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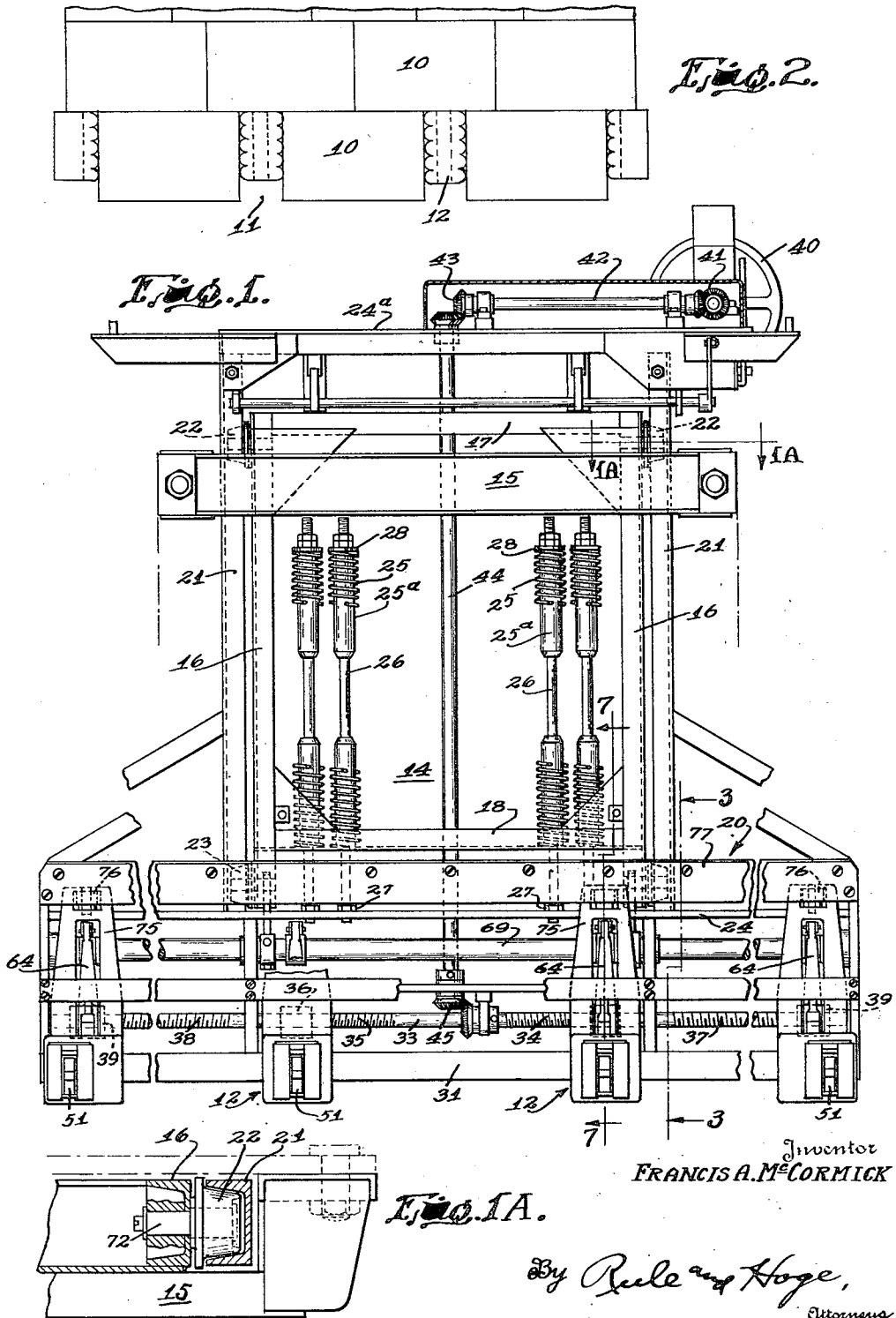
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2,771,204

LIFTING FORK FOR STACKED ARTICLES

Filed June 8, 1955

3 Sheets-Sheet 1



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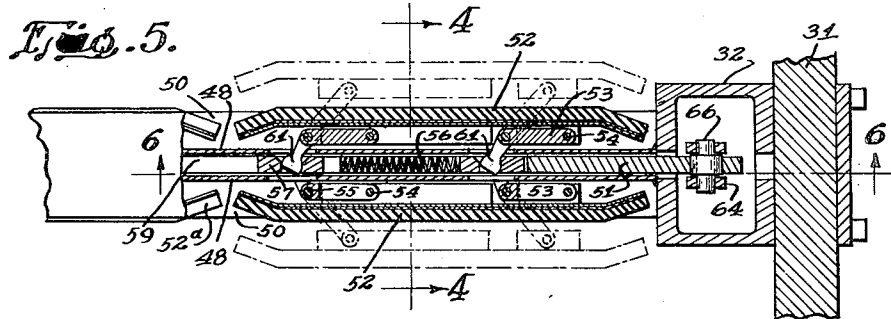
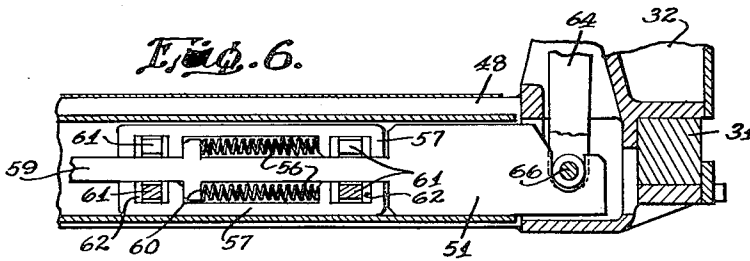
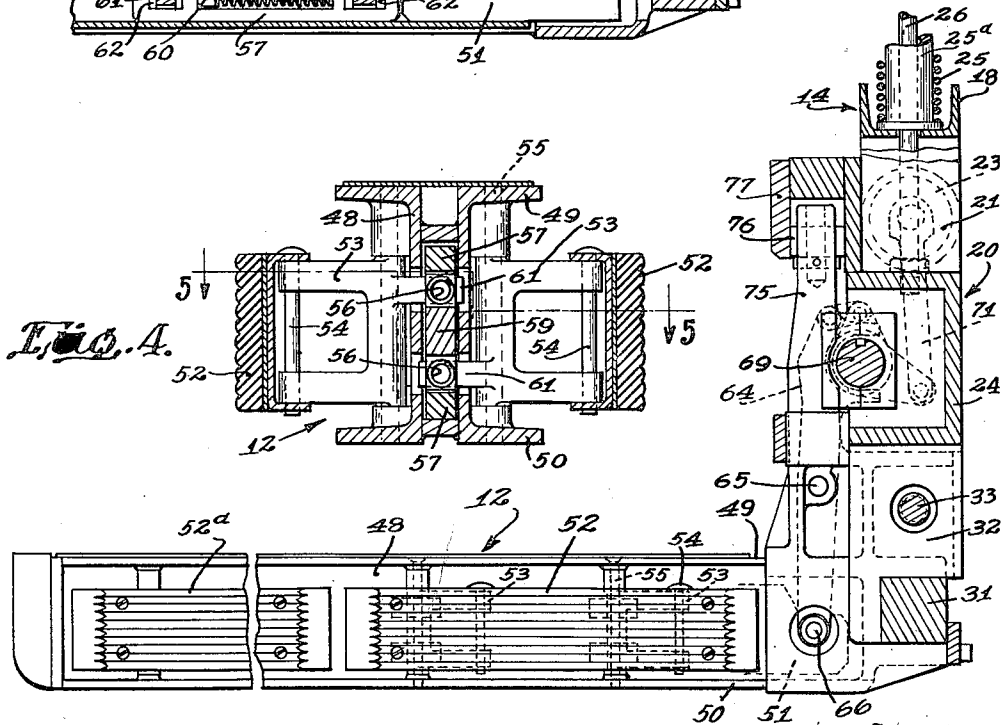


Fig. 3.

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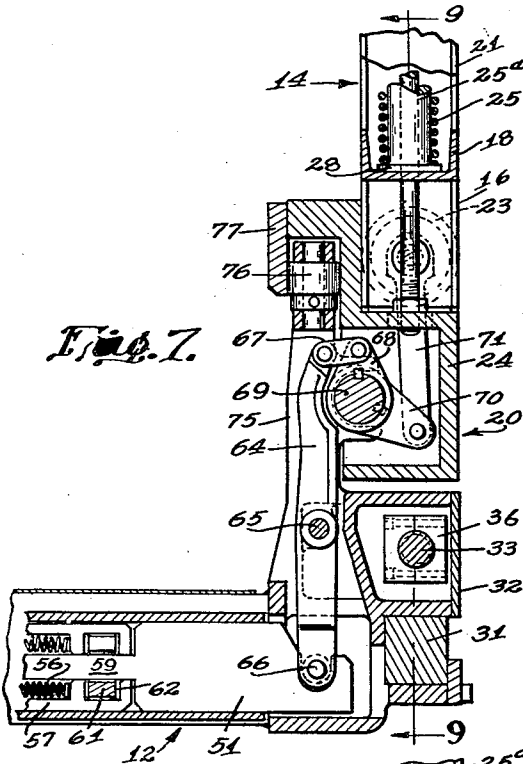


Fig. 7.

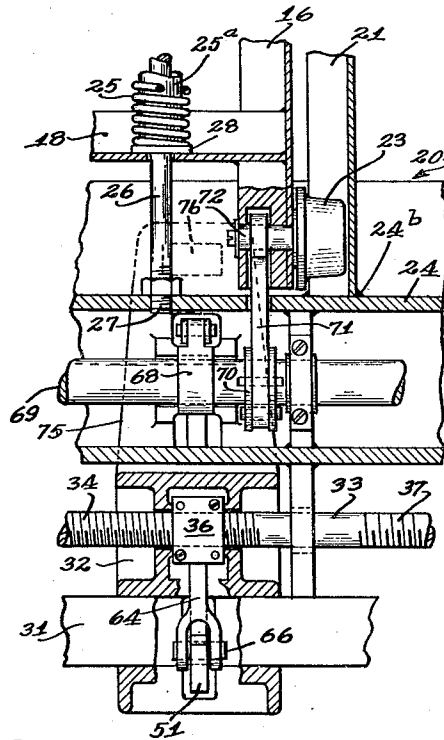


Fig. 9.

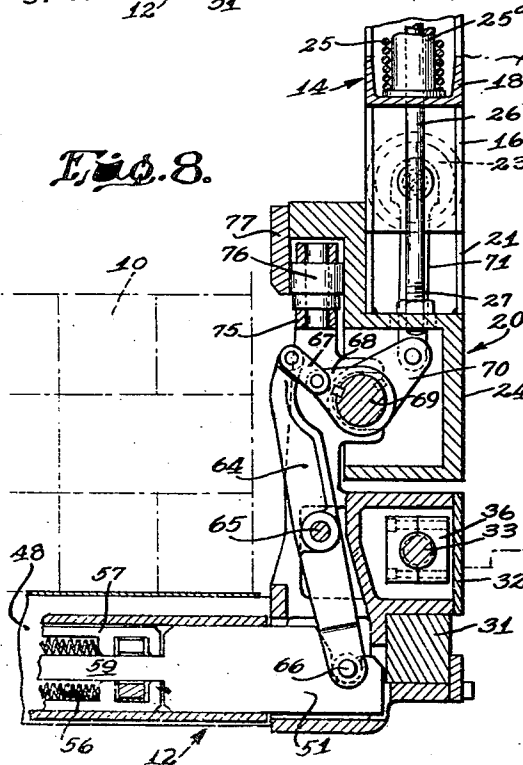


Fig. 8.

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LIFTING FORK FOR STACKED ARTICLES

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Application June 8, 1955, Serial No. 513,995

3 Claims. (Cl. 214—655)

My invention relates to lifting forks which are used for lifting and transporting loads of articles or units each load consisting of a multiplicity of articles stacked or arranged in a compact pile or group. The invention comprises an apparatus of a type which is adapted for lifting a load of articles or units built into a stack or pile comprising a bottom layer consisting of parallel rows or "rail courses" spaced apart to provide spaces for the lifting arms or prongs of the lifting fork. The lifting arms are equipped with expansible gripping devices which are spread to grip the articles forming the lower courses and lift them together with the remaining portion of the load. A lifting fork of this general type is disclosed in the patent to Cartwright, 2,530,375, November 21, 1950, Lifting Fork With Gripping Means. The present invention embodies various modifications and improvements over the apparatus disclosed in the Cartwright patent.

The present invention in the preferred form herein illustrated comprises an upright framework carrying horizontal lifting arms or prongs said framework being mounted on an upright supporting frame for up-and-down movement relative thereto. The supporting frame may be carried by a conventional lifting fork truck. The framework carrying the lifting arms, herein referred to as the movable frame, is yieldingly suspended or supported by the carrier frame. The lifting arms are equipped with expansible gripping devices which are spread by upward movement of the movable frame, to grip the articles forming the "rail courses" so that they are lifted as part of the load unit.

An object of the present invention is to provide improved gripping means for effectively holding the articles forming the lower course of the load and for limiting and controlling the gripping force independently of the weight of the superimposed load.

The invention further includes manually operated means for moving the lifting arms laterally toward and from each other to positions corresponding with the spacing of the "rail courses" and for maintaining equal spacing between the several lifting arms.

Other objects of the invention will appear more fully hereinafter in connection with the following detailed description.

Referring to the accompanying drawings:

Fig. 1 is a front elevational view of the apparatus, parts being broken away;

Fig. 1A is a section at the line 1A—1A on Fig. 1;

Fig. 2 is a diagrammatic elevational view showing a unitary pile of the articles forming the load and the lifting arms in lifting position;

Fig. 3 is a sectional elevation at the line 3—3 on Fig. 1;

Fig. 4 is a cross-section at the line 4—4 on Fig. 5;

Fig. 5 is a section at the line 5—5 on Fig. 4 showing particularly the construction of the expansible gripping means;

Fig. 6 is a sectional elevation at the line 6—6 on Fig. 5;

Fig. 7 is a sectional elevation substantially at the line 7—7 on Fig. 1, showing particularly the means for op-

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erating a pair of grippers, the parts being in the positions assumed while the grippers are retracted;

Fig. 8 is a similar view but with the parts in the positions assumed when the grippers are expanded;

Fig. 9 is a section at the line 9—9 on Fig. 7;

Referring to Fig. 2 which illustrates the way in which the articles 10 are stacked or built into a compact group to form a unitary load, the bottom layer of articles consists of parallel rows or "rail courses" with spaces 11 therebetween to receive the lifting arms or prongs 12. The remaining articles forming the stack or load are compactly arranged with their vertical surfaces in staggered relation, permitting the entire load to be lifted and transported as a unit.

The apparatus includes a supporting frame 14 which may be attached to a lifting frame 15 of a fork truck, said lifting frame being power operated for lifting and lowering the fork. The supporting frame 14 includes vertical frame members 16, an upper cross bar 17, and a lower cross bar 18. The lifting arms 12 extend horizontally forward from an upright framework 20 by which they are carried, said framework being movable up and down relative to the supporting frame 14 and being herein referred to as the movable frame. The movable frame includes vertical channel bars 21 which form tracks for upper and lower guide rolls 22 and 23 journaled in the frame members 16. The movable frame includes lower and upper horizontal frame members 24 and 24^a connected, as by welding 24^b (Fig. 9), to the channel bars 21.

Means for yieldingly supporting the weight of the movable frame 20 include coil springs 25 mounted on sleeves 25^a on vertical rods 26. The rods have a fixed connection at their lower ends 27 with the movable frame 20 such connection being provided by screw threading the rods into the frame member 24 (see Figs. 7-9). The coil springs 25 are held under compression between washers 28 adjacent the upper ends of the rods and the lower cross bar 18 on the supporting frame 14. With this construction the weight of the movable frame 20 and parts carried thereby is yieldingly supported and counterbalanced by the springs which are under sufficient compression to hold the movable frame 20 in its upper position relative to the supporting frame 14.

The lifting arms 12 are mounted for horizontal movement transversely of their direction of length for spacing the arms to correspond with the spacing of the channels 11 (Fig. 2). The frame 20 comprises a cross bar 31 which is square in cross-section and on which are slidably mounted carrier frames 32 individual to the arms 12 and to which the arms are rigidly secured. Means for manually adjusting the lifting arms 12 horizontally includes a screw-threaded shaft 33 extending parallel with the bar 31. The shaft 33 has right-hand and left-hand screw-threads 34 and 35 which are threaded through correspondingly threaded bearing blocks 36 mounted in the carrier frames 32 of the two inner lifting arms 12. The end portions of the rod 33 are formed with right-hand and left-hand screw threads 37 and 38 of greater pitch than the threads 34, 35. These end portions are threaded through bearing blocks 39 (Fig. 1) in the frames 32 of the outer arms 12.

The screw shaft 33 is rotated for adjusting the arms by a hand wheel 40 having driving connection with the shaft through a train of gearing including miter gears 41, shaft 42, gears 43, vertical shaft 44 and intermeshing gears 45 on the shafts 44 and 33. Rotation of the screw shaft 33 in one direction moves the two inner lifting arms farther apart and at the same time moves the outer lifting arms apart at a faster rate. Rotation of the screw shaft in the opposite direction draws the lifting arms closer together. The relative pitches of the screw threads are such that the lifting arms are maintained at equal distances apart, the distances through which the inner and

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outer arms are moved being in the ratio of 1 to 2. The lifting arms are adjusted to correspond to the spacing of the rows of articles 10 forming the "rail courses."

Each of the carrier frames 32 for the lifting arms 12, is formed with an upwardly extending arm 75 with a roller 76 journaled on the upper end portion of the arm. The horizontal frame member 24 provides a track for the rollers. A face plate 77 attached to the frame member 24, forms therewith a channel in which the rollers 76 run. The arms 75 take up the pressure of the load on the fork arms 12 while rollers permit the transverse movement of the arm 12.

The lifting arms 12 are provided with expansible gripping devices which will now be described. Each arm comprises a framework or casing extending lengthwise of the arm including parallel members 48 which as shown in Fig. 4 are substantially U-shaped in cross-section including vertical portions spaced apart and upper and lower horizontal flange portions 49, 50. A slide bar 51 extends lengthwise of the arm, between the members 48, and is movable lengthwise within the arm. Gripper bars 52, extending lengthwise of the arm 12, are mounted on opposite sides of the arm and have a facing of rubber or the like. The grippers have parallel link connections with the arm by means of links 53. Each link is connected by a pivot pin 54 to the gripper bar 52 and to the frame member 48 by a pivot pin 55. Coil compression springs 56 are mounted in a frame 57 which is slidable lengthwise between the vertical walls of the casing 48. The slide bar 51 is formed with a stem 59 which extends lengthwise through the frame 57 and is formed with shoulders 60 which form abutments for one end of each of the springs 56. The opposite ends of the springs bear against the frame 57. Each of the links 53 is formed with an arm 61 which extends into an opening 62 in the slidable frame 57. It will be seen that with this construction the slide bar 51 when moved lengthwise to the right (Figs. 5 and 6) will carry with it the frame 57, the movement being transmitted through the springs 56, and will thereby swing the links 53 about their pivots 55, thus moving the gripper bars 52 to the broken line positions (Fig. 5). The grippers are thus spread apart to gripping position in which they bear against the articles 10 when the lifting fork is in position for lifting its load.

The means for operating the bar 51 (Figs. 7-9) includes a lever 64 connected by a pivot 65 to the frame 32. The lever is connected by a pivot 66 at its lower end to the slide bar 51 and at its upper end is connected by a link 67 to a rock arm 68 splined on a rock shaft 69. A rock arm 70 keyed to the shaft 69 is pivoted to a vertical link 71, the upper end of the link being connected to the pivot pin 72 of the roll 23.

The spline connection of the rock arm 68 with the shaft 69 permits the necessary sliding movement of the rock arm lengthwise of the shaft during adjustment of the lifting arms 12. Each of the lifting arms 12 may be provided with a plurality of pairs of gripper bars 52 arranged in tandem. Thus as shown in Figs. 3 and 5 a second pair of grippers 52^a is provided. These may be operated in the same manner as above described for the first pair. For this purpose the stem 59 of the slide bar 51 is extended and operates through a second frame 57 and springs 56 for spreading the grippers 52^a simultaneously with the spreading of the grippers 52.

The operation may be summarized as follows: The operator first makes any needed lateral adjustment of the lifting arms 12 by means of the hand wheel 40 for spacing the arms to correspond with the spacing of the channels 11 (Fig. 2). The lifting fork is then moved forward so that the lifting arms enter the channels 11. The movable frame 20 is at this time in its upper position relative to supporting frame 14 (Fig. 7). The supporting frame 14 is then lifted, for example, by a motor on the fork truck. During this movement the movable frame is

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carried upward with the supporting frame 14 until arrested by the arms 12 being brought into engagement with the superimposed load. The weight of this load is sufficient to arrest the arms while the supporting frame continues its upward movement permitted by the coil springs 25 which are further compressed during such continued upward movement. This continued movement of the carrier frame after the arms 12 are arrested operates through the links 71 (Figs. 7-9) and arms 70 to rock the shaft 69 so that the levers 64 move the slide bar 51 to the right. The first portion of the movement of the slide bars 51 operates to spread the grippers 52 into contact with the articles 10 of the "rail courses." When the grippers are thus arrested the continued movement of the slide bar 51 is taken up by the compression coil springs 56 which thereby apply a gradually increased pressure of the grippers until the slide bars 51 are arrested by contact with the bar 31. This prevents further relative movement of the supporting frame 14 and the movable frame 20 so that during the continued upward movement of the supporting frame the movable frame 20 is carried with it thereby lifting the load. The load is then carried to any desired position and lowered on to a suitable support. Further lowering of the supporting frame 14 after the weight of the load is taken off the arms 12 permits the springs 25 to operate the slide bars 51 and release the gripping arms and then permits the lifting arms to be lowered and withdrawn from beneath the load.

Modifications may be resorted to within the spirit and scope of my invention.

I claim:

1. A lifting fork comprising a supporting frame, a movable frame mounted for up-and-down movement relative to the supporting frame, lifting arms carried by the movable frame and extending horizontally forward therefrom, gripper bars carried by said arms and extending lengthwise thereof, the gripper bars comprising pairs individual to the lifting arms with the gripper bars of each pair positioned at opposite sides of the arm, slide bars extending lengthwise of the arms and mounted between the gripper bars, parallel links between the gripper bars and the slide bars including pairs of links individual to the gripper bars each link being pivotally connected at one end to its gripper bar and pivotally connected at its opposite end to the lifting arm, and means providing operating connections between the links and slide bars including coil springs and slidable frames, one link of each said pair being formed within an extension engaging one of said slidable frames, the springs being interposed between the slidable frames and slide bars, thereby providing a yielding connection by which the gripper bars when in article gripping position are yieldingly held against the articles, said springs permitting continued movement of the slide bars after the gripper bars are arrested by contact with said articles.

2. A lifting fork comprising a movable frame, lifting arms extending horizontally forward from said frame, carrier frames individual to said arms and to which the arms are rigidly connected, said carrier frames being mounted for horizontal sliding movement on said movable frame, means for adjusting the carrier frames and thereby adjusting the lifting arms toward and from each other, said adjusting means comprising a screw-threaded shaft journaled in the movable frame, the lifting arms including outer arms and intermediate arms, the screw-threaded shaft having right and left-hand screw threads in threaded engagement with the intermediate arms for moving them toward and from each other, the screw-threaded shaft having end portions formed with screw threads of a greater pitch than those of the first mentioned threads and connected to move the outer arms simultaneously with the adjustment of the intermediate arms, the pitch of the screw threads being such that equal

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spacing is maintained between each two adjacent arms during their adjustment, and means for rotating the shaft.

3. A lifting fork comprising a supporting frame, a movable frame connected for up-and-down movement relative to the supporting frame, lifting arms, carrier frames individual to said arms and to which the arms are connected with the arms parallel and extending horizontally forward, gripper bars mounted on said arms, slide bars extending lengthwise of said arms and operatively connected to the gripper bars, a rock shaft mounted in the movable frame and extending horizontally in a direction transverse to the lifting arms, means for operatively connecting the slide bars to the supporting frame, said connecting means including levers pivoted to said carrier frames and to the slide bars, rock arms mounted

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on said shaft for sliding movement lengthwise thereof and splined to the shaft, links connecting said rock arms to said levers, rock arms keyed to said shaft, links connecting said last mentioned rock arms to the supporting frame, and means for adjusting the lifting arms and their carrier frames in a direction lengthwise of said shaft.

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