Dec. 22, 1959 C. W. BOPP 2,918,322

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Filed April 7, 1958 2 Sheets-Sheet 1

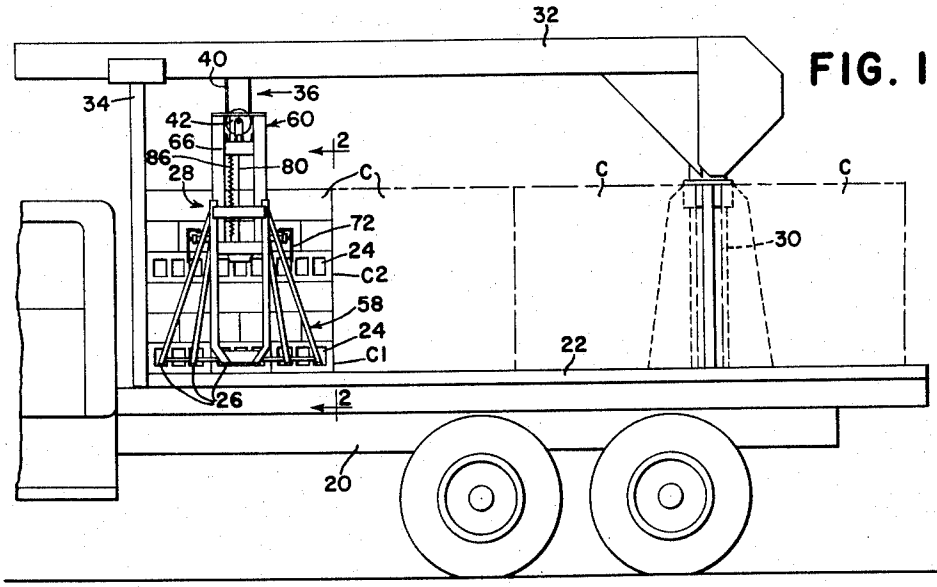

FIG. 1

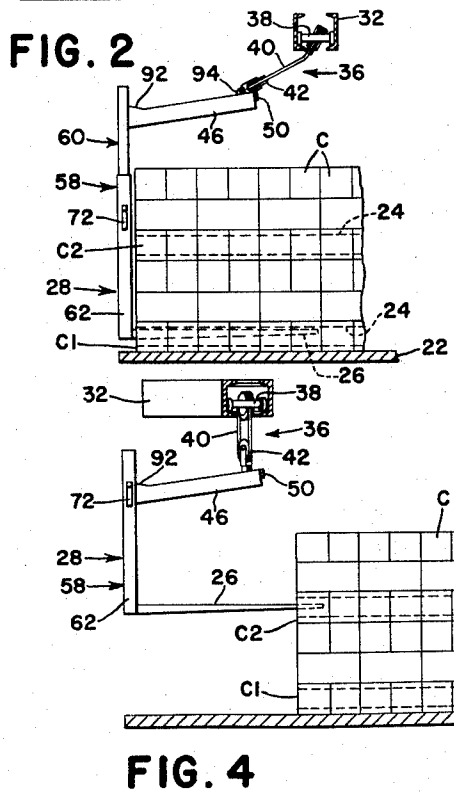

FIG. 2

FIG. 4

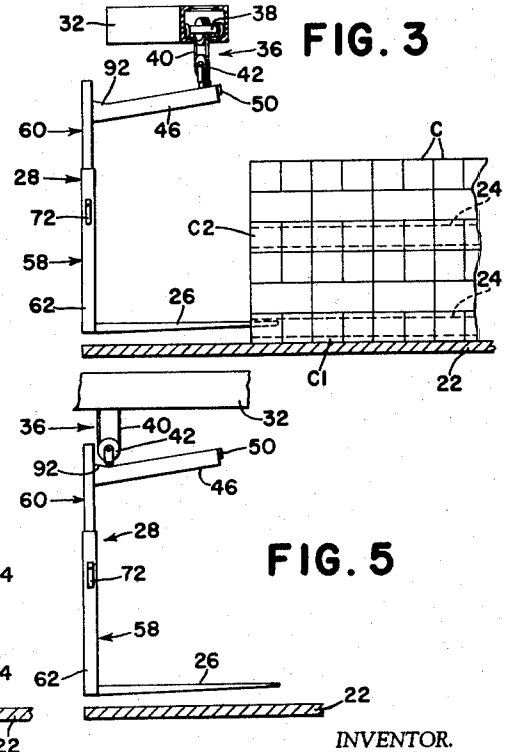

FIG. 3

FIG. 5

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FIG. 7

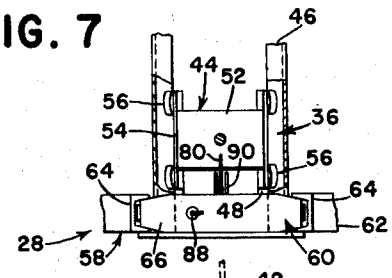


FIG. 6

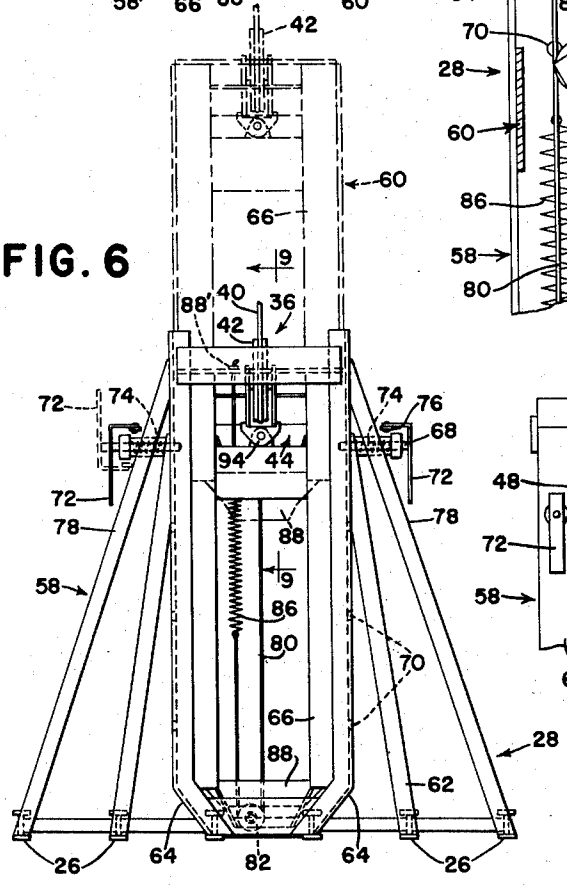


FIG. 9

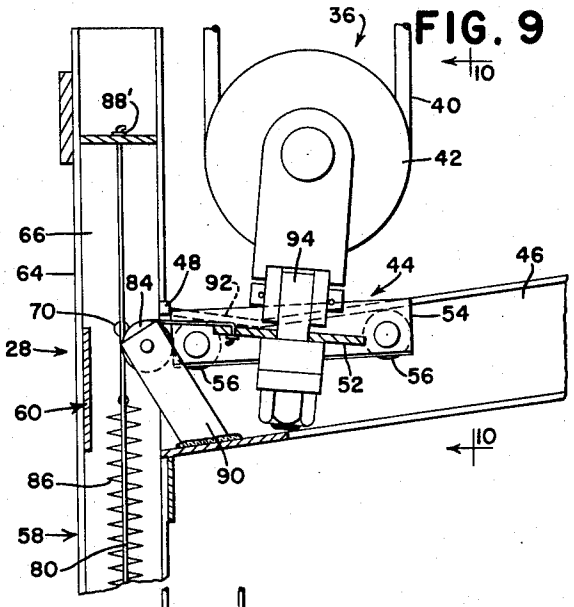


FIG. 11

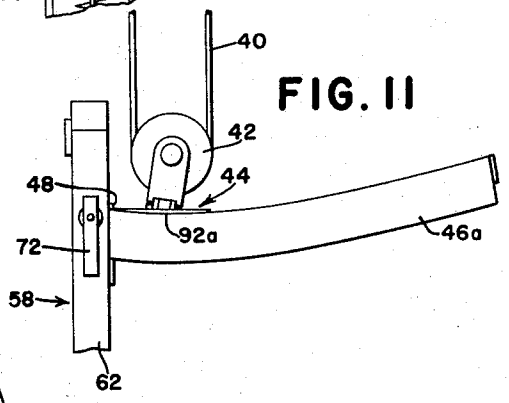


FIG. 10

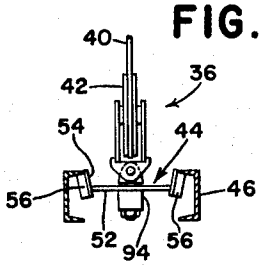
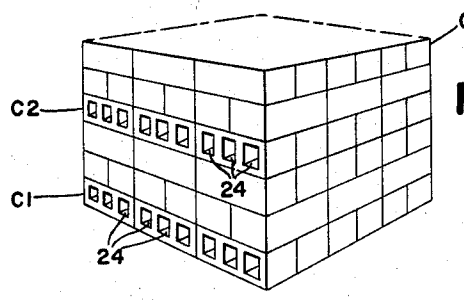


FIG. 8



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2,918,322

LOADER

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Application April 7, 1958, Serial No. 726,867

6 Claims. (Cl. 294—63)

This invention relates to a loader and more particularly to a loader element, especially embodied as a fork for handling concrete blocks and like articles.

In the field of handling concrete blocks, particularly in the loading, transporting and unloading thereof, it is conventional to utilize a heavy duty truck or like vehicle equipped with a boom from which a fork is suspended to lift and lower a quantity of blocks preliminarily assembled or stacked in what is known as a cube, which may be of any size but which is conventionally six blocks deep, three blocks wide and five to six blocks high. The cube is arranged so that the holes in the lowest tier of blocks are alined so as to receive the tines of the fork, the remainder of the blocks being crossed and therefore interfitting with each other so that the cube is relatively compact and capable of withstanding quite a bit of handling.

Experience has shown, for reasons to be elaborated herein, that prior loaders and unloaders of the character referred to suffer somewhat from lack of flexibility and versatility, primarily in that they are not capable of conveniently handling cubes that are split in a horizontal plane. This defect is especially recognizable in unloading from the truck, because prior forks are so high as to interfere with the boom and consequently they cannot be raised enough to enable their tines to penetrate the holes in blocks at levels much above the truck bed. In the fork designed according to the present invention, this shortcoming is eliminated by the provision for adjustability of the fork by means of relatively movable upper and lower sections whereby the upper section can retain its status as to the boom but the lower section can be selectively elevated so that its tines can penetrate blocks at higher levels.

In copending application Serial No. 631,766, filed December 31, 1956 by the present applicant, now Patent No. 2,849,253, there is disclosed a loader fork having provision for the automatic adaptation of the lifting connection to the center of mass of the fork whether empty, loaded or partly loaded, thus affording a self-balancing fork in which the tines are always level, which facilitates block penetration particularly and of course prevents tipping of the fork when loaded and therefore the carried blocks cannot slide off. However, that fork is subject to improvement in the means by which the self-balancing feature is achieved, and it is another object of this invention to bring about that improvement, which resides specifically in releasably confining the lifting connection or suspension means to a position over the center of mass of the empty fork until a diagonal upward force is applied, at which time the suspension means is allowed to be drawn out to its position over the center of mass of the loaded fork.

The foregoing objects will appear in greater detail, along with others inherent in and encompassed by the invention, as preferred embodiments of the invention are disclosed in the ensuing specification and accompanying

sheets of drawings, the figures of which are described below.

Figure 1 is a fragmentary side elevation of a vehicle equipped with a block-handling means embodying the invention.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a view similar to Figure 2, but showing the beginning of penetration of the cube by the fork.

Figure 4 is a view similar to Figure 3, but showing the relation of the shortened or retracted fork to an upper layer of blocks in the cube.

Figure 5 is a view like Figures 2 and 3, but shows the fork empty.

Figure 6 is a rear elevation of the extended fork on a scale enlarged over that of Figure 1, for example, and shows in broken lines the extended position of the fork.

Figure 7 is a plan of Figure 6, with parts in section.

Figure 8 is a schematic perspective of a typical cube.

Figure 9 is an enlarged section generally on the line 9—9 of Figure 6.

Figure 10 is a reduced section on the line 10—10 of Figure 9.

Figure 11 is a fragmentary side view of a fork having a modified upper portion.

Figure 1 illustrates the utility of the invention in a vehicle-equipped block loader and unloader. The vehicle is shown as a motor truck having a chassis 20 and a bed 22 on which a load of cubes C is carried. Only the forwardmost cube is shown in detail but this plus the illustration in Figure 8 will serve to give a general picture of what is involved. In the instance shown, the truck carries eight cubes, four on each side of the median plane of the bed. The exact number is immaterial and is referred to for orientation only. The blocks making up the cubes are or may be conventional concrete, cinder, etc. blocks, here arranged in six layers in which the bottom layer C1 and third layer from the top C2 are significant, having their holes or apertures 24 parallel and alined. The other blocks are crossed as illustrated, which is generally a well known method of forming cubes. In some instances, a cube may be made up of a bottom layer such as the layer C1 and other and different blocks or materials stacked on such bottom layer, which then serves as a pallet. In any event, the alined apertures 24 in the bottom layer C1 serve to receive tines 26 of a loader fork, indicated as a whole by the numeral 28. The fork is adjustable as to height, in a manner to appear presently, and in that case the layer C2 becomes important to receive the fork tines 26 so that less than the whole cube may be handled (Figure 4). Of course, other layers than the bottom and fourth from the bottom may have their holes arranged like those at 24, but the present example will serve as an illustration of the versatility of the fork 28. Hence, the disclosure here as elsewhere is representative and not limiting.

The truck bed 22 is equipped with a mast or pedestal 30 which in turn carries a boom 32 for swinging about the upright axis of the mast, an arrangement which is broadly well known. When the boom is in transport position, as shown in Figure 1, it is releasably locked in a fore-and-aft position, as respects the length of the vehicle, by any suitable boom-locking means, such as that shown generally at 34. When the boom is released it is capable of swinging preferably through at least 360° so as to handle cubes at either side of the truck or rearwardly thereof. Figure 1 shows the fork in one of the foremost cubes C, which is merely by way of example.

The fork is suspended from the boom 32 by suspension means indicated as a whole at 36, and appropriate mechanism is provided to raise and lower the fork, to run it back and forth along the boom and to swing the boom, which details are also well known and therefore are illus-

trated only briefly and will be described on the basis that per se they are comprehended by those versed in the art.

As shown in Figures 2, 3 and 4, the boom is made up of a pair of facing channels along which runs a carriage **38** from which a loop of cable or the like **40** depends to receive a sheave **42** on a four-wheeled cart or trolley **44** on the fork **28**. The trolley is connected to an upper part of the fork by track means **46** which is disposed in overhanging relation to the tines **26**, the tines serving broadly as load-carrying means. The track inclines upwardly and outwardly so that the cart is capable of assuming at least two positions on the track, depending upon whether the fork is empty or loaded. Figure 5 shows the empty position of the cart, wherein the line of lifting force from the overhead support represented by the boom and cable **40**, is near the back of the fork. Figure 2 shows the position of the cart on the track when the fork is loaded, it being understood however that the boom must first be swung out and the carriage **38** moved into vertical alinement with the cart before a lifting force is applied, particularly in the case where the first cube is being unloaded. It will be clear, on the other hand, that when the loaded fork is suspended at **36** the cart will be at the outermost end as shown in Figure 2, so that the lifting force will be directly above the center of mass, which is instrumental in keeping the tines level so that the cube does not tend to slide off. Similarly, when empty, the line of lifting force is above the center of mass of the empty fork (Figure 5), and again the tines will be level, which facilitates cube penetration. Inner and outer stops **48** and **50** are afforded on the track **46** for defining the inner and outer or downhill and uphill positions of the cart. The inner or downhill stop is best shown in Figure 9.

As shown in Figure 10, the track comprises a pair of rigidly related facing channels and the cart includes a transverse plate **52** to which side bars **54** are rigidly joined as by welding. Each side bar carries front and rear rollers or wheels **56**. The details are representative only and could be varied within the scope of the invention. For the present, let it suffice to note that the fork, whether empty or loaded, will be suspended by the means **36** from its respective center of mass for the reasons noted above.

The fork is basically of two-piece construction, including a lower section **58** and an upper section **60**. The lower section comprises the previously described tines **26** and an upright back frame **62** to the lower part of which the tines are rigidly joined as by welding. A central part of the back frame embodies a pair of upright channels **64** which afford guide means for carrying a depending part **66** of the upper section, which part is rigid with the track **46**. Thus, the lower section **58** is in the form of an L and the upper section **60** is in the form of an inverted L, and the two are vertically adjustably related via the guide channels **64** and depending upper section part **66** and are thus capable of assuming an extended position, as shown in full lines in Figure 6 as well as in Figures 1, 2, 3 and 5, or a shortened or retracted position, as shown in Figure 4 and in broken lines in Figure 6. Suitable latch pins **68** provide means for holding the sections in either position, as well as in intermediate positions if desired. Extra holes **70** in the channels **64** for receiving the latch pins **68** are shown in Figure 6. The latch pins thus afford releasable means for the purpose described and these are under control of individual latch levers **72** for overcoming the bias of springs **74** which normally hold the pins in locking position. The levers **72** may be equipped with rollers **76** for effecting a camming action with the downwardly diverging side frame bars **78** of the back frame **62**, thus facilitating withdrawal of the latch pins as well as means for holding the pins withdrawn or released, as suggested in broken lines at the left of Figure 6. In this instance, each roller **76** is journaled on a vertical axis on the horizontal leg of its lever **72**, and, when the lever is turned with the latch pin about the horizontal axis of the latch pin, the roller engages the proximate frame bar **78**; and, since this bar diverges downwardly, the roller must follow this divergence from the vertical and thus withdraws the latch pin.

When the fork is extended, the track **46**, overhanging the tines **26**, is elevated, and thus provides more room for the cube. Hence, the tines **26** may be used to penetrate the holes **24** in the lower layer of blocks at C1 (Figures 1, 2 and 3) and the entire cube may be handled.

When the fork is retracted or shortened (Figure 4), the upper half of the cube C may be handled by entering the tines in the holes **24** of the alined blocks in the layer C2. In those cases in which it is desired to handle, say, just the upper half of the cube as in Figure 4, it will be seen that to attempt to do so with the fork extended or full-height, the top of the fork, and especially the track **46**, would interfere with the boom **32**. This will be readily appreciated if one considers the tines **26** in Figure 4 as fixing the level of the layer C2 and the boom **32** as being fixed against vertical displacement, which it is. Hence, if one were to heighten the fork by extending the upper fork section **60**, it will be seen that the track **46** would be stopped by the boom.

The above demonstrates why it is desirable to provide a fork that can be shortened as to height: namely, to pick up less than a full cube as divided by a horizontal plane. One reason why a half-cube or other fraction of a cube may be desired, is that that particular amount may be all that is required at a certain location, as in unloading blocks around the periphery of a foundation in process. Another and a more significant reason is that the boom can handle a part-cube at a greater distance from the mast **30**. That is to say, a boom of a certain length can safely support a full cube at a certain distance from the mast; say fourteen feet. If the boom happened to be, say, seventeen feet long and the full cube were run out to the extreme end via the carriage **38**, the boom would be damaged because of the excess load on the longer lever arm. However, the same boom would safely carry less than a full cube at its extreme end, such as a half-cube. Thus, the arrangement disclosed here increases the versatility of the equipment, enabling the use of a longer boom in which full cubes can be safely handled through a portion thereof and half-cubes can be handled safely through the additional portion thereof, which therefore materially increases the reach of the boom and eliminates the necessity of maneuvering the truck. Since equipment of this type is normally operated by an operator standing on the ground and manipulating an electric remote control, it will be seen that the requirement that he returns to the vehicle periodically to maneuver same would be a nuisance. According to the present invention, if he sees that he can reach the indicated location by only a partly loaded boom, he will simply shorten the fork to its Figure 4 position and pick off the top half of the cube, returning the fork for the bottom half, finding it easier for the fork to make two trips than to change the position of the truck, which may be difficult because of excavations, poor footing, traction etc.

It will be recalled that the fork was previously described as having the track **46** along which the cart or suspension means part **44** is movable uphill and downhill between the two positions defined by the stops **48** and **50**, according to the condition of the fork as empty or full. At this point it should be noted that since the two positions discussed here are based on location relative to center of mass, the level of the fork when carrying a half cube or other section of layers will not be disturbed. It is only when the cube is divided vertically that the center of mass changes. Provision for that condition is made in the patent identified above and need not be discussed further here.

However, the present invention makes one significant departure from the automatic shifting of the cart **44** to accommodate different centers of mass in that it provides also for facilitating penetration of the cube by the tines. For this purpose, it must be considered that the cart is normally biased for return to its downhill position. A representative biasing means is shown here as including a cable **80** trained over a pair of sheaves **82** and **84** and connected to a spring **86**. The sheave **82** is carried by a lower part **88** of the part **66** of the upper fork section and the spring is anchored at **88'** to an upper part of the upper section part **66** (Figure 6). The other sheave **84** is carried at **90** by the upper fork section (Figure 9) adjacent to the junction of the track **46** and upper section part **66**.

The track **46** includes at its downhill portion a reversely inclined track portion **92**, which causes the cart **44** to take the position shown in Figure 9 when it is in its downhill position. That is to say, the rear wheels **56** of the cart are received by the minor track portion **92** and the front wheels of the cart are received by the major track portion. Without the reversed inclination **92**, the status of the cart would be such that a vertical lifting force thereon would have an uphill component along the track **46**, so that the cart would tend to run uphill when the fork is subjected to certain loads or to obstructions constituting loads, which will be presently amplified. This tendency has been overcome in the past by using a relatively strong spring at **86**, but the problem there was that the fork must be fully loaded before the lifting force could overcome the spring force, which was found to militate against easy insertion of the tines in the block apertures. For example, let it be assumed that the cart is at its downhill position (Figure 5) and an attempt is made to insert the tines into the lower layer apertures. Note that the tips of the tines **26** would lead the lifting or suspension point by a fairly large amount. Now, with the boom turned out at angle to the cube so that the tines can enter the block holes, the boom carriage **38** is run inwardly on the boom and the tines are manually guided into the block apertures. Since the tines lead the suspension point in the example assumed, the resistance of the blocks to the tines causes the fork to tip clockwise, turning the tines downwardly, because the lever arm is the distance between the tine tips and the suspension point. Thus, the carriage **38** via the cable **40** and cart **44** "pushes" the fork, increasing its tendency to tip, even though theoretically the fork should remain level when suspended at its center of mass. But, irregularities in the blocks and partial misalinement of the block apertures destroy the theoretical perfection, and initial penetration is often difficult.

However, according to the present invention, a much lighter spring is used at **86** and this in combination with the reversed track portion **92** achieves a novel result, in regard to which attention is again directed to Figure 9, wherein it is shown that the cart is received in part by the reversed track portion **92** and in part by the major track portion. Thus, the line of pull or overhead lifting force has no component uphill of the track, and if the fork is empty and the pull or lift remains directly vertical or substantially so, the cart remains in its downhill position. Hence, the structure just described comprises means acting on the downhill-positioned cart for temporarily overcoming the tendency of the cart to run immediately uphill, at least until the occurrence of some other event, about to be described. Or, stated otherwise, the means is releasable responsive to such other event, which is here a pull on the suspension means in a direction diverging upwardly and outwardly as respects the aforesaid direct overhead pull, and such diverging pull overcomes the temporary lock of Figure 9 on the cart and the cart then runs uphill as it should when the fork is loaded.

The above will be best understood from an examination of Figures 3 and 9. The latter shows the temporarily retained position of the cart, downhill and above the center of mass of the empty fork. This appears also in Figure 5. Figure 3 shows the initial penetration of the blocks by the tines. Here, as soon as the tines "feel" the obstruction of the blocks, which as heretofore explained causes the fork to tip in a clockwise direction generally about the tips of the tines as a fulcrum, the fork temporarily stops, but the carriage **36** continues to move along the boom **32** in an inward direction, or to the right as seen in Figure 5. This results in the exertion on the cart **44** of a pull that diverges from a direct overhead pull, and that pull breaks the temporary lock on the cart as established by the reversely inclined track portion **92**, whereupon the cart runs immediately to its uphill position (Figure 3) even though the tines have not yet fully penetrated the block apertures. Thus, the applied force "pulls" rather than pushes the fork tines into the block layer and the tendency of the fork to tilt clockwise as aforesaid is counteracted, and the tines approach a level status in which insertion into the layer is made much easier. Of course, when the tines are fully home, the lifting force will then be vertical to raise the cube and, since the pull is now over the center of mass, the balancing feature is intact. When the cube is set down and the cable **40** relaxed, the load of the cube is removed from the tines, and the spring **86**, though relatively light for the purposes just described, is strong enough to return the cart to its downhill position, and the carriage **38** is backed out along the boom **32** to withdraw the tines from the layer C1. Since the cart **44** is then in its downhill position, it will be above the center of mass of the empty fork. The same results and advantages are achieved when only a half or less horizontally-divided cube is handled. The sheave **42** is connected to the cart **44** by an appropriate articulated joint **94** to allow the necessary substantially universal movement.

Figure 11 illustrates a modified version of the structure just described, as respects the shape of the track, and here the track is shown at **46*a*** as being arcuate or curved. A portion **92*a*** thereof proximate to the back of the form is relatively "flat" and achieves the function of the reverse incline **92** in Figure 9, for example. The other components of the fork structure are designated by numerals heretofore employed in Figures 1–10 and these need not be re-applied. The significant point is that the portions **92** and **92*a*** serve the same functions, namely to temporarily retain the downhill position of the cart by resisting the uphill component until a lifting force is converted to a combined lifting and pulling force, which conversion is effected as the carriage **38** moves in along the boom **32** and as the fork tends to tilt when penetration is initiated, or this conversion may result from either occurrence or may partake of both.

It will thus be seen that a novel and improved fork or loader element has been provided, incorporating the features of self-balancing, adjustability and control of the suspension means as respects its change from a downhill status to an uphill status, all of which lend themselves to affording a fork or the like having a wider range of utility and versatility than known constructions. Features of the invention other than those outlined herein, as well as variations in the embodiments disclosed, will readily occur to those versed in the art, and these may all be achieved without departure from the spirit and scope of the invention.

What is claimed is:

1. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and inclining upwardly and outwardly therefrom in overhanging relation to the load-carrying means; suspension means riding the track and receivable

of lifting force from the overhead support so as to tend to run uphill on the tracks; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position substantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; control means on the element and operative on the downhill-positioned suspension means to resist the tendency of the suspension means to run uphill when subjected to a lifting force directly overhead whereby to releasably retain said suspension means in its downhill position, said control means being releasable in response to a lifting force applied upwardly and outwardly to the suspension means so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

2. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and inclining upwardly and outwardly therefrom in overhanging relation to the load-carrying means; suspension means riding the track and receivable of lifting force from the overhead support so as to tend to run uphill on the track; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position substantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; said track being so shaped at a downhill portion thereof as to act on the downhill-positioned suspension means to resist the tendency of the suspension means to run uphill when subjected to a lifting force directly overhead whereby to retain said suspension means in its downhill position until subjected to a lifting force applied upwardly and outwardly thereto so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

3. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and inclining upwardly and outwardly therefrom in overhanging relation to the load-carrying means; suspension means riding the track and receivable of lifting force from the overhead support so as to tend to run uphill on the track; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position substantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; said track having at a downhill portion thereof a track part extending uphill in the direction opposite to that of the track so as to receive the downhill-positioned suspension means for resisting tendency of the suspension means to run uphill when subjected to a lifting force directly overhead whereby to releasably retain said suspension means in its downhill position until subjected to a lifting force applied upwardly and outwardly thereto so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

4. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and inclining upwardly and outwardly therefrom in overhanging relation to the load-carrying means; suspension means riding the track and receivable of lifting force from the overhead support so as to tend to run uphill on the track; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position substantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; said track having such shape and inclination that a downhill portion thereof is of lesser slope than an uphill portion thereof so as to receive the downhill-positioned suspension means for resisting tendency of the suspension means to run uphill when subjected to a lifting force directly overhead whereby to releasably retain said suspension means in its downhill position until subjected to a lifting force applied upwardly and outwardly thereto so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

5. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and being at least in part of upwardly concave shape so as to extend upwardly and outwardly in overhanging relation to the load-carrying means; suspension means riding the track and receivable of lifting force from the overhead support so as to tend to run uphill on the track; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position substantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; said track having a downhill portion directed inwardly and uphill relative to said upwardly concave shape so as to receive the downhill-positioned suspension means for resisting tendency of the suspension means to run uphill when subjected to a lifting force directly overhead whereby to releasably retain said suspension means in its downhill position until subjected to a lifting force applied upwardly and outwardly thereto so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

6. A loader element adapted to be lifted by an overhead support, comprising: a generally upright back part and load-carrying means rigid on and extending generally horizontally outwardly from a lower portion of said back part; a track rigidly secured to an upper portion of said back part and inclining upwardly and outwardly therefrom in overhanging relation to the load-carrying means; suspension means riding the track and receivable of lifting force from the overhead support so as to tend to run uphill on the track; uphill and downhill stops on the element respectively establishing for said suspension means a downhill position sustantially directly over the center of mass of the empty element and an uphill position substantially directly over the center of mass of the loaded element; control means on the element and operative to releasably confine the downhill-positioned suspension means to its downhill position when subjected to a lifting force directly overhead and releasable in response to a lifting force applied upwardly and outwardly to the suspension means so that said suspension means runs uphill; and means biasing the suspension means for return to its downhill position.

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