July 2, 1968 J. D. DIXON 3,390,798

INDUSTRIAL LIFT TRUCKS

Filed June 1, 1966 2 Sheets-Sheet 1

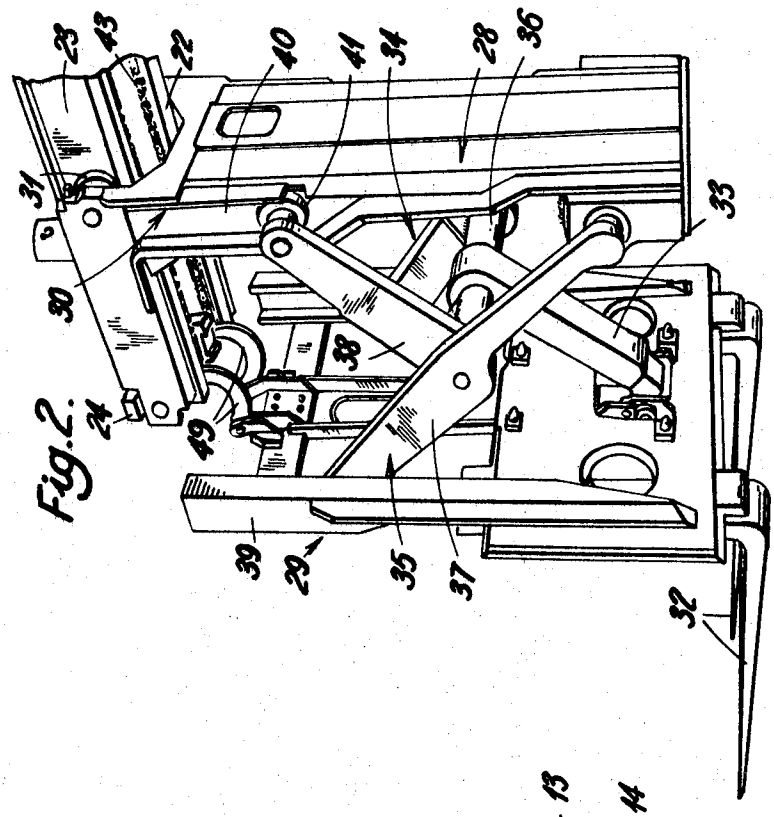

Fig. 2.

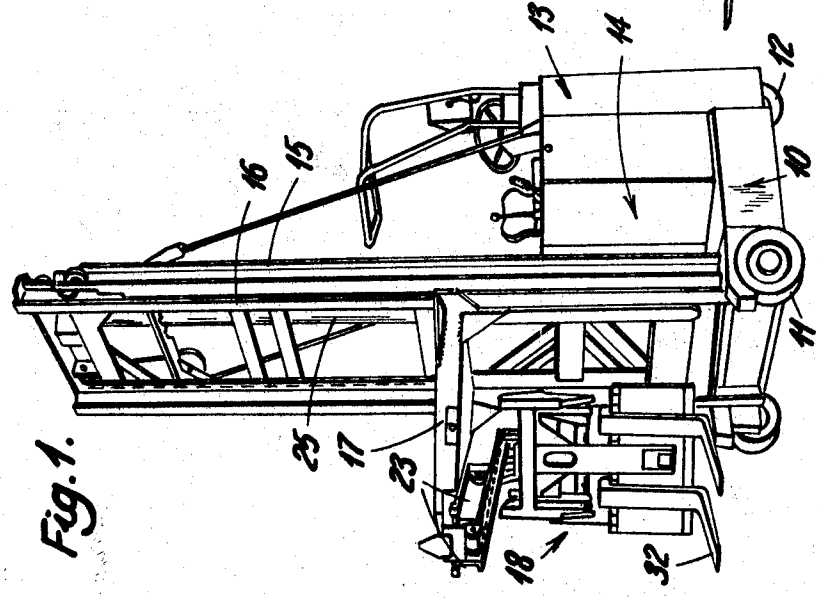

Fig. 1.

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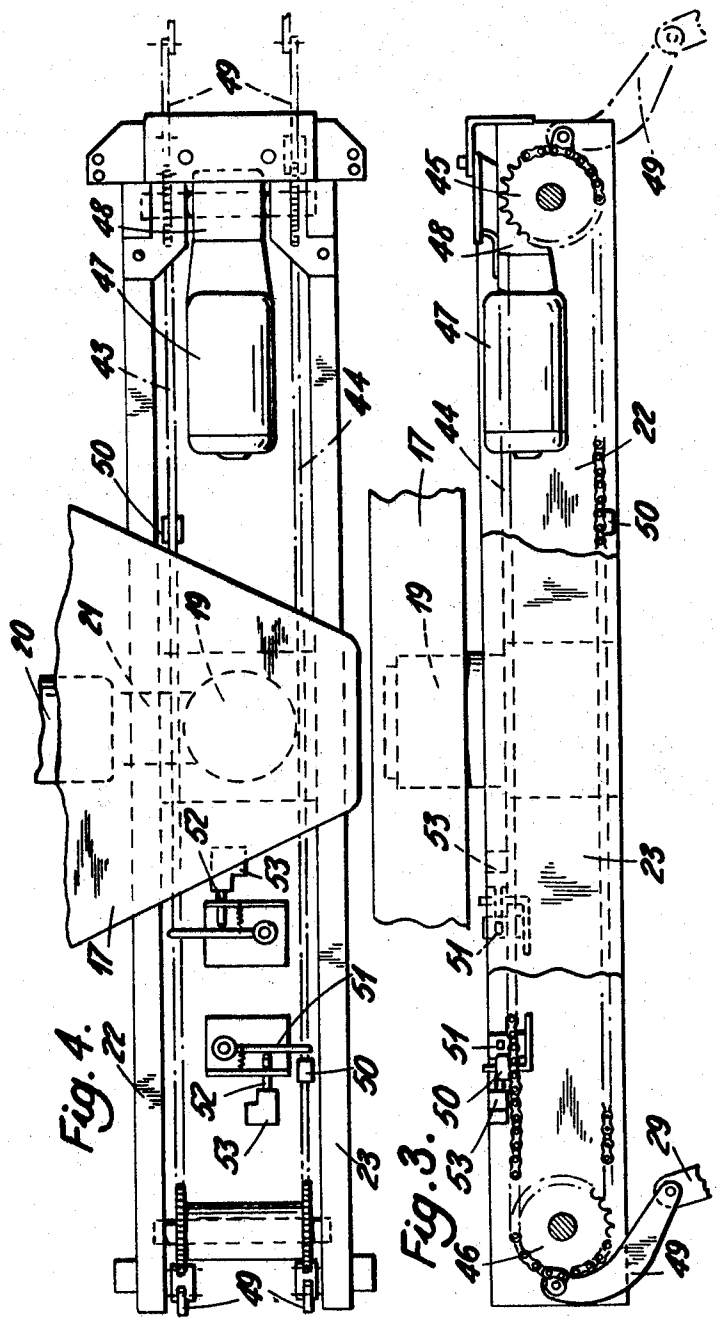

Fig. 4.

Fig. 3.

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INDUSTRIAL LIFT TRUCKS

John David Dixon, Basingstoke, England, assignor to Lansing Bagnall Limited, Basingstoke, England, a British company

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ABSTRACT OF THE DISCLOSURE

An industrial lift truck has a load-lifting carriage, a reach carriage formed in two parts, one part being supported and guided for reach movement by the load-lifting carriage and the other part having load carrying means, which parts are connected together by a scissors-like coupling, and driving means which are capable of both advancing and retracting the said part of the reach carriage which is guided for reach movement by the load-lifting carriage and also of expanding and contracting the said coupling.

This invention relates to industrial lift trucks.

According to the invention an industrial lift truck is provided with a load-lifting carriage, a reach carriage connected to the load-lifting carriage, guide means for the reach carriage, means for advancing and retracting the reach carriage along the guide means, which advancing and retracting means comprise a driving member with a driving connection to the reach carriage which member moves (e.g. at a substantially constant speed) along a path which is mainly parallel to the direction of movement of the reach carriage along the guide means and which path at one, or each end thereof turns away from the parallel portion whereby the rate of movement of the member in said direction is reduced when the member reaches said end and the rate of movement of the reach carriage is reduced.

In the preferred form of the invention, the truck is provided with an upstanding mast, a horizontally extending bracket constituting the load-lifting carriage which bracket is carried on the mast and from which depends the reach carriage, means for effecting relative movement between the mast and the bracket, and a turntable mechanism mounted on the bracket so as to be able to effect rotation of the reach carriage.

It is also preferred that the reach carriage is formed in two parts connected together by a scissors-like coupling and that one of said parts is provided with load carrying means, the parts of the reach carriage being movable independently of each other by expansion or contraction of the said coupling. In this case the driving member is preferable in driving connection with the part of the reach carriage which is provided with the load carrying means.

The driving member may be a link.

In one form of the invention, the said advancing and retracting means comprise an endless chain or belt which passes around two pulleys or sprockets positioned at either end of the guide means for the reach carriage, which chain or belt carries the driving member. Preferably the driving member is capable of being directed a part way around one of the pulleys by the chain or belt to turn it away from the parallel portion of its path.

Stop means are preferably provided to stop the advancing and retracting means when the rate of movement of the driving member has been reduced by the required amount.

By way of example, one construction of truck in accordance with the invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a front perspective view of the truck;

FIGURE 2 is a rear perspective view of the reach carriage of the truck shown in FIGURE 1;

FIGURE 3 is an elevation, partly cut-away, of the means for advancing and retracting the reach carriage of the truck shown in FIGURES 1 and 2, the figure showing the two extreme positions of the driving member in driving connection between the said means and the reach carriage; and

FIGURE 4 is a plan view of the means shown in FIGURE 3.

With reference to the drawings, the truck comprises a heavy body **10** with two wheels **11** at the front corners on fixed axes and two steering and propelling wheels **12** at the back, and an appropriate driving mechanism **13** over the back wheels **12** with a space **14** between the steering and driving mechanism and the front end of the body **10**. At the front end there is a fixed or outer mast **15** and on the outer mast there is a rising or inner mast **16**. Running in this rising mast **16**, there is a horizontal and forwardly projecting load lifting carriage or bracket **17**. Each of the masts **15, 16** is formed of two upright guide members in parallel spaced-apart relation in known manner and the space between the two sides of the masts is unobstructed so that the forwardly projecting bracket **17** can run up and down freely. A jack **25** is provided for effecting this raising and lowering of the bracket **17** and of the inner mast **16**, which jack **25** is provided behind the guide members of the outer mast **15**, i.e. in the space **14** between the outer mast **15** and the driving mechanism **13** of the truck.

The bracket **17**, which in its lowest position, is well spaced above the ground, has secured to its underside a turntable mounting **19**. This turntable mounting **19** comprises a gear wheel mechanism and is driven by an electric motor **20** through a worm reduction gear **21**. On either side of the turntable mounting and movable in fixed relation therewith, there are two channel-shaped guides **22, 23** disposed parallel to one another with their flanges facing outwardly. The guides extend in both directions from the turntable mounting **19** for a short distance and are made of as great a length as will clear the mast on rotation of the turntable mechanism, the length of the guides **22, 23** being determined by the amount of overhang of the bracket **17**.

On the guide channels **22, 23** there is an underhung reach carriage **18**, which carriage is formed in two parts **28, 29**, the part **28** being provided with rollers **31** to run in the guide channels **22, 23**. Stop means **24** are provided at each end of the guide channels. The other part **29** is provided with outwardly projecting load-carrying forks **32**. Means are provided for attaching the two parts **29, 28** of the reach carriage together, which means comprise a pair of scissors-like couplings **34, 35** and a central lever **33**, the couplings **34, 35** and the lever **33** being mounted on a transverse shaft **36**. Each coupling (see FIGURE 2) comprises a first link **37** extending between the two parts **28, 29** and a second link **38** extending between the shaft **36** and the part **28**. The upper ends of the links **37, 38** are provided with rollers **41** which engage in vertical guides **39, 40** respectively. By this arrangement, each part **28, 29** of the reach carriage may be moved independently of the other part by expansion or contraction of the couplings **34, 35**. The provision of the guides **39, 40**, also allows the couplings **34, 35** to expand or contract without necessitating a corresponding amount of expansion or contraction of the two parts of the reach carriage.

The mechanisms for moving the reach carriage **18** comprises a pair of endless chains **43, 44** extending be-

tween two sprockets **45**, **46** located one at either end of the guide channels **22**, **23**, the sprockets **45** being driven by an electric motor **47** through a reduction gear box **48**. Connecting one of the chains **43**, **44** to the corresponding side of the part **29** of the reach carriage, there is a driving member **49** which, in this example, is a rigid arcuate link designed to travel in fixed relation with the part **29** of the reach carriage and in a path parallel to that of the part **29** until the reach carriage approaches either its fully advanced position (shown in chain lines) or its fully retracted position (shown in full lines). At either of these points the end of the link **49** which is attached to one of the endless chains **43**, **44** will be located such that it will begin to pass around one of the sprockets **45**, **46** i.e. follow the path of the chain which turns the link away from the path of the reach carriage. This effect will cause the rate of movement of the link **49** and hence the reach carriage in the direction of movement of the carriage to be reduced, which reduced rate of movement will be steadily increased until a stop mechanism operates to stop the motor **47** driving the chains **43**, **44** and hence to stop the movement of the link **49**. This stop mechanism comprises for each direction of traverse of the chains **43**, **44**, a horizontal projection **50** fixed to the respective chain and which is capable of deflecting a lever **51** against spring pressure thereby allowing the plunger **52** of a limit switch **53** to move longitudinally a sufficient extent to change the state of the switch. With reference to the drawings, the stop **50** on the chain **44** is located a short distance ahead of the link **49** and is operative at the position of the link which is associated wtih the fully retracted position of the reach carriage. Also, the stop **50** on the chain **43** is located a further distance ahead of the corresponding link **49** and is operative at the position of the link which is associated with the fully advanced position of the reach carriage.

The motors **20** and **47** are controlled by hand levers rotated on top of the driving mechanism **13** within easy reach of the operator, so he can control the rotating and reaching movements of the reach carriage **18** at positions intermediate the limits of their movement.

In operation, movement of the chains **43**, **44** in one direction or the other will by means of the links **49**, effect movement of the part **29** of the reach carriage which, in turn, will effect either subsequent or simultaneous movement of the part **28** of the reach carriage, the reduced rate of movement being effected just before both the parts **28**, **29** of the reach carriage reach their fully advanced or retracted positions.

I claim:

1. An industrial lift truck having a load-lifting carriage, a reach carriage connected to the load-lifting carriage, which reach carriage is formed in two parts, one part being supported by the load-lifting carriage and the other part having load carrying means, and which parts are connected together by a scissors-like coupling, the parts of the reach carriage being movable independently of each other by expansion and contraction of the said coupling, guide means provided by the load-lifting carriage for guiding the reach movement of the said one part of the reach carriage, and driving means which are capable of both advancing and retracting the said one part of the reach carriage along the guide means and also of expanding and contracting the said coupling between the two parts of the reach carriage, which driving means comprise an endless member extending between and around two fixed points positioned one at either end of the said guide means for the said one part of the reach carriage and a driving link pivotally connected at one end to the said endless member and at its other end to the said other part of the reach carriage.

2. A truck as claimed in claim **1** in which the said endless member is an endless chain which passes between and around two sprockets positioned one at either end of the guide means for the said one part of the reach carriage, the path of the chain between the sprockets being parallel to the direction of movement of the reach carriage, and in which the driving link is capable of being carried by the chain a part way around each of the sprockets whereby during said passage of the link around a part of each of the sprockets, the speed of the link in the direction of movement of the reach carriage, and hence the speed of the reach carriage, is reduced.

3. A truck as claimed in claim **2** in which stop means are provided to stop the said chain when the driving link has moved the required distance around the respective sprocket.

4. A truck as claimed in claim **1** in which the truck is provided with an upstanding mast, a horizontally extending bracket constituting the load-lifting carriage which bracket is carried on the mast and from which depends the said one part of the reach carriage, means for effecting relative movement of the bracket up and down the mast, and a turntable mechanism mounted on the bracket so as to be able to effect rotation of both parts of the reach carriage as a unit.

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ROBERT G. SHERIDAN, *Primary Examiner.*

HUGO O. SCHULZ, *Examiner.*

R. BALLANTYNE, *Assistant Examiner.*