Jan. 9, 1968 G. K. STOILOV 3,362,503

LIFTING MEANS CONSTRUCTION

Filed Feb. 24, 1966 2 Sheets-Sheet 1

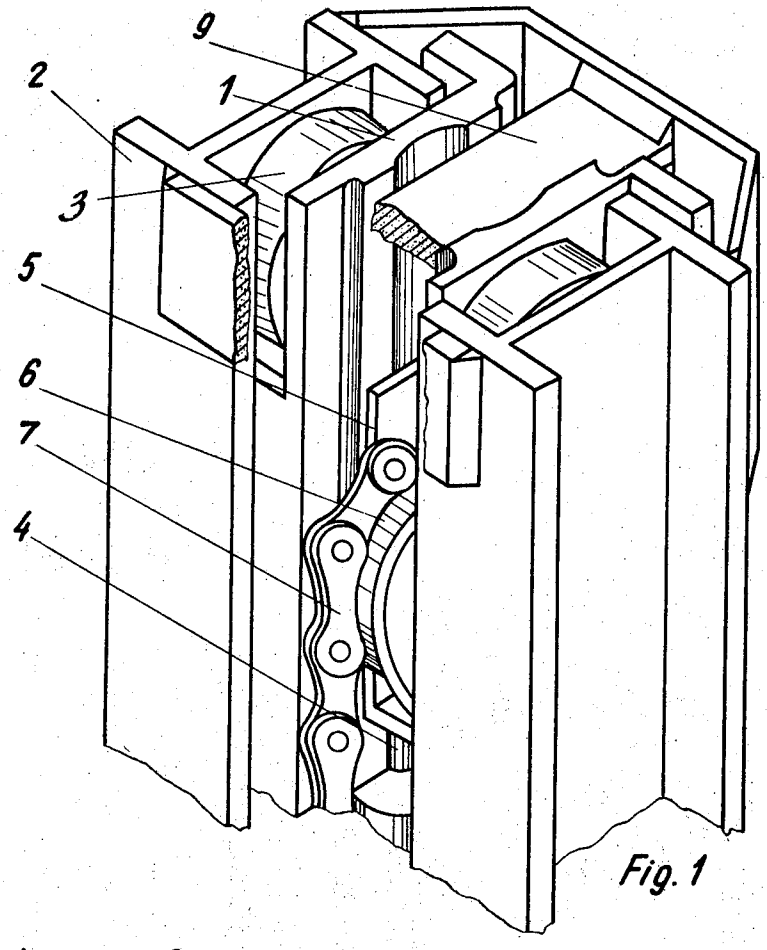

Fig. 1

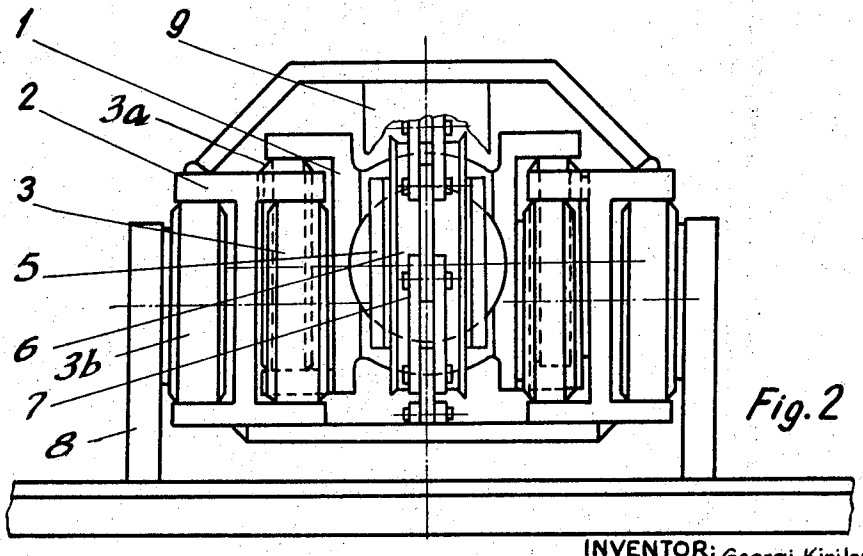

Fig. 2

INVENTOR: Georgi Kirilow STOILOV
by: Arthur O. Klein
Attorney

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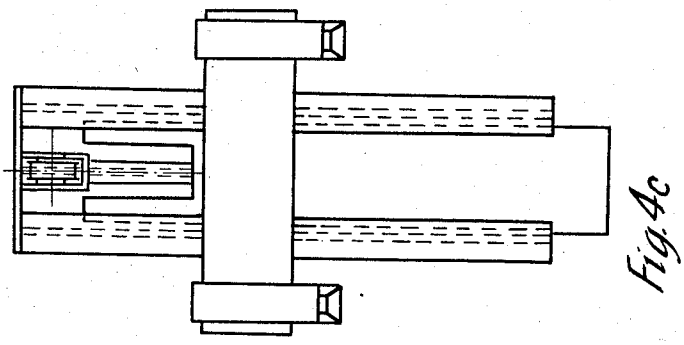

Fig. 4c

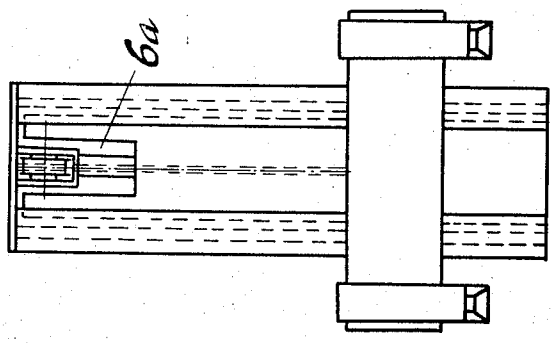

Fig. 4b

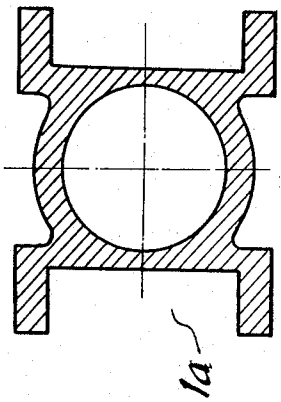

Fig. 3

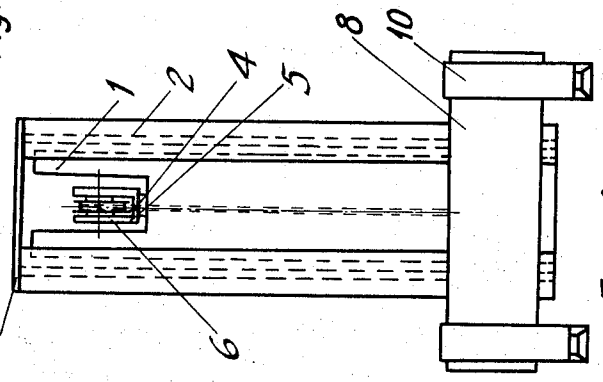

Fig. 4a

INVENTOR:

Georgi Kirilov STOILOV

BY Arthur O. Klein

his Attorney

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3,362,503

LIFTING MEANS CONSTRUCTION

Georgi Kirilow Stoilov, Sofia, Bulgaria, assignor to Nautshno-Izsledovatelski i Proektno-Konstruktorski Institut po Elektrokari i Motokari, Sofia, Bulgaria, a firm

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This invention relates generally to improved lifting means for fork-lift trucks and similar devices. In particular, the mechanism of this invention relates to a novel column construction which incorporates hydraulic fork-lift means.

There are already known in the art hydraulic lift trucks which incorporate a stationary column having vertically extending recesses at opposite sides of its outer periphery which serve to slidingly guide a pair of sliding blocks that are connected to a vertically movable column which forms part of the fork-lift carriage. The vertically movable column is constructed of two semi-circular shell members having flanged edge portions adapted to receive a plurality of clamping bolts and further having guiding slides operatively mounted thereon over which the rollers of the vertical carriage are adapted to run. The two main members of the aforedescribed known hydraulic lifting means, i.e., the stationary column and the movable column, frictionally move with respect to each other, which results in diminished efficiency and therefore affects the power input supply requirements for the device. Furthermore, the aforedescribed movable known fork-lift hydraulic lifting means comprise specially designed shell-shaped component members which are quite costly to manufacture.

It is a general object of this invention to provide an improved hydraulic fork-lift lifting device of the aforedescribed character having the following important advantages:

(a) Improved efficiency due to guidance by means of rollers of the movable fork-lift carriage;

(b) A significant decrease in the number of component parts and, consequently, in overall weight, due to the fact that the hydraulic lifting cylinder is incorporated in the stationary column itself;

(c) Greater visibility for the operator of the device since the overall width of the fork-lift vehicle is smaller, due to the unitary construction of the stationary column and the hydraulic lifting cylinder.

(d) Structural component parts of standard cross-section may be used in constructing the hydraulic lifting cylinder.

The improved hydraulic lifting means of this invention operate as follows:

The stationary column of the device is composed of prefabricated plates of suitable cross-section, so that the stationary column has a pair of opposite vertically extending recesses. Furthermore, the stationary column is provided with an axial cylindrical bore. A plunger or piston is reciprocably movably mounted in said cylindrical bore. The pair of lateral recesses guide a movable column by means of rollers. This movable column is constructed of two I-shaped upright beams which are mutually rigidly connected to each other by means of a plurality of welded connecting plates. The vertically movable fork-lift carriage is guided by means of rollers along the I-shaped double beam portion of the movable column. On top of the plunger or piston there is rotatably mounted a chain roller which movably guides a chain. One of the ends of this chain is bolted to the stationary column and the other end is connected to the vertically movable fork-lift carriage. Thus, the speed of the plunger or piston has a 1:2 ratio with respect to the carriage.

The upper end of this stationary column is provided with a recess within which the plunger or piston with the chain roller mounted thereon may freely travel for a certain predetermined distance before the vertically movable carriage is engaged and starts moving upwardly. After the plunger or piston has travelled this predetermined free-travel distance, the vertically movable carriage and the plunger of piston travel jointly. In this way a free initial lift of the carriage and a close fitting of the cross-sections of the telescoping column members is ensured.

The lifting operation comprises the following two stages: During an initial lifting stage the chain roller travels freely within the recess of the stationary column. During this initial stage the vertically movable fork-lift carriage travels twice as fast as the piston or plunger, while the movable double-I beam column remains stationary. This initial lifting stage continues until a chain roller, mounted on top of the piston or plunger, reaches the upper end of the recess in the stationary column, whereupon this chain roller engages a plate member of the movable, double-I beam column, and thereafter the plunger or piston and the double-I beam column move jointly. Thus, in the initial lifting stage the height of the fork-lift truck remains unchanged.

During the second lifting stage the movable double-I beam column travels upwardly jointly with the chain roller, thereby causing the overall height of the fork-lift truck to gradually increase.

In order to make the invention more clearly understood, reference will be made to the accompanying drawing which is given by way of example and in which:

FIGURE 1 is a partial view in perspective of the column top of the improved hydraulic fork-lift lifting device of this invention;

FIGURE 2 is a top plan view of the column top illustrated in FIGURE 1 with certain portions cut away for sake of clarity;

FIGURE 3 is a plan cross-sectional view illustrating the shape of the stationary column member;

FIGURE 4*a* is a diagrammatic elevation of the device of this invention, illustrating the vertical carriage in its bottom position;

FIGURE 4*b* is a diagrammatic elevation of the device of this invention, illustrating the vertical carriage in its upper limit free-travel position; and

FIGURE 4*c* is a diagrammatic elevation of the device of this invention after the plunger or piston of the hydraulic cylinder has passed the upper limit of its free-travel and has emerged from the recess in the stationary column.

Referring now specifically to the drawing, there is illustrated in FIGURES 1 and 2 the top ends of the stationary column **1** and of the movable double-I beam column **2**. The double-I beam column **2** forms two pairs of vertically extending channels. The stationary column **1** forms a third pair of channels **1***a* as illustrated in FIG. 3. A first pair of guide rollers **3***a* is rotatably mounted on the webs of the double-I beam column **2** at the lower end of the double-I beam column **2**. A second pair of guide rollers **3** is mounted on the webs **1***a* at the top end of the stationary column **1**. A third pair of guide rollers **3***b* is rotatably mounted on the vertically movable carriage **8** and causes the latter to be guided along the outer pair of channels of the double-I beam column **2**. The pair of rollers **3***a* and **3** cause the double-I beam **2** to be guided along the pair of channels **1***a* formed by the stationary column **1**. A plunger or piston **4** is reciprocally mounted in the stationary hydraulic cylinder column **1**. The plunger or piston **4** has a fork member **5** projecting upwardly therefrom. A chain roller **6** is axially rotatably supported

by said fork member 5. A chain 7 is movably guided over the chain roller 6. The chain 7 is secured at one of its ends to the rear portion of the stationary column 1 and at its other end to a vertically movable carriage 8. A plate member 9 is welded to the top of the double-I beam column 2. The chain roller 6 runs idle with respect to the double-I beam column 2 in the first lifting stage. After the chain roller 6 has risen to the top of the recess 6*a*, the fork member 5 strikes the plate 9 and begins to lift the double-I beam column 2.

Referring now specifically to FIGURES 4*a* and 4*b*, it will be noted that the chain roller 6 arises in a "dead stroke" until the top of the fork member 5 strikes the plate member 9. During this portion of the lifting operation the vertical carriage 8 together with the fork-lift 10 rises without changing the overall dimensions of the fork-lift truck itself.

Referring now specifically to FIGURE 4*c* it will be noted that in the second lifting stage the chain roller 4 and fork member 5 rise out of the recess 6*a* and lift up with them the double-I beam column 2 after the fork member 5 strikes the plate member 9.

It is of course to be understood that what has been described above is applicable not only to hydraulic fork-lift truck devices but also to other lifting devices. It is, therefore, not desired to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

What I claim is:

1. An improved lifting means construction, comprising in combination, a first column having an axial bore and a pair of oppositely projecting channel members extending along said first column, piston means reciprocally mounted in said first column, a chain having one end secured to said first column and being slidably mounted over said piston means, a second column slidably mounted with respect to said first column, movable carriage means slidably mounted with respect to said second column, the other end of said chain being secured to said movable carriage means, said first column further including a recess axially extending downwardly from the top end of said first column, a plate member secured over said second column, and activating means operatively connected to said piston means for selectively reciprocally moving the latter; whereby said piston means are adapted to move freely within the confines of said axially extending recess without lifting said second column with respect to said first column, said piston means when selectively acted on by said activating means moving upwardly and striking said plate member and thereafter lifting said second column with respect to said first column.

2. The improved lifting means construction as set forth in claim 1, wherein said activating means comprise hydraulic activating means for selectively reciprocably moving said piston means in said axial bore.

3. The improved lifting means construction as set forth in claim 1, wherein said piston means include a fork member projecting upwardly therefrom, and a chain roller rotatably mounted in said fork member, said chain being movably mounted over said chain roller.

4. The improved lifting means as set forth in claim 3, including roller means operatively mounted between said first and second column for guiding said second column along said pair of oppositely projecting channel members of said first column.

5. The improved lifting means as set forth in claim 4, including a pair of third rollers rotatably mounted in said movable carriage means for guiding said movable carriage along the pair of outer channels of said pair of rigidly connected I-beams.

6. The improved lifting means as set forth in claim 3, wherein said roller means comprise a first pair of rollers rotatably mounted adjacent to the top end of said first column and a second pair of rollers rotatably mounted adjacent to the bottom end of said second column.

7. The improved lifting means as set forth in claim 1, wherein said movable carriage means include fork-lift means laterally extending therefrom.

8. The improved lifting means as set forth in claim 3, including a plurality of plates welded to said pair of I-beams so as to rigidly connect them to each other.

9. The improved lifting means as set forth in claim 7, wherein said chain roller when activated via said piston means moves said movable carriage upwardly by acting on said chain, the speed of said movable carriage being double the speed of said piston means.

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EVON C. BLUNK, *Primary Examiner.*

H. C. HORNSBY, *Assistant Examiner.*