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Description

The present invention is a novel vehicle which combines the functions of excavator and loader and displays important advantages over prior vehicles of this general type.

A number of vehicles are available which are described variously as excavator/loaders, digger/loaders or backhoe/ loaders and which are designed to perform two main functions. Firstly, an articulated arm at one end of the vehicle, usually the rear, carries a bucket designed to dig below ground level and thereby excavate a trench or hole. This excavator bucket is normally narrower than the overall width of the vehicle and digs back towards the vehicle. Secondly, the vehicle carries, usually at its front end, a loading bucket for lifting excavated material from ground level upwards into lorries for transport away from the excavation site. The loader bucket is usually at least as wide as the vehicle. Vehicles are also available which perform only one of these functions, or which perform a second function by the provision of special secondary attachments.

A major difficulty in designing vehicles of this general type is that of providing adequate counter-balancing to balance the effect of the respective operating bucket under load. Thus the unbalancing moment of a full loader bucket at the end of the loader arm has to be off-set by a considerable weight rearward of the adjacent vehicle wheels, especially when the loader is operating on a sloping site and/or at the limits of its reach. This weight must either take the form of heavy ballast built into the vehicle or be provided by the weight of a digger arm and bucket fitted to the other end of the vehicle. This normally means that either the vehicle carries undesirable excess weight in its design or the two functions must be performed at opposite ends of the vehicle.

A typical such prior dual-function vehicle is described in UK Patent Specification GB-A-2040260. That vehicle has a loader unit at one end and an excavator (back-hoe) unit at the other. To stabilise the vehicle during movement between operating locations, the back-hoe unit is designed to adopt an inwardly-inclined position when not in use, US Patent Specification US-A-4273502 describes a latch mechanism for locking such an inwardly-inclined back-hoe boom during transport.

A significant disadvantage of such prior excavator/loaders is that, since the two functions are performed separately at opposite ends of the vehicle, seating and controls have to be provided for the operator facing each end of the vehicle as desired. Such duplication adds to both the cost and dimensions of the vehicle.

An alternative approach is described in US Patent Specification US-A-3892322, which shows a vehicle to which a backhoe assembly may, be detachably secured and which also carries a scraper blade. When the scraper blade is to be used, the backhoe boom is swung sideways and rearwardly into a position in which interference between the two functions is reduced. US-A-3712490 also describes a detachable backhoe assembly, the arm of which may adopt a rearward inclination for transport purposes.

In German Published Patent Application DE-A-3331516, an excavator/loader is illustrated in which both functions are carried out at the same end of the machine. In order to achieve this result, the operating jib is formed in three sections, described respectively as a pre-jib, a main jib and an arm. When the machine is to function as a loader, the main jib and the arm are set essentially at right angles to each other and remain in that position throughout the loading operation. When the machine is to function as an excavator, the pre-jib and the main jib are set in approximate relative alignment and remain in that position throughout the excavating operation. Controls are provided to achieve the relative movements of the three jib sections, as well as the movement of the jib overall relative to the turntable upon which it is mounted and the movement of the operating bucket relative to the jib.

It is an object of the present invention to provide an improved excavator/loader in which both functions are performed at the same end of the vehicle, which nonetheless is stable in both modes of operation and which is of more simple design, and is therefore easier to operate and maintain, than prior forms of excavator/loader.

The excavator/loader according to the present invention comprises a mobile chassis having a ground-contacting area defined by wheels or tracks, a first generally horizontal pivot upon said chassis, an articulated operating arm having only two sections, a first arm section pivoted at a first end thereof about said first pivot for pivotal movement between an outer position in which said first arm section extends away from said ground-contacting area and an inner position (the "stowed" position) in which said first arm section is inclined generally inwardly with respect to said ground-contacting area, a second generally horizontal pivot at the second end of said first arm section and a second arm section pivoted at a first end thereof about said second pivot, and is characterised in that said first pivot lies in the region of one end of said ground-contacting area, that, when the first arm section is in its inner position, the second pivot lies above said ground-contacting area, and that means are provided at the second end of said second arm section for interchangeably attaching to said arm section a loader bucket and an excavator bucket, whereby the vehicle may function as a loader when the first arm section is in its inner position and as an excavator when the first arm section is in its outer position.

By virtue of the above-defined features, the vehicle of the present invention is able to function, in a stable manner, as either a loader or an excavator without requiring a third arm section such as that described in DE-A-3331516. The duplication of controls associated with prior art vehicles having the two functions at opposite

ends is rendered unnecessary. The locating of the first arm section as specified during the loading operation reduces or removes the need for counter-balance weighting in the vehicle. In spite of its diversity, the excavator/loader is a relatively simple vehicle.

The point at which the first arm section is pivoted to the vehicle (that is, the first pivot point) depends upon other features of the overall design but it is located in the region of one end (the "front" end) of the wheel-base or of a ground-contacting area defined by tracks on which the vehicle may be mounted. It is about this pivot point that the arm operates when in its excavating mode. For example, when the vehicle is wheel-mounted, the first pivot point preferably lies in the region of the axis of the front wheels or slightly forward or rearward thereof.

The first pivot point is preferably set low on the vehicle. Thus, for example, in the case of a wheel-mounted vehicle, the first pivot point preferably lies below the height of the upper circumference of the front wheels of the vehicle. When the overall geometry does not allow the pivot point to be set between the front wheels or in the corresponding position in the case of a track-laying vehicle, as for example when the operating arm is rounded upon a turn-table, then the pivot point may be set somewhat forward of that position, for example low on an overhanging forward extension of the chassis.

The mounting of the first pivot point is such as to allow pivoting about a horizontal axis, to permit the excavating function to be carried out and also to enable the first arm section to be stowed. In addition, it is advantageous to provide for pivoting of the arm about a vertical axis, to allow the vehicle to excavate to at least a limited extent generally sideways of the vehicle. The mounting at the first pivot point may therefore comprise two separate pivots, of which it is preferred that the vertical-axis pivot is towards the rear.

If desired, the first pivot point may be so mounted as to be displaceable laterally relative to the length of the vehicle so that the latter may more effectively operate close to an obstruction when in its excavating mode. This may be achieved by mounting the pivot point upon a laterally displaceable carriage or bracket or, less conveniently, upon a turntable.

In the stowed position of the first arm section, the point at which the latter is pivoted to the second arm section (hereinafter referred to as the second pivot point) lies above or rearward of the first pivot point. In order not unduly to limit the outreach of the arm in its loading function, the second pivot point preferably lies at most only a short distance, measured in a horizontal direction, behind the first pivot point. For example, the horizontal distance may be of the general order of about 25 per cent of the length of the wheelbase or other ground-contacting area of the vehicle. Thus, in its stowed position, the first arm section may be vertical or more preferably may have a rearward orientation, inclined to the vertical by an angle of the order of 5 to 45 degrees, e.g. 20 to 40 degrees, although the angle may be greater if desired.

The first arm section may be lockable in its stowed position, but need not be so. For example, an electrical, hydraulic or mechanical locking device may be provided so that, when the vehicle is being used in its loading mode, the operating lever which controls the pivoting of the first arm section, or a ram which brings about that pivoting, is rendered inoperative.

To gain the maximum benefit of the vehicle of the present invention, it is desirable that the bucket be of a quick-release variety in order that, when the operator changes from an excavating to a digging operation or vice versa, a bucket appropriate to the relevant operation can rapidly be fitted. Thus the attachment fitting may be of a type which permits a quick interchange by conventional manual methods, for example of the nut-and-bolt type. Alternatively, an attachment mechanism of the claw type, optionally operable by the operator without descending from the vehicle, may be preferred.

The stability of the vehicle, especially in the excavating mode, may be enhanced by the provision of outriggers or other ground-contacting stabilisers, which may be used merely to brace the vehicle against the ground or may, by jacking, lift two or all of the wheels clear of the ground. Manoeuvrability of the vehicle may be enhanced by providing a skid-steer drive arrangement.

The invention will now be further described with reference to the accompanying drawings, in which:-

Fig. 1 is an elevation from the side of one form of excavator/loader according to the present invention; and

Fig. 2 is a plan view of the excavator/loader of Fig. 1.

More specifically, in Fig. 1 the excavator/loader is illustrated with the vehicle in loading mode shown in full line and with the excavating mode operation shown in chain-dotted line. In Fig. 2, the excavator/loader is shown in excavator mode and with outriggers and stabiliser extended.

The illustrated embodiment is a particularly compact form of the invention. The vehicle has a wheelbase (that is, the horizontal distance between front and rear axles) of about 1.3 metres and an overall maximum dimension, with the operating arm and bucket retracted, of less than 3 metres.

The illustrated vehicle has front wheels 3, 3 and rear wheels 4, 4 and carries a single, forward-facing seat 5 for the operator.

The operating arm consists of a first arm section 6, pivoted about a horizontal pivot 7 which in turn is linked to the vehicle body about a vertical pivot 8, and a second arm section 9, pivoted at 10 to the outer end of the first arm section 6. The vertical pivot 8 lies about 0.2 metres to the rear of the axis of rotation of the front wheels 3, 3 and the horizontal pivot 7 lies approximately in line with that axis.

At the outer end of second arm section 9, a

bucket (11 or 12) appropriate to the operating mode is carried. The bucket 11 is the loading bucket and the bucket 12, mounted the opposite way round from bucket 11, is the excavating bucket. Each bucket is secured to the arm at just two mounting points (as viewed from the side), namely a pivot mounting 13 and a control link mounting 14, by means of which latter the tipping action is transmitted to each bucket. Alternatively, the mounting points 13 and 14 may support an intermediate carrier plate on the end of the operating arm, the alternative buckets then being detachably secured on the carrier plate by a quick-release mounting.

Operation of the arm and bucket is effected by means of four double-acting hydraulic rams. A first ram 15 controls the pivoting of the first arm second 6 about the first pivot point 7; a pair of rams 16, 16. effect relative pivoting of the arm sections about the second pivot point 10; a fourth ram 17 controls the bucket tipping.

The excavator/loader is also provided with outriggers 18, 18 and a rear stabiliser 19, which may be lowered into contact with the ground to give increased stability of operation of the vehicle in the excavating mode.

As is most clearly shown in Fig. 1, the vehicle may function as a conventional excavator (the chain-dotted feature) by operation of the four rams as desired. However, the design is such that, by operation of the ram 15, the first arm section 6 may be swung upwards and backwards until the pivot point 10 is in the position illustrated in full line, in which position the pivot point 10 lies about 0.3 metres to the rear of pivot point 8. With the first arm section 6 in this position, where it is inclined backwards at an angle of the order of 30 degrees to 40 degrees to the vertical, the vehicle may be used as a conventional loader, by operation of the rams 16 and 17 only.

Thus the vehicle of the present invention is a true excavator/loader, in which the two primary functions may be carried out using a single set of controls by an operator in a single forward-facing seat.

Claims

1. A vehicle which can function alternatively as a loader and as an excavator and which comprises a mobile chassis having a ground-contacting area defined by wheels (3, 4) or tracks, a first generally horizontal pivot (7) upon said chassis, an articulated operating arm having only two sections, a first arm section (6) pivoted at a first end thereof about said first pivot (7) for pivotal movement between an outer position in which said first arm section (6) extends away from said ground-contacting area and an inner position in which said first arm section (6) is inclined generally inwardly with respect to said ground-contacting area, a second generally horizontal pivot (10) at the second end of said first arm section (6) and a second arm section (9) pivoted at a first end thereof about said second pivot (10), characterised in that said first pivot (7) lies in the region of one end of said ground-contacting area, that, when the first arm section (6) is in its inner position the second pivot (10) lies above said ground-contacting area, and that means (13, 14) are provided at the second end of said second arm section (9) for interchangeably attaching to said arm section a loader bucket (11) and an excavator bucket (12), whereby the vehicle may function as a loader when the first arm section (9) is in its inner position and as an excavator when the first arm section is in its outer position.

2. A vehicle according to claim 1, characterised in that, in said inner position of said first arm section (6), the latter is inclined at an angle to the vertical of from 5 to 45 degrees.

3. A vehicle according to claim 1 or claim 2, characterised in that, in said inner position of said first arm section (6), the distance apart of the two pivots (7, 10), measured in a horizontal direction, is about 25 per cent of the length of the ground-contacting area of the vehicle.

4. A vehicle according to any of the preceding claims, characterised in that the first arm section (6) is lockable in its inner position.

5. A vehicle according to any of the preceding claims, characterised in that it is wheel-mounted and in that said first pivot (7) lies below the height of the upper circumference of the wheels (3, 4) thereof.

6. A vehicle according to any of The preceding claims, characterised in that said first arm section is mounted upon both a generally horizontal pivot (7) and a generally vertical pivot (8).

7. A vehicle according to any of the preceding claims, characterised in that said generally horizontal pivot (7) is laterally displaceable relative to the length of said chassis.

Patentansprüche

1. Fahrzeug, wahlweise als Lader oder Bagger einsetzbar, mit einem Fahrgestell, dessen Bodenberührungsfläche durch Räder (3, 4) oder Raupen definiert ist. einem ersten im wesentlichen horizontalen Drehbolzen(7) am Fahrgestell einem beweglichen nur aus zwei Abschnitten bestehenden Ausleger- oder Arbeitsarm, von denen ein erster Ausleger-Abschnitt (6) mit einem ersten Ende am ersten Drehbolzen (7) zwecks Bewegung einer außerhalb des Bereichs der Bodenberührungsfläche liegenden Stellung und einer innerhalb dieses Bereichs und in bezug auf die Bodenberührungsfläche nach innen geneigten Stellung bewegbar ist, mit einem zweiten im wesentlichen horizontalen Drehbolzen (10) am zweiten Ende des ersten Ausleger-Abschnitts (6) und einem zweiten Ausleger-Abschnitt (9) dessen erstes Ende drehbeweglich mit dem zweiten Drehbolzen (10) verbunden ist, dadurch gekennzeichnet daß der erste Drehbolzen im Bereich eines Endes der Bodenberührungsfläche liegt, derart. daß in der nach innen geneigten Stellung des ersten Ausleger-Abschnitts (6) der zweite Drehbolzen (10) oberhalb der Bodenberührungsfläche liegt, und

daß am zweiten Ende des zweiten Ausleger-Abschnitts (9) Mittel (13, 14) zur wahlweisen Aufnahme einer Ladeschaufel (11) und einer Baggerschaufel (12) vorgesehen sind derart, daß das Fahrzeug in der Innenlage des ersten Ausleger-Abschnitts (9) als Lader und in der Außen- oder Ausleger-stellung des ersten Ausleger-Abschnitts als Bagger arbeitet.

2. Fahrzeug nach Anspruch 1, dadurch gekennzeichnet, daß in der Innenlage des ersten Ausleger-Abschnitts (6) dieser in bezug auf die Lotrechte unter einem Winkel von 5° bis 45° geneigt ist.

3. Fahrzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß in der Innenlage des ersten Ausleger-Abschnitts (6) der Abstand zwischen den beiden Drehbolzen (7 und 10) in der Waagerechten etwa 25 Prozent der Länge der Bodenberührungsfläche des Fahrzeugs beträgt.

4. Fahrzeug nach einem der vorhergehenden Ansprüche. dadurch gekennzeichnet. daß der erste Ausleger-Abschnitt (6) in seiner Innenlage arretierbar ist.

5. Fahrzeug nach einem der vorhergehenden Ansprüche. dadurch gekennzeichnet. daß das Fahrwerk Räder (3, 4) aufweist und daß der erste Drehbolzen (7) tiefer liegt als der höchste Punkt am Umfang der Räder (3. 4).

6. Fahrzeug nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der erste Ausleger-Abschnitt auf einem im wesentlichen horizontalen Drehbolzen (7) und auf einem im wesentlichen vertikalen Drehbolzen (8) gelagert ist.

7. Fahrzeug nach einem der vorhergehenden Ansprüche. dadurch gekennzeichnet daß der im wesentlichen horizontale Drehbolzen (7) relativ zur Länge des Fahrgestells verschieblich angeordnet ist.

Revendications

1. Engin pouvant fonctionner soit comme chargeuse, soit comme excavatrice, du genre composé d'un châssis mobile présentant une zone de contact avec le sol définie par des roues (3, 4) ou des chenilles et équipé d'un premier pivot (7) généralement horizontal, d'une flèche articulée comportant deux sections seulement, la première section (6) étant articulée par sa première extrémité autour dudit pivot (7) entre une position d'extension, dans laquelle elle s'écarte de la zone de contact de l'engin avec le sol, et une position repliée dans laquelle elle est inclinée généralement vers l'intérieur par rapport à ladite zone de contact avec le sol, d'un deuxième pivot (10) généralement horizontal situé à la deuxième extrémité de ladite première section (6) de la flèche et d'une deuxième section (9) articulée par sa première sur ledit deuxième pivot (10), caractérisé en ce que ledit pivot (7) se trouve au voisinage d'une des extrémités de ladite zone de contact avec le sol, en ce que lorsque la première section (6) de la flèche se trouve dans sa position repliée vers l'intérieur, le deuxième pivot (10) se trouve au-dessus de ladite zone de contact avec le sol, et en ce que des moyens (13, 14) sont prévus à la deuxième extrémité de la deuxième section (9) de la flèche pour y fixer de manière interchangeable un godet de chargement (11) et un godet de creusement (12), l'engin pouvant fonctionner comme chargeuse quand la première section (6) de la flèche occupe sa position repliée, et comme excavatrice quand la première section de la flèche se trouve dans sa position d'extension vers l'extérieur.

2. Engin suivant la revendication 1, caractérisé en ce que, dans la position repliée de ladite première section (6) de la flèche, celle-ci forme avec la verticale un angle compris entre 5 et 45°.

3. Engin suivant l'une quelconque des revendications 1 ou 2, caractérisè en ce que, dans la position repliée de ladite première section (6) de la flèche, la distance horizontale entre les deux pivots (7, 10) est égale à environ 25 % de la longueur de la zone de contact de l'engin avec le sol.

4. Engin suivant l'une quelconque des revendications précédentes, caractérise en ce que la première section (6) de la flèche est verrouillable dans sa position repliée.

5. Engin suivant l'une quelconque des revendications précédentes, caractérisé en ce qu'il est monté sur roues et en ce que ledit premier pivot (7) est situé plus bas que la partie supérieure de la circonférence des roues (3, 4).

6. Engin suivant l'une quelconque des revendications précédentes, caractérisé en ce que ladite première section de la flèche est articulée à la fois sur un pivot généralement horizontal (7) et un pivot généralement vertical (8).

7. Engin suivant l'une quelconque des revendications précédentes, caractérisé en ce que ledit pivot généralement horizontal (7) peut se déplacer latéralement par rapport à la longueur dudit châssis.

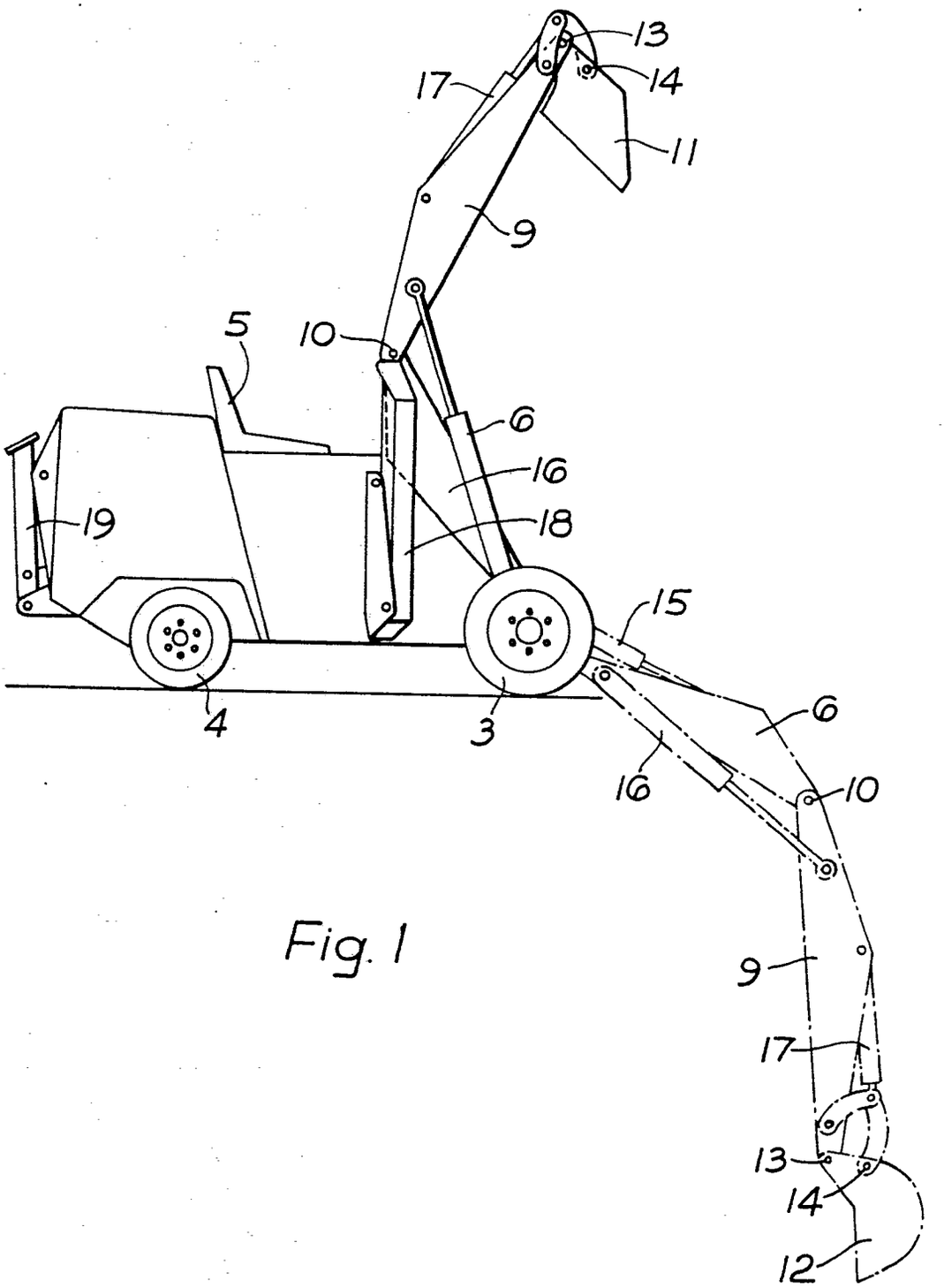


Fig. 1

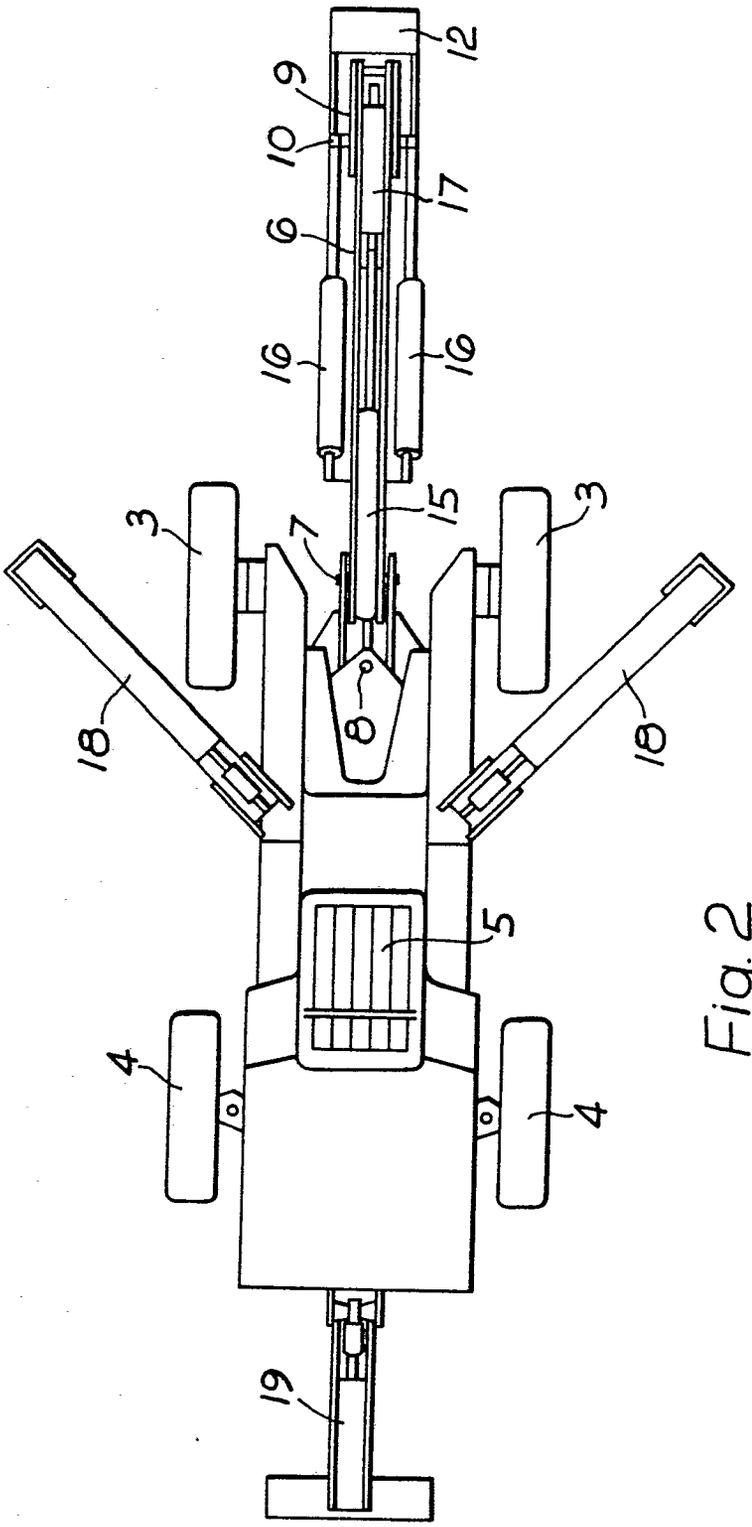


Fig. 2