping containers to load and unload goods onto the backs of lorries for example. Thus the load is not lifted to great heights e.g. by fully extending the loading arm 25, but this extension is required to enable loads to be withdrawn from and placed inside containers for examples. By providing the carriage 28 with a ground engaging rolling member 27, the load carried by the lifting forks 35 may be supported on the ground at least when the arm 25 is lowered, and at maximum reach, whils

the arm 25 may be retracted to a length at which the machine 10, even without the presence of the counterweight 33 may counterbalance the load while it is lifted, provided the load is not too great. In this case, the engine 13 weight will effectively provide some counterbalancing of the load.

In the example, there is provided a double acting hydraulic actuator 31 between the loading arm 25 and the body 11 from each side of which fluid is displaceable depending upon whether the loading arm 25 is raised or lowered, which displaced fluid is fed to the hydraulic actuator which is provided to tilt the loading implement 32 about axis B, to maintain the attitude of the loading forks 35 during lifting and lowering.

Alternatively, self-levelling of the loading implement 32 may be achieved by other means.

Pressurised hydraulic fluid for powering the various hydraulic actuators 30 of the loading arm 25 and loading device 32 is provided by a hydraulic pump 36 (see figure 2) driven directly from the engine 13, the pump 36 pumping fluid from a reservoir 37 to a hydraulic system, fluid flow to the various actuators 30 being controlled by one or more hydraulic control valves 40 which may be manually or electrically operated as required. Thus a supply of pressurised hydraulic fluid is always available while the engine 13 is running.

The loading machine 10 further includes an air compressor 45 which may be driven from for example, an engine turbocharger, or otherwise from the engine 13 or from a motor. The air compressor 45 pressurises air in a pressurised air system 46, and particularly charges a reservoir 48, the pressurised air being usable as hereinafter described, by the braking system 5 for applying service brakes of the machine 10.

The pressurised air is delivered to an air valve 49 which is actuated by a brake pedal 50 which is located in the operator's cab 9. The proportion of air which is permitted to pass the valve 49 depends upon the extent to which the foot pedal 50 is depressed and thus the air pressure downstream of the valve 49 is representative of a brake demand. The further the pedal 50 is depressed, up to its full extent of depression when substantially all the air delivered to the air valve 40 may pass therethrough to apply full braking pressure, the more pressurised air is provided to air-hydraulic actuators, one of which is indicated at 55, for applying service brakes.

The ground engaging structure provides for each wheel 15, 16 in this example, a braking device 56 for applying braking to the wheel 15, 16, each braking device 56 being operated to apply the brake by hydraulic fluid pressurised by an air-hydraulic actuator 55. Each air-hydraulic actuator 55 may be operative to supply pressurised hydraulic fluid to one or a plurality of the braking devices 56.

In this example, each braking device 56 is a pad and disc type device including a rotatable member namely a disc 57, which rotates with the associated wheel 15, 16, and a braking member, i.e. a pad 58 (or pads) which is/are moveable into frictional engagement with the rotating disc 57 to effect braking, by hydraulic fluid acting for example through a "slave" piston and cylinder arrangement.

The air-hydraulic actuator 55 pressurises hydraulic fluid from a brake fluid reservoir 62, by means of an air powered servo 61 mechanism such that the hydraulic fluid pressure developed, and accordingly the extent of braking, depends upon the air pressure delivered from the pedal operated air valve 49. Thus the further an operator depresses the brake pedal 50, the greater the braking force applied by the braking device 56 to its associated wheel 15, 16, to match the brake demand.

The service brakes 56 preferably are released by mechanical springs when air pressure is no longer supplied to the air-hydraulic actuators 55, i.e. when the brake pedal 50 is released. The foot pedal 50 too may be returned to its uppermost, unbraking position, by a mechanical spring, although in each case some other brake return/pedal release mechanism may be provided as required.

In accordance with the present invention, the braking system 5 for the machine 10 further includes a brake control system including a controller 110 which provides a brake anti-locking function to resist any braked wheel 15, 16 skidding relative to the ground as a result of becoming locked during braking when a low friction condition exists between the wheel 15, 16 and the ground.

Thus the braking system 5 includes, for each braking device 56, a wheel speed sensor 112 to sense the rotational speed of each of the wheels 15, 16 and to provide an electrical signal input to the controller 110 along a line, one of which for the one wheel shown in figure 2, is indicated at 114.

Typically the wheel speed sensor 112 includes an annulus of teeth which rotate with the wheel 15, 16 e.g. with the rotatable brake disc 57, and an optical sensing device mounted with respect to a wheel hub, for sensing the teeth as they move past the device as the wheel, and hence as the annulus, rotates. The construction of such a wheel speed sensor 112 is well known and further description is considered unnecessary.

The controller 110 is configured to determine from the electrical signal inputs from the wheel speed sensors 112 of all or at least some of the wheels 15, 16, when the brakes are applied, whether any wheel is skidding, or is about to skid, relative to the ground as a result of becoming locked during braking when a low friction condition exists between the ground and the wheel.

This may be achieved by the controller 110 using an algorithm which compares wheel 15, 16 speeds as sensed, and makes calculations as is well known in the art of anti-lock braking technology.

In the event that a skidding or potential skidding condition is determined, the controller 110 is operative to modulate the hydraulic fluid pressure provided by the air-hydraulic actuator 55 which provides hydraulic fluid pressure to apply braking, to at least the skidding wheel 15, 16. Preferably though, such modulated hydraulic fluid pressure is supplied at least to both the wheels 15 or 16 on the axle 18, 19 on which a skidding or potentially skidding wheel is sensed, and more preferably, to all four wheels 15, 16 in the event that any one wheel 15, 16 is determined to be skidding or about to skid.

Typically, the controller 110 may modulate the hydraulic pressure provided to apply braking by cycling the hydraulic fluid pressure provided by the air - hydraulic actuator 55 or actuators, between a pressure reduction phase and a pressure increase phase although a cycle may also include a pressure hold phase between the pressure reduction and the pressure increase phases. In each case, by cycling releasing and applying the braking force applied to a wheel, steerability of the machine 10, even at high speeds may be maintained during braking without risk of loss of control.

Such modulation of the hydraulic fluid pressure is preferably achieved by modulating the brake demand pressurised air signal which is delivered from the foot pedal 50 valve 49. Thus the braking system 5 may include a single one, or possibly a plurality of modulating air pressure valves 115, which in accordance with an electrical control signal which passes along a line 116 from the controller 110 to the modulating air pressure valve 115, modulates the demand signal from the foot brake 50 valve 49, which is applied to the air-hydraulic actuator or actuators 55.

Where only a single modulating air pressure valve 115 is provided, this would vary the brake demand signal for all four wheels 15, 16, but where a plurality of such modulating air pressure valves 115 are provided, for example with each air pressure modulating valve 115 serving only one or two of the air-hydraulic actuators 55 for one or two of the braking devices 56 for one or two of the wheels 15, 16, this would permit the controller 110 to modulate the brake demand signal differently for e.g. for the front and the rear wheels 15, 16, if required.

In each case, the brake demand signal is only modulated to modulate the hydraulic fluid pressure applied to the braking device 56 or devices, when a skidding condition or potential skidding condition, is determined.

The machine 10 further includes a transmission brake for applying primarily when the machine 10 is parked, and particularly when no supply of pressurised air for the service brakes 56, may be available.

In this example, the machine 10 is four wheel driven and accordingly to achieve adequate transmission braking, two such transmission brakes, indicated at 65, 66 are provided.

Each transmission brake 65, 66 in this example, includes a disc 67 each of which is carried by a respective transmission member for the rear wheel 16 drive, and for the front wheel 15 drive. Also there is provided for frictionally engaging each disc 67, a pad, or pads 68 in this example. The pads 68 are urged towards and into engagement with their respective discs 67, by mechanical springs 69, and hence in their rest conditions, the transmission brakes are applied to brake the discs 67 and hence the transmission members.

However the transmission brakes 65, 66 are releasable by the application of pressurised hydraulic fluid to pressurised hydraulic fluid brake releasing devices 70, 71. By virtue of the transmission brake releasing devices 70, 71 being hydraulically releasable, notwithstanding that the springs 69 applying the brakes will be very strong springs in order to generate sufficient braking force to apply the transmission members 22, 23 adequately, the brake releasing devices 70, 71 may be made much smaller than comparable air operated units.

The pressurised hydraulic fluid for releasing the transmission brakes 65, 66 is derived from the hydraulic circuit of the machine 10, via a fluid feed line indicated at 72, the hydraulic fluid passing though a transmission brake control valve 75. The transmission brake control valve 75 is biased by a spring 76 towards a first operative condition as indicated in figure 2, in which the hydraulically operated brake releasing devices 70, 71 are each connected through the transmission brake control valve 75 to the reservoir 37 or another low pressure area, and so the devices 70, 71 will not act to release the transmission brakes 65, 66 which thus will be applied by the springs 69. In a second operative condition to which the valve 75 is moveable against the spring 76, pressurised hydraulic fluid from the supply line 72 may pass to the hydraulically operated brake releasing devices 70, 71 to release the brakes. 65, 66.

The transmission brake control valve 75 is moved to its second operative condition when the transmission brakes 65, 66 are released only when pressurised air is provided to the valve 75 along an air supply line indicated at 78, in response to operation of an operator transmission brake control valve 80 from within the cab 9. Desirably the transmission brake control valve 80 is hand operated by an operator actuating a brake release lever 81.

In this example, pressurised air for releasing the transmission brakes 65, 66 is derived from the air system 46 provided for applying the service brakes 56. Thus pressurised air may be delivered from the air system 46 along a line 82 to the transmission brake control valve 80.

It will be appreciated that in the event of a failure in the air system, or when the pressure in the air system 46 deliberately is released, e.g. when it desired to park the machine 10 for long periods, no pressurised air will be available to move the transmission brake control valve 75 against its spring 76 to its second operative condition and thus the transmission brakes 65, 66 will remain or be applied. This provides for a fail safe feature in that braking from the transmission brakes 65, 66 will always be available.

Similarly in the event of any failure of the hydraulic pump 36, there will be no pressurised hydraulic fluid available actually to release the transmission brakes 65, 66. Thus the use of the pressurised air actuated transmission brake control valve 75 results in the transmission brakes 65, 66 being applied in the event of either of both air system 50 or hydraulic pressure failures.

In another example the transmission brakes 65, 66 need not be of the disc and pad type, but the invention may be applied to another kind of friction brake, such as drum and calliper, where the transmission member may carry a drum, or further alternatively, the transmission brake or brakes 65, 66 may each be a multi-interleaved plate type brake.

Pressurised air for actuating the transmission brake control valve 75 may be derived from other than the service brake air system 46, for example from a dedicated air source.

Pressurised hydraulic fluid for releasing the transmission brake control valve 75 may be derived from other than the hydraulic system of the machine 10

which includes actuator 30 and control valve 40 for operating the loading arm 25 of the machine, for example from a dedicated pressurised hydraulic fluid supply.

The transmission brake or brakes 65, 66 may be applied by hydraulic fluid pressure, as well as released by hydraulic fluid pressure by operation of the air actuated transmission brake control valve 75.

Various other modifications are possible without departing from the scope of the present invention.

For example, referring to figure 3, a view from the rear of part of an alternative embodiment of the present invention is shown. Similar parts to those of the loading machine of figure 1 are indicated by the same references.

In this embodiment, instead of a tower frame structure 22 to mount the loading arm 25 at a relatively high position of the body 11 for pivotal movement about its horizontal pivot axis A, the loading arm 25 is provided at a lower position of the body 11 of the machine 10, not so significantly above the rear wheels 16 of the machine 10 (the wheel well 16a for the rear wheel 16 being indicated in figure 2), but mounted still by a mounting structure 22a between a pair of body plates 11a, 11b.

It can be seen that at a rearmost position, the body plates 11a, 11b, and a rear cross-plate 11c, together provide a rearwardly opening housing 33a for fitting the counterweight 33. The counterweight 33 may be slid in and out of the housing 33a from the rear, for example, by a lifting machine such as another loading machine. The counterweight 33 includes a pair of laterally-of-the-machine 10 spaced eye formations 29a, 29b fixed to the counterweight 33 proper by fastenings or even by welding, and a central towing hook or eye 29c is also provided, again which is fixed to the counterweight 33 proper.

The eye formations 29a, 29b and the hook or eye 29c facilitate handling of the counterweight 33 by a suitable lifting machine for fitting and removing the counterweight 33.

To lighten the loading machine 10 for more convenient and efficient transportation, the counterweight 33 may be removed from its housing 33a and either the removed counterweight may be transported separately to, or an alternative counterweight 33 fitted at, a destination to which the machine 10 is transported, or the machine 10 may be operated without any counterweight 33, in which case the ground engaging wheels 27 or other ground engaging rolling members provided on the carriage 32 at the free end of the loading arm 25 may support the outbound end of the loading arm 25 on the ground to counterbalance overturning forces, whilst the arm 25 is handling heavy loads and/or greatly extended.

In each embodiment described, a retaining device may be provided positively to lock the counterweight 33 in its housing 33a or otherwise to the body 11 of the machine 10 where fitted, to prevent the counterweight 33 inadvertently being removed. For example a simple interference locking pin may be provided, or within the housing 33a for the counterweight, a mechanical or power released latch may be provided which retains the counterweight until released.

In another embodiment, instead of the counterweight 33 being received in a housing 33a provided by the body 11 of the machine, the counterweight may otherwise be fitted to and removeable from the body 11.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for

attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A wheeled loading machine including a body mounting a loading arm, a ground engaging structure including front and rear ground engaging wheels, the loading arm being mounted at a position towards a rear of the machine for up and down movement about a generally horizontal axis, and the loading arm extending forwardly beside a cab which is mounted at one side of the body, to an outermost end which is beyond a front of the body, where a loading implement is provided, and the arm being extendible to vary the length of the loading arm, and wherein at the outermost end of the loading arm there is provided at least one ground engaging rolling member which engages the ground when the loading arm in a lowered position.

2. A machine according to claim 1 wherein the loading implement is provided at the outermost end of the loading arm on a carriage which is mounted at the outermost end of the loading arm.

3. A machine according to claim 2 wherein the carriage includes the at least one ground engaging rolling member.

4. A machine according to any one of the preceding claims wherein the at least one ground engaging rolling member is one or more wheels.

5. A machine according to any one of the preceding claims wherein the body includes, at the rear end, a fitting for a counterweight.

6. A machine according to claim 5 wherein the counterweight when fitted to the body, is at a low position and extends rearwardly of the body beyond the horizontal axis about which the loading arm is moveable.

7. A machine according to claim 5 or claim 6 wherein the fitting enables the counterweight readily to be removed from the body.

8. A machine according to claim 7 wherein the fitting is a housing into which the counterweight may be fitted by sliding the counterweight into the housing.

9. A machine according to claim 7 or claim 8 wherein the counterweight includes at least one formation by means of which the counterweight may be handled by a lifting machine, to facilitate fitting and removing the counterweight from the body of the machine.

10. A machine according to any one of the preceding claims wherein the engine is mounted by the body above the level of the rear axle and below a rear portion of the loading arm.

11. A loading machine substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

12. A method of operating a wheeled loading machine which includes a body mounting a loading arm, a ground engaging structure including front and rear ground engaging wheels, the loading arm being mounted at a position towards a rear of the machine for up and down movement about a generally horizontal axis, and the loading arm extending forwardly beside a cab which is mounted at one side of the body, to an outermost end which is beyond a front of the body, and the loading arm having at its outermost end a mounting for a loading implement and the arm being extendible to vary the length of the loading arm, and at the outermost end of the loading arm there is provided at least one ground engaging rolling member which engages the ground when the loading arm is in a lowered position, and the body includes, at the rear end, a fitting for a counterweight which enables the counterweight readily to be removed from the body, and the method including at a first work location, removing the counterweight from the body, transporting the machine with the

counterweight removed, to a destination where further work operations are to be carried out using the machine, and one of

a) transporting the counterweight to the destination separately from the machine, and at the destination, fitting the counterweight to the machine and performing the further work operations, or

b) fitting an alternative counterweight to the body of the machine at the destination and performing the further work operations with the alternative counterweight fitted, or

c) operating the machine at the destination to perform the further work operations without any counterweight fitted to the fitting of the body, which further work operations include extending the loading arm and handling a load with the load handling implement, with the ground engaging rolling member in contact with the ground.

13. A method of operating a wheeled loader substantially as hereinbefore described with reference to the accompanying drawings.

14. Any novel feature or novel combination of features described herein and/or as shown in the accompanying drawings.

The Patent Office

For innovation

23

Application No:	GB0619129.0	**Examiner:**	Mr Karl Whitfield
Claims searched:	1-10 & 12	**Date of search:**	26 January 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X,Y	X: 1-4, 10 & 12, Y: 5-9	EP0346292 A1 (MANITOU) roller 13
X,Y	X: 1-4, 10 & 12, Y: 5-9	US4289442 A (STEVENS) roller 64
X,Y	X: 1-4, 10 & 12, Y: 5-9	DE2128073 A1 (HFM) roller 43
X,Y	X: 1-4, 10 & 12, Y: 5-9	JP2006044877 A (HITACH) wheel 25
Y	5-9	US6047791 A (HOEBELHEINRICH) figs 2-7

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

B66F

The following online and other databases have been used in the preparation of this search report

WPI, EPODOC