SPECIFICATION

Recovery vehicle

This invention relates to a recovery vehicle and in particular to a recovery vehicle for medium and heavy duty work, that is which is capable of recovering heavy trucks and other vehicles which have become immobilised.

There are several different types of medium to heavy recovery vehicles at present available and these normally have two or three axles with four or six wheel drive. Various vehicle manufacturers such as Scania, Scammell, Volvo, AEC and Fodens all produce suitable chassis fitted with engines and cabs on which the necessary recovery equipment is fitted. One of the most suitable sets of recovery equipment is known as the EKA D2030 equipment which has been fitted in the past to most of the above vehicles. The equipment is sometimes known as a "top hamper" and comprises a main boom pivotally connected at one end, about a horizontal axis, to a sub-chassis mounted on the vehicle, the pivot being located between the cab of the vehicle and the rear axle or the foremost rear axle if two are provided, the main boom being movable between a horizontal stowage position and a raised lifting or suspended towing position by means of one or more hydraulic rams extending between the frame of the vehicle and the main boom. At its rear end, the main boom is kinked downwardly to extend almost to ground level when the main boom is in its stowed position and to the lower end of this kinked extension a generally L-shaped folding boom is pivotally connected about a horizontal axis. In the stowed position, the main arm of the folding boom extends substantially vertically, and in its position of use, it extends substantially horizontally.

The main arm of the folding boom is provided with a rearwardly extending extendable boom which, in the stowed position, also extends vertically. The extendable boom can be extended horizontally and rearwardly when the folding boom has been moved from its stowed position to its working position and can be locked mechanically in various positions. Various different lifting bars and lifting forks can be connected to the extendable end of the extendable boom. Also forming part of the top hamper are a main winch and a pair of extendable anchor legs at the rear of the vehicle provided with suitable spades which are extended for lifting and recovery operations.

The above described top hamper or recovery equipment has been used extensively in the past for winching heavy vehicles out of ditches and for suspended and supported tows. For winching, the main boom would be arranged in its stowed position but the folding boom and extendable boom would be moved to an operating position in which the extendable boom extends horizontally, and the anchor legs would be extended, the main winch which is normally mounted on the main boom adjacent its pivot axis having its winch rope passed over a suitable pulley at the free end of the main boom and being connected to the vehicle to be recovered. For suspended towing, the extendable boom is extended beneath the recovered vehicle and engaged either with a chassis member or the front axle, whereupon the main boom is raised sufficiently to raise the front axle of the vehicle being recovered off the ground, whereupon the weight of the suspended vehicle is supported mechanically on the chassis of the recovery vehicle so as to take the load off the hydraulic rams. With a supported tow the front wheels of the recovered vehicle are normally supported on a wheeled trailer device which is then hooked to a towing hook attachment(s) carried by the extendable boom.

If it is desired to use the above described EKA recovery equipment as a crane facility, then a crane extension must be fitted to the extendable part of the extendable boom together with a suitable mechanical support beneath the extendable boom to take some of the load off the hydraulic rams. Such a facility has limited utility, firstly because of the time necessary to erect a crane extension and also because of the limited reach of the crane extension and the limited load capability. Furthermore, the crane facility has suffered from the major disadvantage that it is not capable of slewing.

The disadvantages of the above mentioned crane or lifting facility have to some extent been overcome in the past by fitting to the recovery vehicle a separate crane between the mounting or pivot point of the main boom of the EKA system and the cab of the vehicle. This crane has been provided with a turntable and hence has been capable of slewing but because of its location on the vehicle, its lifting facilities have been very limited due to the very considerable length of the boom. Also, of course, the mounting point of the crane is substantially mid-way between the foremost rear axle and the front axle which in itself is a disadvantage. It also has to be borne in mind that with a separate slewing crane, duplicate hydraulic systems and control systems have to be provided thus considerably adding to the cost of the vehicle. Furthermore, the extra crane adds to the weight of the vehicle and while many vehicles of this nature have been provided in the past, many of them later had their crane removed because of the low frequency of use and its weight, and limited lifting capabilities.

One of the principal users of medium and heavy recovery vehicles apart from the haulage industry, public transport systems and emergency services, are the military services and particularly the Army. At present, the Army is using various of the above described available vehicles fitted with EKA recovery equipment and for medium duty work a three-axle vehicle fitted with a traditional slewing crane with an extendable boom and hydraulic support arms. The EKA equipment, however, has limited craning facilities as previously described whereas the vehicle provided with the slewing boom has limited recovery capabilities.

We have now devised a recovery vehicle which has all the advantages of the above described known recovery and crane equipment but which overcomes most if not all the known disadvantages and which also meets the requirements of the British and

foreign armies. Amongst these requirements are that the vehicle must be capable of undertaking a front suspended or supported tow of any heavy military vehicle. The recovery vehicle must, therefore, have a twin rear axle; preferably, both the axles should be driven so that the vehicle has a cross-country capability and is able to operate in terrain where battle tanks are used. Furthermore, the vehicle should have a powerful winch pull and adequate rope length beyond the rear of the vehicle and also be capable of winching to the front for self-recovery. Also, the earth anchors, i.e. anchor legs on the vehicle, should be capable of resisting the winch pull in any ground which can be traversed by the vehicle. It is also desired that such vehicles should be capable of lifting loads from flat bed vehicles or transmission units from battle tanks and be capable of swinging such a lifted load through around 200°. This means that as well as being usable in the field, the vehicle can be used in a workshop.

According to the present invention we provide a recovery vehicle having a main lifting device movably supported on the vehicle and a slewing crane supported on the vehicle, the crane having a turntable supported on a fixed deck and having a boom supported adjacent one end on the turntable for movement between stowed and raised positions, there being a mechanical link connectable between the main lifting device and crane boom, the arrangement being such that when the mechanical link is connected between the main lifting device and crane boom, the crane boom can be used to lift the main lifting device.

The main lifting device may be for example a main boom.

Preferably, the main lifting device is provided with a folding boom to which an extendable boom is connected.

The slewing crane is preferably supported on the vehicle in the vicinity of the rear axle or foremost one of the rear axles of the vehicle.

Preferably the crane boom is moved between it stowed and raised positions by one or more hydraulic rams extending between the turntable and boom.

Preferably, a locking device is provided to lock the turntable against slewing when the crane boom is used to lift the main boom.

Preferably, the main boom is pivotally supported at one end on the vehicle.

Preferably, the crane boom is pivotally supported on support arms projecting upwardly from the turntable adjacent the periphery thereof and two hydraulic rams are pivotally connected to upstanding lugs on the crane boom, one on each side thereof intermediate the two ends of the boom, the opposite ends of the rams being pivotally connected to further upstanding lugs on the turntable located diametrically opposite the support arms.

Preferably, a rigid link, e.g. a rod or plate, is provided for connecting the crane boom to the main boom and is arranged to extend between suitable brackets on the two booms; several links of different length could be provided if required. If desired, the link may be pivotally connected at one end to one of the booms and when disconnected from the other boom may be pivoted to a stowage position lying along the length of the other boom. Alternatively, the mechanical link may be formed of one or more chains.

Preferably, a main recovery winch is fixed to the vehicle at a location between the turntable and the cab of the vehicle.

It is preferred that a separate winch be mounted on the crane boom for operating the crane hook. This means that the main winch can be used independently of the crane, and that the crane can be used to assist in recovery operations. Preferably, the crane boom is extendable.

Preferably, the main boom, folding boom and extendable boom are similar to the standard EKA recovery equipment although the main boom is shorter.

Preferably, the traditional extendable anchor legs are provided at the rear of the vehicle. As an alternative to providing a main boom pivotally connected at one end to the vehicle, a lifting device in the form of a cradle could be provided which runs in upwardly extending guide tracks. The casing for the anchor legs could be utilised to provide these tracks.

A preferred embodiment of recovery vehicle is now described by way of example with reference to the accompanying drawing, which is a side elevation, with parts omitted or broken away for the sake of clarity, and showing other parts in outline only.

Referring to the drawing, a 3-axle recovery vehicle having a standard main chassis 1 and cab 3 is illustrated, the vehicle having a main boom 5 for heavy duty vehicle recovery purposes pivotally connected thereto at 7. The pivot point 7 is substantially above the forwardmost rear axle 9 of the vehicle rather than in the traditional location nearer the front of the vehicle as with standard EKA equipment. In other respects, however, the main boom 5 is similar to standard EKA equipment with a depending rear end portion 11 to which is pivotally connected a folding boom 13 about an axis 15. The folding boom 13 is generally of L-shaped construction, the longer arm of the L comprising an extendable boom 17 having a fixed portion 19 and an extendable portion 21 to which a variety of different towing and lifting equipment can be connected in known manner for suspended and supported towing in known manner. The main boom 5 and folding and extendable booms 13 and 17 are shown in full lines in their stowed position whereas the operating position of the extendable boom and folding boom are shown in fainter lines at 23. Various operating heights and positions of the extendable portion 21 of the boom 23 are shown at 25. Likewise, a raised position of the main booms 5 is shown at 27.

At its rear, the vehicle is provided with two extendable anchor legs adjacent the rear axle to which spades 29 of traditional construction are attached. These anchor legs, when extended in known manner, normally by means of hydraulic rams, provide anchorage and stability when the recovery vehicle is used for winching or craning as will hereinafter be described. Amidships, the vehicle

is provided with two extendable and adjustable outriggers, which are slidable in boxes 30 mounted on the vehicle chassis.

The recovery vehicle is provided with a slewing crane 31 having an extendable boom 33 on the end of the extendable portion of which is a pulley over which a rope carrying a lifting hook is entrained. The crane boom 33 is pivotally supported at its other end on a support, preferably two support arms 37, which themselves extend upwardly from an edge region of a turntable 39. The turntable 39 is rotatably supported on a deck 41 which itself is secured to a sub-frame 43 of the equipment. Intermediate its two ends, the crane boom 33 is further supported by a pair of spaced hydraulic rams 45 which are pivotally connected at their upper ends to lugs 47 projecting upwardly from the boom 33 and at their lower ends to further lugs 49 upstanding from the periphery of the turntable 39 at a location substantially diametrically opposite the point on the turntable at which the support arms 37 are connected thereto. By extending the hydraulic rams 45, so the crane boom 33 can be moved from its positions of rest shown in the drawings to a raised position, as desired, for lifting purposes.

Descending from the crane boom 33 is one or a pair of brackets 51. One or a pair of similar brackets 53 upstand from the main boom 5 and one or a pair of mechanical links (not shown) are connectable between the brackets 51 and 53. The links 55, when connected between the brackets 51 and 53, are used for raising and lowering the main boom 5 using the hydraulic rams 45 of the crane 31. When not in use, the links 55 can be disconnected from one of the brackets 51 or 53 and pivoted to a stowage position lying either along the boom 33 or the boom 5, or removed altogether. The links 55 may be rods or plates or, alternatively, chains or ropes could be used.

Forwardly of the main boom 5 and support arms 37, a main winch 61 for the recovery vehicle is mounted on the frame of the equipment. This winch 61 is of standard construction and has a winch cable which is used for recovery purposes, the winch cable being played out when desired over a fair lead 62 mounted on a swivel 64 capable of pivoting about a horizontal fore-and-aft axis on the end of the main boom 5, and then hitched onto the vehicle to be recovered. For recovery purposes, of course, the anchor legs and spades would be brought into operation.

For various reasons, a second winch 65 is provided adjacent the pivoted end of the crane boom 33 for operating the cable and hook of the slewing crane. The boom of this can of course be extended in known manner.

Because the slewing crane 33 is supported on the deck 41 substantially above the axle 9, rather than in a more traditional position nearer the front end of the vehicle, the crane, when its boom 33 and the outriggers are extended, can be used to lift much heavier loads at a far greater reach than with known cranes or EKA main booms provided with lifting attachments of known construction. The crane can in fact easily be used for lifting engines out of tanks or for lifting dead weights off flat bed vehicles and the load can then be slewed round to the side of the vehicles without any difficulty, this of course being made possible because the crane is located much nearer the rear of the vehicle than is normal. Furthermore, because the crane is a permanent fixture on the vehicle, time is not wasted in specially adapting the EKA main boom for this purpose.

When the recovery vehicle is to be used for suspended or supported towing, the EKA type main boom 5, folding boom 11 and extendable boom 17 together with a suitable attachment of extendable boom 17 is used in known manner, and in order to lift the main and associated booms 5, 13 and 17 from their position of rest to one of their working positions 25,27 shown in the drawing, it is first advisable to lock the crane against slewing movement and then to connect the main boom 5 to the crane boom 33 with the mechanical link(s). Then, by operating the hydraulic rams 45, the crane boom 33 will be lifted thus lifting the main boom 5, folding boom 13 and extendable boom 17 to its desired recovery/towing position. Once the recovery operation has been completed with the attachment on the extendable boom 17 correctly located under the vehicle to be towed, and the vehicle has been lifted as necessary, one or more suitable transverse support bars are passed through a set of apertures provided in upstanding plates (not shown) located, e.g. on the upper ends of the anchor legs, these support bars supporting the main boom 5 so as to take the total weight of the vehicle to be towed during a suspended tow; preferably, the support bars lock the main boom against any movement, up or down. Once the support bar(s) have been placed in position, so the pressure in the hydraulic rams 45 can be vented, which of course means that the total weight of the recovered vehicle is mechanically supported rather than being supported by hydraulic pressure which of course could have a disastrous result if there was a hydraulic hose failure or loss of pressure.

Because the vehicle is provided both with a crane and with EKA recovery equipment, it will be appreciated that certain recovery operations can be performed more easily than had the vehicle only had the recovery equipment. For example, if a crashed vehicle loses both its front wheels, the main winch can be used to drag the crashed vehicle towards the recovery vehicle, the extendable boom 17, 21 can then be positioned ready for a suspended or supported tow, whereupon the crane 31 can then be used to lift the crashed vehicle onto the attachment fitted to the extendable boom. Without the crane this would not be possible. Also, of course, because the crane has a slewing capability, a slight misalingment of the crashed vehicle with the attachment on the extendable boom can easily be rectified.

Although the main boom and crane boom have both been shown in the drawing as being pivotally supported on the vehicle chassis towards their forward ends, other movable methods of attachment are envisaged, especially for the main boom. This could, for example, be replaced by a lifting device in the form of a cradle supported on generally vertically

extending guide tracks at its front and rear ends. It is envisaged that the housings for the extendable anchor legs could be adapted to provide the guide tracks, in which case, the folding boom 13 and extendable boom 17, 21 would be supported on a mast running on the guide tracks. The lifting device, i.e. cradle, would still be moved vertically up and down its guide tracks by using the hydraulic rams 45 of the crane boom and connecting link(s) and would still be held in its raised position by suitable support bars.

It should also be realised that while hydraulic rams are preferred for lifting the crane boom and for performing other functions on the vehicle, other, preferably power operated, devices could be used.

It will thus be appreciated that we provide a recovery vehicle having a full recovery capability, slewing crane lifting capability and supported or suspended towing capability which has all the advantages of prior art vehicles but which only requires one or a pair of hydraulic rams or other devices for lifting the crane and main booms and furthermore which has the capability of lifting heavy loads at a reach far in excess of the capability of known recovery vehicles. Furthermore, the total weight supported on the crane is carried by the vehicle substantially above the forwardmost rear axle of the vehicle and the only act needed to convert the vehicle from a recovery mode to a lifting mode is to disconnect or connect as the case may be the link joining the booms 33 and 5. It is believed that such a vehicle will be relatively cheap to manufacture, will meet the requirements of the haulage industry, public transport systems and the emergency services and furthermore will be capable of use both on the roads and tracks and most of all in crosscountry situations such a might be experienced by armed forces in time of war.

CLAIMS

1. A recovery vehicle having a main lifting device movably supported on the vehicle and a slewing crane supported on the vehicle, the crane having a turntable supported on a fixed deck and having a boom supported adjacent one end on the turntable for movement between stowed and raised positions, there being a mechanical link connectable between the main lifting device and crane boom, the arrangement being such that when the mechanical link is connected between the main lifting device and the crane boom, the crane boom can be used to lift the main lifting device.

2. A recovery vehicle according to claim 1 wherein the main lifting device is provided with a folding boom to which an extendable boom is connected.

3. A recovery vehicle according to claim 1 or 2 wherein the slewing crane is supported on the vehicle in the vicinity of the rear axle or foremost one of the rear axles of the vehicle.

4. A recovery vehicle according to any one of claims 1-3 wherein the crane boom is moved between its stowed and raised positions by one or more hydraulic rams extending between the turntable and boom.

5. A recovery vehicle according to any of claims 1-4 wherein a locking device is provided to lock the turntable against slewing when the crane boom is used to lift the main lifting device.

6. A recovery vehicle according to any one of claims 1-5 wherein the main lifting device comprises a boom.

7. A recovery vehicle according to claim 6 wherein the main boom is pivotally supported at one end about a horizontal axis on the vehicle.

8. A recovery vehicle according to any one of claims 1-5 wherein the main lifting device comprises a cradle running on upwardly extending guide tracks.

9. A recovery vehicle according to claim 8 wherein the guide tracks are provided on housings for extendable anchor legs at the rear of the vehicle.

10. A recovery vehicle according to any of claims 1-9 wherein the crane boom is pivotally supported adjacent its rear end about a horizontal axis on the turntable.

11. A recovery vehicle according to claim 10 wherein the crane boom is pivotally supported on support arms projecting upwardly from the turntable adjacent the periphery thereof.

12. A recovery vehicle according to claim 11 wherein two hydraulic rams are pivotally connected to upstand ng lugs on the crane boom, one to each side thereof intermediate the two ends of the boom, the opposite ends of the rams being pivotally connected to further upstanding lugs on the turntable located diametrically opposite the suport arms.

13. A recovery vehicle according to any one of the preceding claims wherein a rigid link is provided for connecting the crane boom to the lifting device.

14. A recovery vehicle according to claim 13 wherein the rigid link is pivotally connected at one end to the crane boom or main lifting device.

15. A recovery vehicle according to any of claims 1-12 wherein the mechanical link comprises a flexible member.

16. A recovery vehicle according to any one of the preceding claims wherein a main winch is mounted on the vehicle between the turntable and cab of the vehicle.

17. A recovery vehicle according to any of the preceding claims wherein the crane has its own winch.

18. A recovery vehicle substantially as hereinbefore described with reference to the accompanying drawing.

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ERRATUM

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