Dec. 13, 1955 S. E. RODMAN 2,726,780

INDUSTRIAL LIFT TRUCK

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Fig.1.

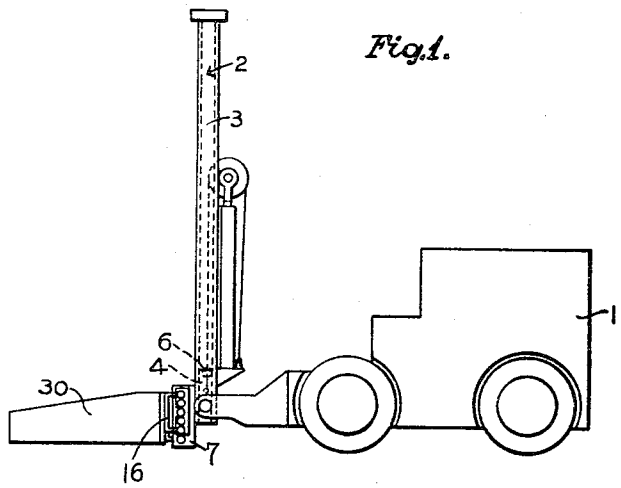
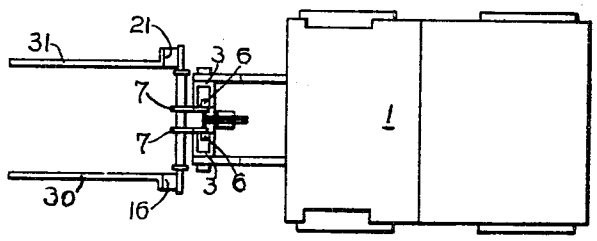


Fig.2.



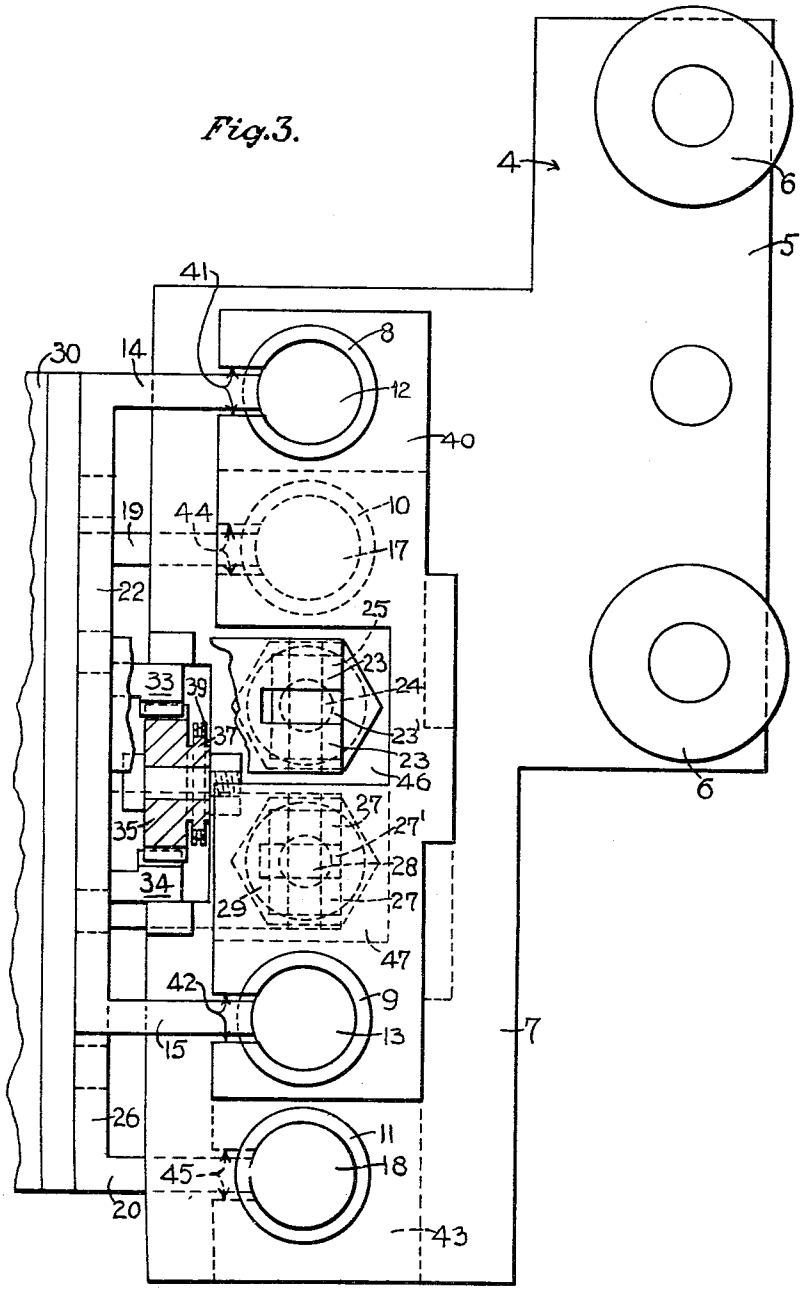
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Dec. 13, 1955 S. E. RODMAN 2,726,780

INDUSTRIAL LIFT TRUCK

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Fig. 3.



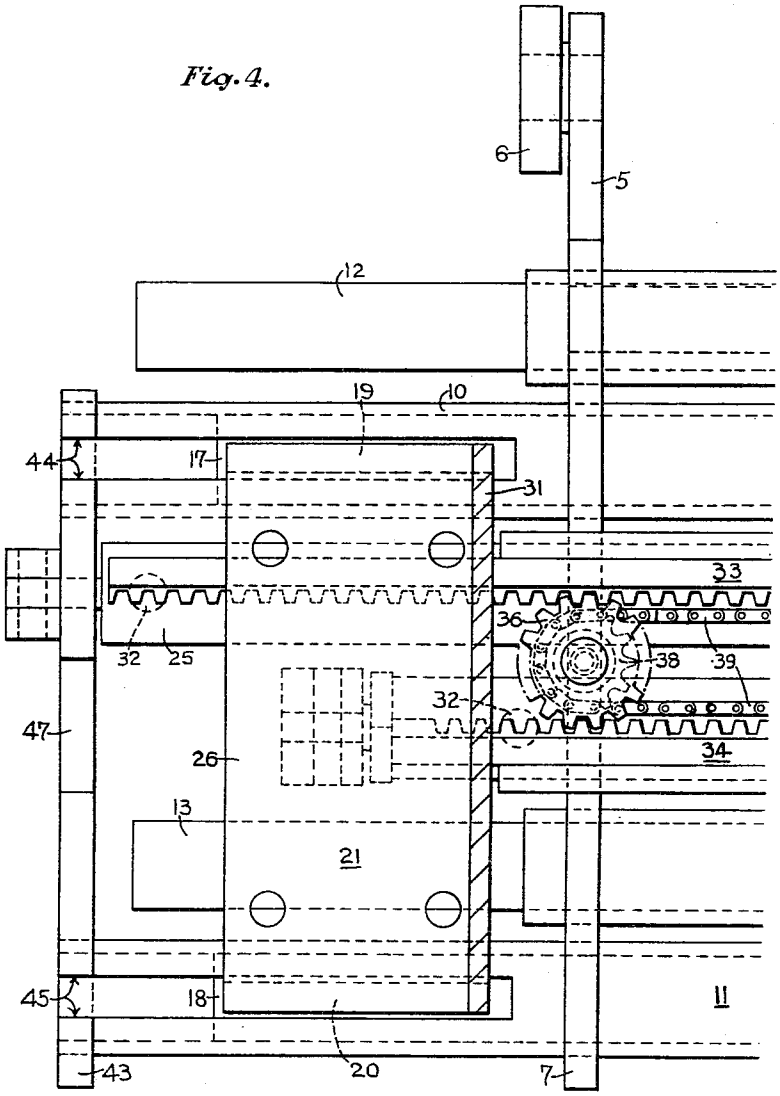
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INDUSTRIAL LIFT TRUCK

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Fig. 4.



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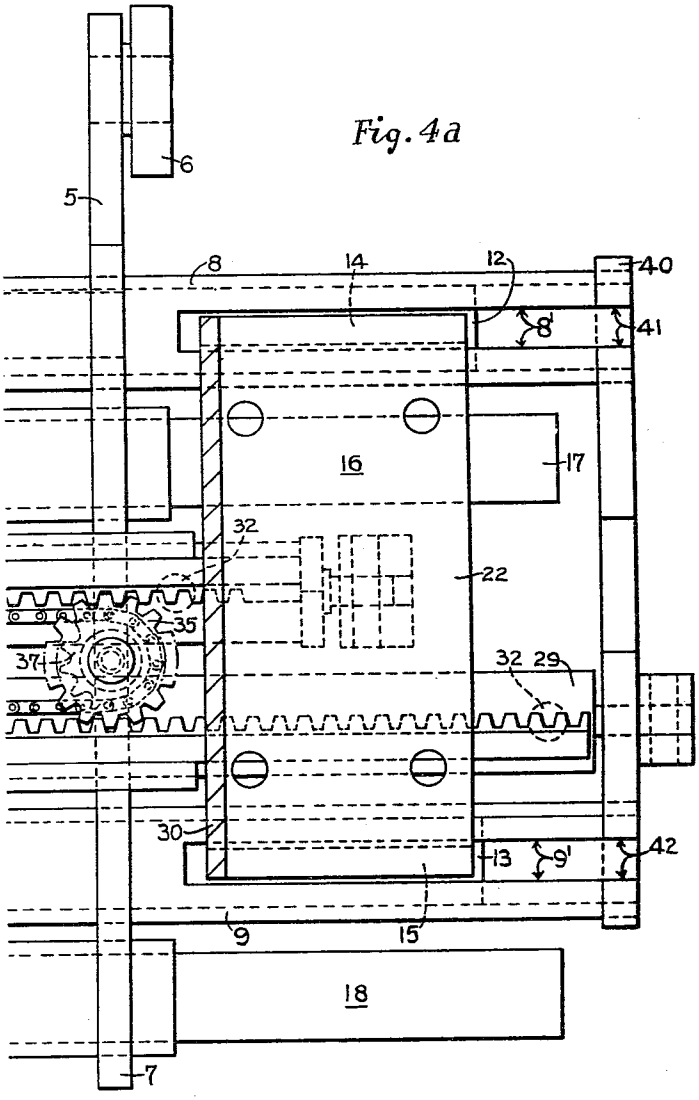
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INDUSTRIAL LIFT TRUCK

Filed March 12, 1952 6 Sheets-Sheet 4

Fig. 4a



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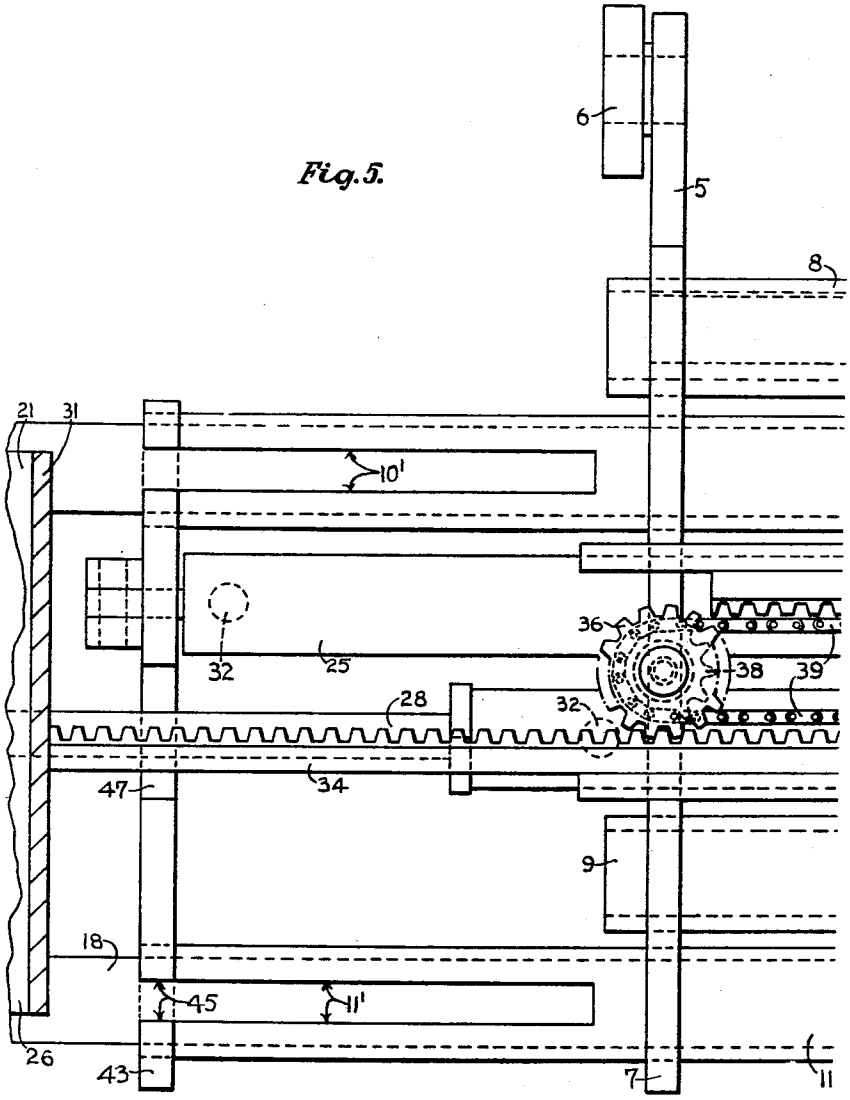
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Fig. 5.



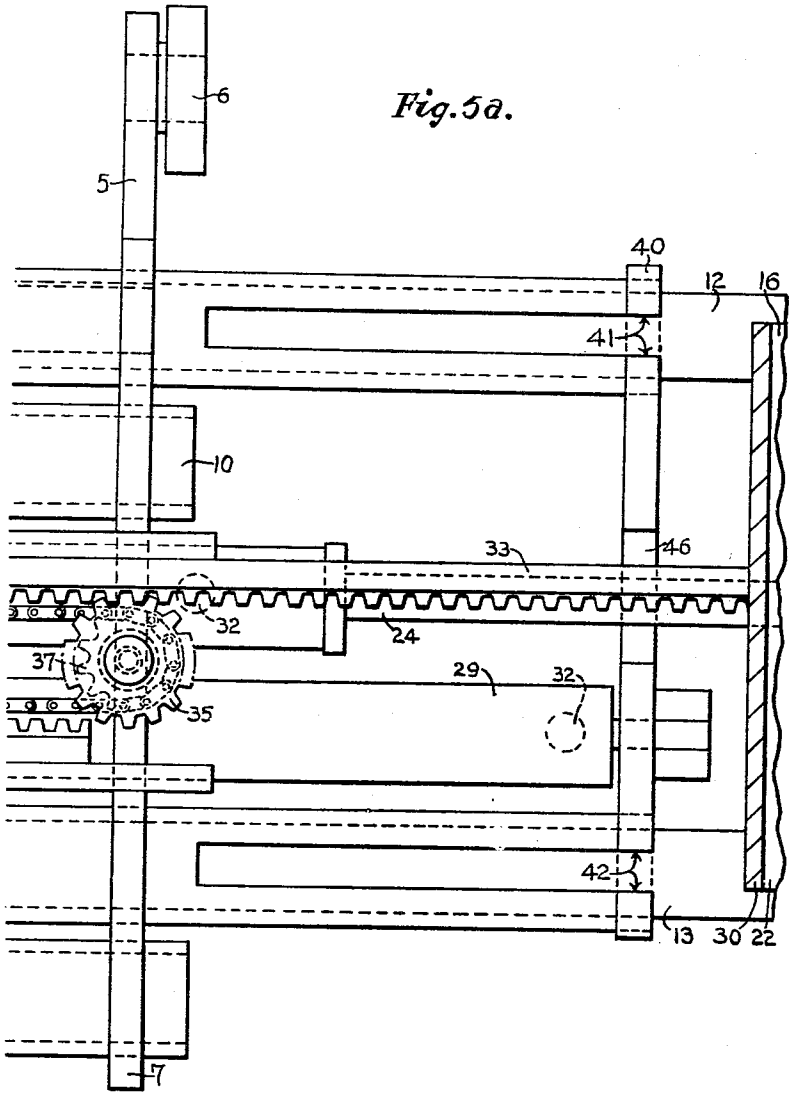
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Fig. 5a.



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United States Patent Office 2,726,780 Patented Dec. 13, 1955

2,726,780

INDUSTRIAL LIFT TRUCK

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Application March 12, 1952, Serial No. 276,171

2 Claims. (Cl. 214—653)

This invention relates to a self-loading transporting device of the kind in which two loading members are movable towards and away from each other for engaging themselves with or disengaging themselves from a load.

According to the invention, a self-loading transporting device of the hereinbefore specified kind has a positive connection between the two loading members which prevents each loading member from moving a substantially different amount relative to the other loading member.

The said loading members may be jointly raisable and lowerable.

The loading members are preferably movable towards and away from each other by hydraulic driving means.

The said hydraulic driving means preferably has cylinders adapted to be controllably fed with oil under pressure and rams adapted to be displaced by the said oil entering the cylinders.

There are preferably relief valves associated with the driving means for controlling the maximum oil pressure and the said valves may be adjustable.

The loading members and the means for driving them towards and/or away from each other are preferably provided on a slide or carriage which is raisable and lowerable on a guide which may or may not be tiltable.

The said positive connection may consist of rack and pinion mechanism which connects the loading members together.

Each loading member may have a rack, and each rack may mesh with the same pinion mounted on a relatively stationary part, or with at least one of two laterally spaced pinions rotatably mounted on relatively stationary parts of the device, the two pinions being connected or not by other means than the racks so as to prevent each pinion from rotating substantially without the other.

Each pinion may have a sprocket wheel connected to it, the two sprocket wheels having a chain mounted on them to prevent one from rotating without the other.

The transporting device on which the loading members are provided may be a truck or other conveyance having wheels or a tractor or conveyance which has its own track forming means.

The loading members may be two arms or jaws adapted to adjust a load into and clamp it between them in a substantially central position relative to the device by inward application to external opposed sides of the load, and/or to adjust a load into and hold it jointly in a substantially central position relative to the device by outward application to internal opposed sides of a load.

The cylinders are preferably on the slide or carriage and the rams are on the loading members. Each of the loading members may be actuated towards and away from the other by a separate cylinder and ram, and the cylinders and rams be double acting.

The said loading members may be detachably connected to the slide or carriage or brackets provided thereon to enable loading members which are of a different form and are adapted for obtaining a purchase on a load in a different way or for carrying a load in

a different way to be attached to the slide or carriage in place of the first named loading members as their use may be required.

The said slide or carriage may be carried and guided by two upright carrying members adapted to be tilted on the transporting device, and the cylinders and rams and also guide means for the loading members be provided on a dropped part of or dropped brackets on the slide or carriage to enable the said loading members to be lowered relatively close to the ground whilst making possible a substantial clearance between the lower ends of the carrying members and the ground.

In the more or less diagrammatic drawings—

Figure 1 is a side elevation of a self-loading transporting device comprising a wheeled truck,

Figure 2 is a plan view of Figure 1,

Figure 3 is a detached side view, partly in section, of parts of the device, with portions broken away.

Figures 4 and 4*a* are fragmentary front views, partly in section, of a detached part of the said device and show different halves respectively of the said part, and

Figures 5 and 5*a* are similar views to Figures 4 and 4*a*, but with portions broken away, and parts shown in another position.

Figures 3 to 5*a* are drawn to a larger scale than the remaining figures.

Referring to the drawings, in the construction shown therein, as applied by way of example to a wheeled truck or a tractor or a tracked transporting vehicle employed more particularly for unloading and stocking bales or taking bales from stock and loading the same onto wagons or the like for road or rail transport, the truck **1**, Figures 1 and 2, tractor or tracked vehicle is provided with an elongated guiding and supporting frame **2** mounted to swing about a horizontal axis for example under hydraulic power. The frame **2** has two longitudinal guide members **3** of channel section forming parallel guides for a slide **4** or carriage composed of two plates **5** having slide blocks or rollers **6** engaging the channels of the guide members **3** and connected together laterally and having forwardly projecting parts **7** which are dropped relative to the remaining parts of the plates **5** so that the dropped parts **7** are lower than the bottom ends of the guide members **3** when the slide **4** is in its lowest position. The dropped parts **7** register with each other and have secured to them horizontal guide tubes **8, 9, 10, 11** extending from one plate **5** to the other and fixed to the plates **5** and situated one below another. The guide tubes **8** and **9** guide and have slidable in them slide rods **12** and **13** respectively whose ends are connected rigidly to the flanges **14** and **15** respectively of a U-bracket **16**, the guide tubes **8** and **9** having slots **8'** and **9'** respectively to accommodate the flanges **14** and **15** of the bracket **16**. The guide tubes **10** and **11** guide and have slidable in them slide rods **17** and **18** respectively whose ends are connected rigidly to the flanges **19** and **20** respectively of a second U-bracket **21**, the guide tubes **10** and **11** also having slots **10'** and **11'** respectively to accommodate the flanges **19** and **20** of the bracket **21**. The bracket **16** has provided on its web **22** lugs **23** connected by a pin **23'** to the outer end of a hydraulic double acting ram **24** which faces in one lateral direction and works in a double acting cylinder **25** extending from one of the plates **5** to the other and connected rigidly to the plates **5**. The bracket **21** has provided on its web **26** lugs **27** connected by a pin **27'** to the outer end of a double acting ram **28** which faces in the reverse lateral direction and works in a double acting cylinder **29** extending from one of the plates **5** to the other and connected rigidly to the plates **5**. The ends of the guide tubes **8** and **9** have a plate **40** fixed to them, the plate **40** having slots **41** and **42** to allow passage therethrough of the flanges **14** and **15** respectively of the

U-bracket 16. The end of the cylinder 29 is also fixed to the plate 40. The guide tubes 10 and 11 have a plate 43 similar to the plate 40 fixed to their ends, the plate having slots 44 and 45 for the flanges 19 and 20 respectively of the U-bracket 21. The end of the cylinder 25 is also fixed to the plate 43. The plates 40 and 43 also have gaps 46, 47 respectively to allow passage of the rams 24 and 28 respectively. The guide tubes 8, 9, 10, 11, slide rods 12, 13, 17, 18, rams 24 and 28 and cylinders 25 and 29 are substantially horizontal and by the introduction of oil under pressure into the requisite ends of the cylinders 25 and 29 the rams 24 and 28 can be forced outwards in reverse directions and inwards in reverse directions, the brackets 16 and 21 being thereby forced away from each other or towards each other. Each of the brackets 16 and 21 has a removably bolted to it a rigid clamp arm 30, 31 respectively which projects forwards from the respective bracket.

The cylinders 25 and 29 are connected pairwise by piping 32 to an oil control valve or valves (not shown) whereby oil can be fed jointly to the inner ends of both cylinders 25 and 29 and released jointly from the outer ends thereof or can be fed jointly to the outer ends of the cylinders 25 and 29 and released jointly from the inner ends in order to operate the rams 24 and 28 in the hereinbefore described manner.

In order positively to obtain an equal amount and strength of motion of the two arms 30, 31, toothed racks 33, 34, secured for example at one end to the U-brackets 16 and 21 respectively, are provided to mesh with toothed wheels 35, 36 respectively rotatable on stationary parts, for example the plates 5 are coupled together by sprocket wheels 37, 38 respectively and a driving chain 39 so that on motion of each U-bracket taking place, the other U-bracket must move the same amount in the reverse direction, and therefore neither U-bracket can move an amount which is substantially different from the amount moved by the other U-bracket. This arrangement ensures that both arms 30, 31 must move substantially the same amount inwards or outwards and cannot move substantially different amounts and must exert the same effort when the fluid under pressure is fed to the cylinders 25 and 29. In Figures 4 and 4*a*, the arms 30, 31 are shown in a closed position. In Figures 5 and 5*a*, the arms 30, 31 are shown in a separated position.

In operation, for example to unload a bale from a lorry and deposit it in a store room, without first supporting the bale from below above the floor of the lorry on which it rests, the slide 4 or carriage is operated to bring the arms 30, 31 to a height level with the sides of the bale, and the truck 1, tractor or tracked transporting vehicle is maneuvered to bring the thus operated slide 4 or carriage into a position where the arms 30, 31 are situated at opposite sides of the bale, with the bale between them, whereupon the rams 24 and 28 are operated to force the arms 30, 31 towards each other until they act on the sides of the bale and thereby squeeze or clamp the bale between them. The lateral grip thus obtained on the bale is sufficient to enable the bale to be lifted from the platform of the lorry without the aid of supporting means applied beneath the bale. The slide 4 or carriage is then raised to lift the bale clear, the truck 1, tractor or tracked vehicle driven to draw the bale away from the floor, the slide 4 or carriage partly lowered and the truck 1, tractor or tracked vehicle driven to the storing spot, whereupon the slide 4 or carriage is further lowered to lower the bale onto the said spot and the rams 24 and 28 are then operated to drive the arms 30, 31 away from each other and thereby release the bale. The loading of a bale from store onto a lorry takes place with equal facility without the need to have the bale supported above the storage floor prior to the loading.

Assuming the U-brackets 16, 21 to be in the position shown in Figures 5 and 5*a*, preparatory to being moved towards each other in order to cause the arms 30 and 31

to grip between them the bale resting on the said floor and projecting upwards somewhere between the said arms, the motive liquid is forced into the cylinders 25 and 29 in order to propel the U-brackets towards the positions shown in Figures 4 and 4*a*. It will be observed that when the said brackets are in the positions shown in Figures 5 and 5*a*, the rack 34 meshes only with the pinion 36 and the rack 33 meshes only with the pinion 35. The sprocket wheels 37 and 38 and the driving chain 39 however positively connect the pinions together and therefore the U-bracket 21 cannot move inwards without there being a corresponding inward movement of the U-bracket 16 equalling in amount substantially the inward movement of the U-bracket 21. Therefore notwithstanding a non-central disposition of the bale relative to the truck, tractor or tracked vehicle, neither arm can remain stationary whilst the other arm is moving and the arms are positively caused to approach the said centre equally and one of them to push the bale before it until the bale has arrived in a substantially central position with an arm pressing positively and with equal force against each side thereof. This centering connection therefore compels the bale to take up a central position and the arms to grip the bale only when it is in or has been moved by one or other of the arms into the central position, thereby ensuring that the bale is automatically so disposed relative to the vehicle that it can be carried along relatively narrow passages or through relatively narrow openings by the vehicle with reduced danger of fouling the sides of the passage or opening. When the rams are operated to separate the U-brackets 16 and 21, the said centering connection ensures that the arms shall move substantially equal distances outwards and therefore that free space shall be left for occupation by a load in a substantially central position relative to the truck, tractor or tracked transporting vehicle.

Where the required extent of maximum opening of the arms is sufficiently small conveniently to permit it, each rack may be arranged never to move out of simultaneous mesh with both pinions, or one pinion only may be provided and mounted in a central position on a relatively stationary part provided for it, in either of which cases the sprocket wheels 37 and 38 and driving chain 39 can be dispensed with.

It is to be understood that the expression "positive connection between the two loading members" hereinbefore and hereinafter employed includes positive connections other than the racks and pinion or pinions, or racks, pinions, sprocket wheels and driving chain hereinbefore described. It must be held to include also other mechanical connections such as levers, hydraulically interconnected rams, or electrical devices.

If a bale is to be stored between two other bales and the space available therefor is not quite sufficient, the arms can be inserted into the space and the rams 24, 28 operated to drive the arms 30 and 31 apart and thereby cause them to push the two other bales further apart and thereby make room for the said bale. Due to the positive connection between the arms, they are forced to move to any equal extent and therefore displacement of both of said bales is ensured.

Barrels or any other objects can be gripped laterally in a similar manner by the forcing of the arms 30, 31 towards each other, for lifting, lowering and transport. Pairs of arms particularly suited in size and form for handling objects of particular form may be provided and interchanged for the arms 30, 31. Relief valves, which are preferably adjustable are preferably provided in conjunction with the said valve, valves or piping to allow oil above a predetermined pressure to escape without operating the rams and thereby enable the pressure applied by the arms to be suited to the particular objects to be handled so that a clamping pressure sufficient to ensure safe lifting of the load without crushing of the load materially can be obtained.

The brackets **16**, **21** may have removably bolted to them arms adapted to enter the interior of an object, such as a pipe or frame and, by driving the brackets **16**, **21** away from each other, be forced to grip the object by being forced away from each other against two opposed internal lateral surfaces of the object, they enable such objects to be stocked in touching positions or removed from a stock in which they touch, it being unnecessary to provide accommodation between the objects in stocking or in stock for the said internally acting lifting arms.

I claim:

1. A self-loading transporting device comprising a carrier, two upright members on which the carrier is travellably mounted, means for tilting the upright members, a part on the carrier, horizontally rectilinearly movable loading members carried by the said part, hydraulic cylinders carried by the said part, hydraulic rams working in the said cylinders and connected to the loading members for driving them separately by separate drive or by joint drive, and toothed parallel racks, pinions for meshing with both racks, sprocket wheels rotating with said pinions and a driving chain connecting said sprocket wheels together, the said racks, pinions, sprocket wheels and chain interconnecting the loading members for constraining them always to approach a substantially equal distance towards and recede a substantially equal distance from a fixed centre plane of the device even if the load when encountered by one of the loading members is not central relative to the said plane, and constraining the said hydraulic cylinders and their rams to act jointly on one loading member alone when resistance to movement of that loading member and not the other loading member is encountered.

2. A self-loading transporting device comprising in combination two separate rectilinearly movable loading members each of which is movable linearly towards the other for gripping a load between them, a separate hydraulic prime mover connected positively to each of the

loading members for urging the loading members separately towards each other, in combination with a separate toothed rack rigidly connected to each loading member in parallelism, a toothed carrier wheel rotatable on the device and in constant mesh with the first of the two racks, a separate toothed carrier wheel rotatable on the said device in parallelism with the first toothed carrier wheel and in constant mesh with the second of the two racks, a separate sprocket wheel connected to each of the toothed carrier wheels to rotate therewith and a driving chain mounted on the two sprocket wheels for positively transmitting motion directly from either sprocket wheel to the other and therefore positively transmitting motion via the chain and sprocket wheels from either toothed wheel to the other and therefore positively transmitting rectilinear motion via the chain, sprocket wheels and toothed carrier wheels from either rack to the other and therefore positively transmitting rectilinear motion via the chain, sprocket wheels, toothed carrier wheels and racks in approaching directions from either of the loading members to the other and also positively transmitting the power of each prime mover to the loading member to which power is applied directly by the other prime mover when movement of the last named loading member but not the other loading member is obstructed.

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