Sept. 2, 1952 L. D. HUFFMAN 2,609,113

FORK STRUCTURE FOR LIFT TRUCKS AND HOISTS

Filed March 16, 1948 2 SHEETS—SHEET 1

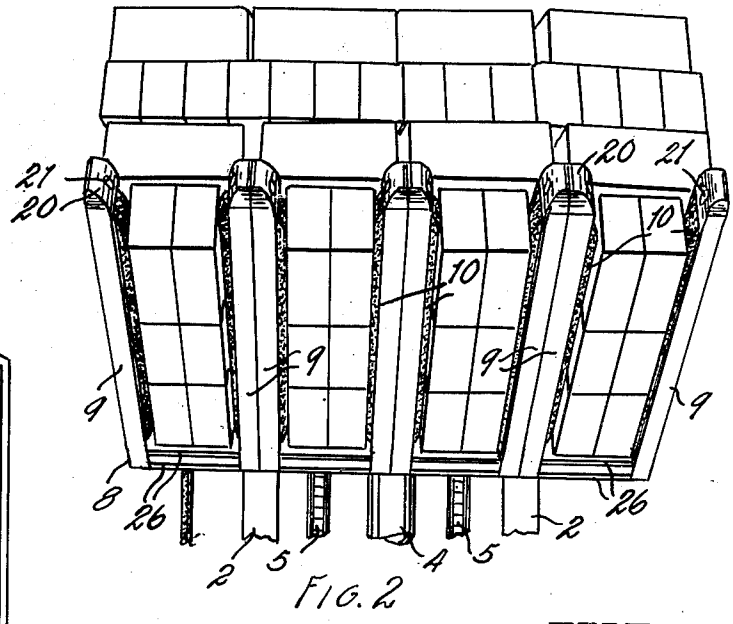


FIG. 2

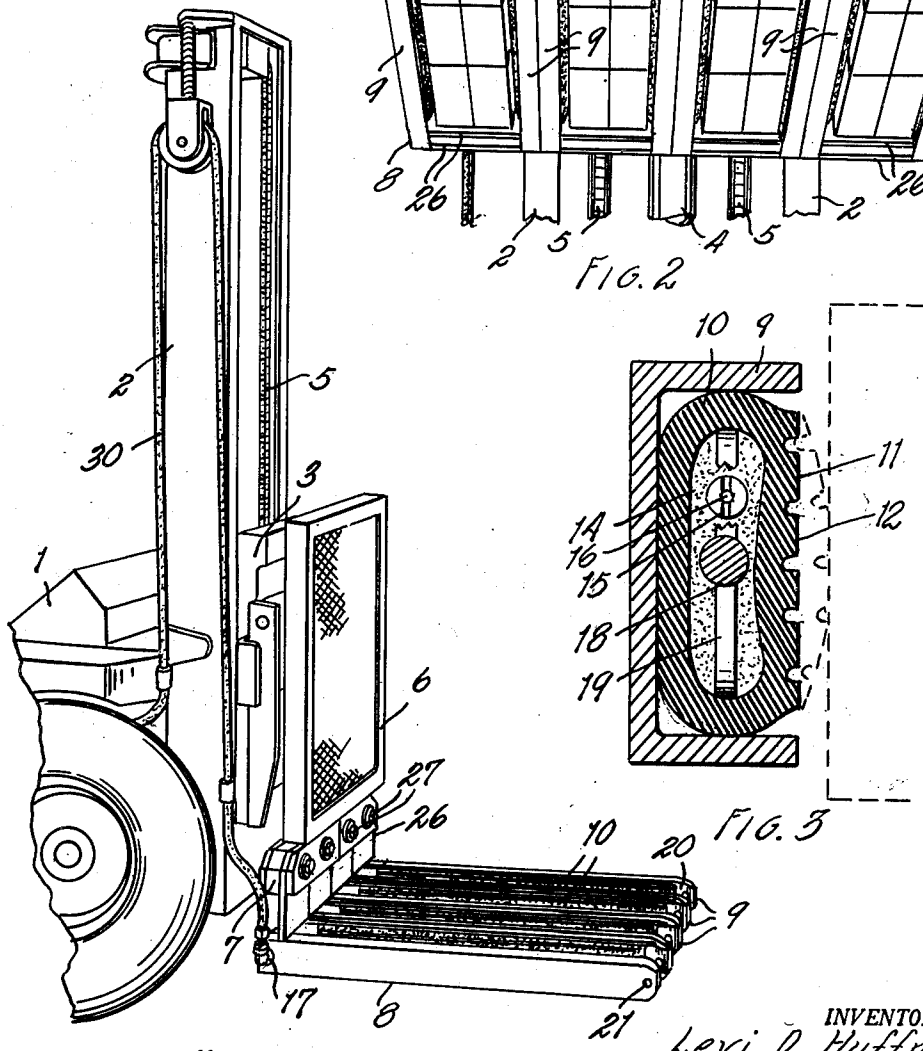


FIG. 1

FIG. 3

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2 SHEETS—SHEET 2

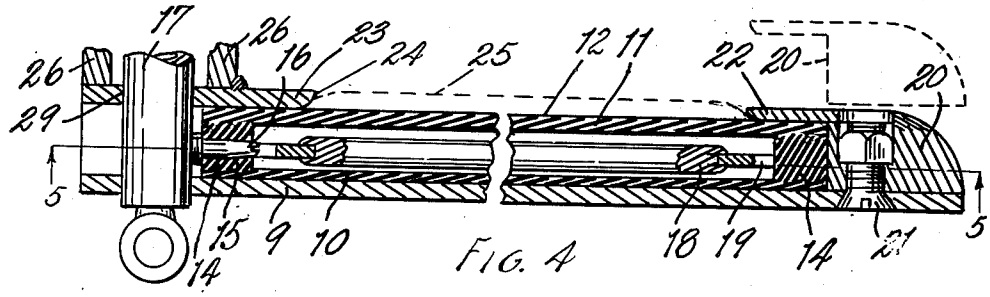


FIG. 4

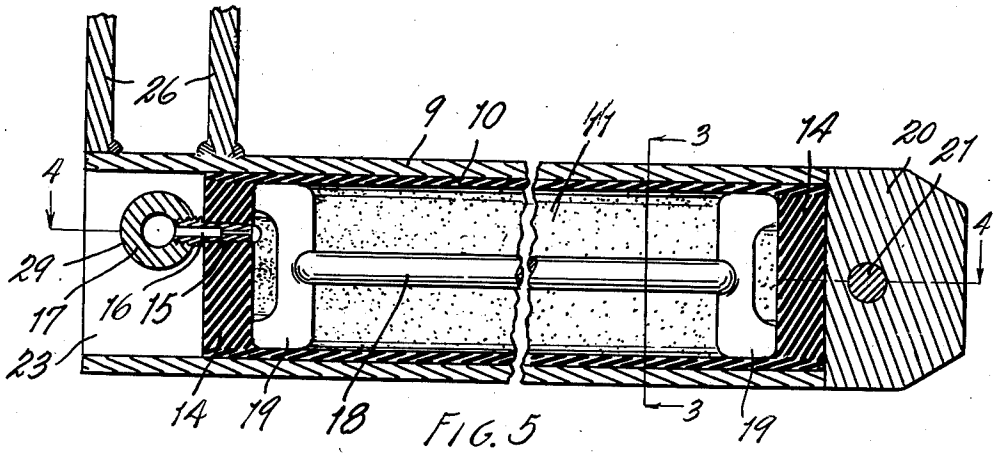


FIG. 5

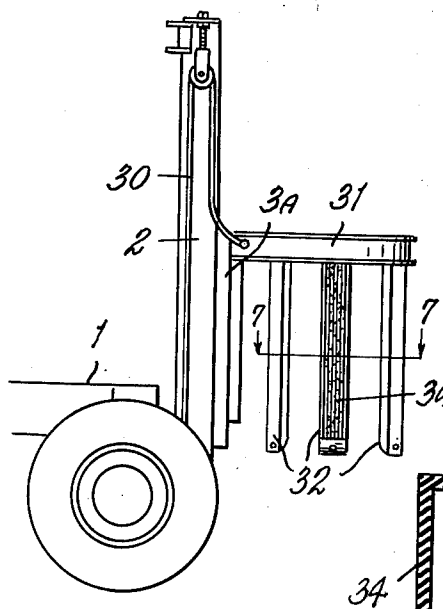


FIG. 6

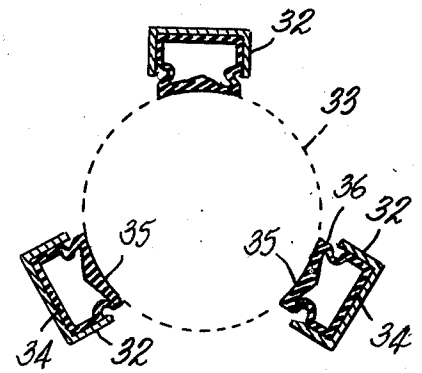


FIG. 7

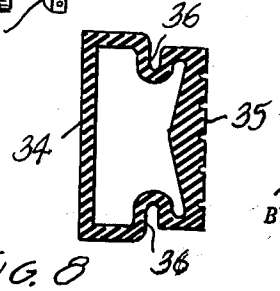


FIG. 8

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UNITED STATES PATENT OFFICE

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FORK STRUCTURE FOR LIFT TRUCKS AND HOISTS

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15 Claims. (Cl. 214—65.2)

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This invention relates to improvements in fork structure for lift trucks and hoists.

The principal objects of this invention are:

First, to provide a novel form of fork structure for lift trucks and the like for lifting stacks of bricks or similar articles without the use of a skid or pallet.

Second, to provide expansible grip elements for the tines of a lift fork which can apply a uniform gripping pressure to a series of bricks or similar articles to lift the bricks and other bricks stacked upon those engaged by the grips.

Third, to provide a tine structure for a lift fork which is extremely strong and easily assembled to contain a pneumatically expansible grip element.

Fourth, to provide a novel form of pneumatically expansible grip element for a lift truck which element has a wide range of expansion and which is reinforced against longitudinal collapse.

Fifth, to provide a pneumatically expansible grip element which is inexpensive to manufacture and easily installed in the supporting tines of a lift fork.

Sixth, to provide pneumatically expansible load engaging members which may be mounted in any of a plurality of positions on a lift machine for gripping and lifting various objects.

Further objects relating to details and economies of the invention will appear from the description to follow. The invention is defined and pointed out in the claims.

The drawings, of which there are two sheets, illustrate a preferred form of my lift fork and tine element therefor and a modified arrangement of my tine element and a modified form of expansible grip element.

Fig. 1 is a fragmentary perspective view of the forward end of a lift truck with my lift fork installed thereon.

Fig. 2 is a fragmentary perspective view of my lift fork in raised position with a load of bricks supported thereon.

Fig. 3 is a transverse cross sectional view of an exterior tine element of my lift fork, the gripping element being shown in full line in collapsed position and in dotted lines in extended gripping position.

Fig. 4 is a fragmentary horizontal cross sectional view taken longitudinally through one of the tine elements along the line 4—4 in Fig. 5.

Fig. 5 is a fragmentary vertical cross sectional view taken longitudinally through one of the tines along the line 5—5 in Fig. 4.

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Fig. 6 is a fragmentary side elevational view of a modified arrangement of my tine or load engaging member on a lift truck.

Fig. 7 is a horizontal cross sectional view along the line 7—7 in Fig. 6.

Fig. 8 is a transverse cross sectional view through a modified form of expansible gripping element for my fork structure.

Hydraulically or mechanically operated lift trucks for lifting and transporting bulk materials are well known in the material handling art and it has previously been proposed to provide lift forks for these trucks having tines provided with load gripping elements so that the tines may be introduced into spaces in the lower tier of a stack of material to be lifted, such as a stack of blocks or bricks. The load gripping elements on the fork are then actuated to grip the blocks or bricks in the lower tier so that the load may be lifted and transported without the use of a separate platform or pallet.

My present invention provides a novel form of pneumatically expansible gripping element for the tines of a lift truck and further provides a novel means of mounting the tines on the carriage of the lift truck to form the complete lift fork.

In the drawings I have illustrated more or less conventionally a motorized lift truck 1 provided with a mast 2 and carriage 3. The carriage is arranged to be raised and lowered on the mast by the action of a hydraulic piston 4 (see fig. 2) and chains 5. The carriage 3 is provided with a generally vertical rack 6 along the lower edge of which extends a transverse lift bar 7. My lift fork generally designated by the numeral 8 is carried by the lift bar 7 in a manner to be more particularly described presently.

The lift fork 8 comprises a plurality of tine elements 9 secured to the lift bar 7 in transversely spaced relationship so as to be adapted to be pushed between sections of a lower tier of bricks or other objects to be transported as illustrated in Fig. 2. The tine elements 9 are channel shaped in cross section and are mounted in pairs with the channels facing toward each other. Positioned within the channel section of each tine is an elastic expansible grip element 10 of horizontally flattened section. The exposed side wall 11 of the grip element is provided with scuff treads or facing. The gripping element 10 in its unstressed or collapsed position assumes the shape illustrated in the full line illustrated in Fig. 3 but is arranged to expand and project the gripping face thereof outwardly into the position in-

dicated by the dotted lines in Fig. 3, gripping of the bricks or other work to be moved by the lift truck.

The ends of the grip element 10 are closed or sealed against the escape of air by a pair of end elements or members 14 preferably made of rubber vulcanized within the ends of the grip elements which are desirably sections of a tube of suitable cross section. The end member 14 in the inner end of the tine element defines an aperture 15 arranged to fit around and receive an air nipple 16 screwed into a manifold pipe 17 by means of which air under pressure is supplied to each of the grip elements 10. Each grip element is provided prior to the sealing of the end members 14 with a stretcher or extending rod 18 having end members 19 secured to each end thereof to engage the end members 14.

The outer ends of the grip elements 10 are retained within the channel section of the tines by means of end blocks 20 also positioned between the flanges of the tines and secured thereto by the countersunk flat head screws 21. The outer surface of the blocks 20 have secured thereto the outer retaining plates 22 which extend inwardly along the edges of the flanges of the tine to form a pocket of substantial depth to receive the outer end of the grip element 10. The inner ends of the tines 9 are closed between the flange thereof by inner retaining plates 23 which are welded to the edges of the flanges on the tines. It will be noted that the opposed edges of the inner and outer retaining plates are curved outwardly as at 24 (see Fig. 4) to provide a smooth engagement with a gripping face 11 of the gripping element as it is expanded by air pressure to the position illustrated by the dotted line at 25 in Fig. 4.

The individual tines 9 are assembled in pairs with the channels of the pairs of the tines and therefore the gripping faces opposed to each other. Each pair of tines is secured as by welding at the rear to the spaced vertical plates 26 adapted to be secured to the lift bar 7 by the bolts 27. If desired the sloping reinforcing plates 28 may be welded between the upper flange of the tines and the forward plates 26.

The webs of the tines at the rear ends thereof and the inner retaining plates 23 are apertured as at 29 to receive the manifold pipe 17 from which the nipples 16 project for connection with the gripping elements 10. A flexible conduit or hose 30 is provided for connecting the manifold with a suitable air compressing and regulating mechanism (not shown) mounted on the truck 1.

From the description it should be apparent that the lift truck may be operated to force the tines of the lift fork into the spaces left therefor in the lower tier of a stack of bricks and air pressure may then be admitted through the hose 30 and manifold 17 to expand the gripping elements and tightly grip the bricks between the opposed faces of the tines.

Figs. 6 and 7 illustrate a modified arrangement of my tine or gripping element as attached to a carriage 3A of the truck. The carriage 3A is provided with a forwardly extending frame work 31 to which three gripper elements 32 are rigidly secured in a generally vertical and angularly spaced position so that the carriage and gripper elements may be lowered over a cylindrical object such as a drum or can 33 (see Fig. 7). The gripper elements may then be expanded as previously described to engage the side of the drum so that it may be lifted with the carriage and moved to any desired position.

Fig. 8 illustrates a modified form of cross section for my expansible gripping element. The element 34 provides a gripping face 35 which is substantially as wide as the body of the element. The bellows folds 36 are formed in the top and bottom wall of the gripping element to allow greater expansion of the grip element.

In all forms and arrangements of my lift fork and gripping element a uniform grip action may be applied by the grip element along substantially its full length and this gripping pressure may be varied to suit the type of load being lifted by the operator of the truck. My lift fork and gripping element is thus adapted to handle relatively heavy loads where a high gripping pressure is required and relatively light and fragile loads where a light force is sufficient to hold the weight. It will be noted that each collapsible grip element is restrained against longitudinal motion by engagement with the manifold 17 and by reason of the stretcher bar 18 which prevents the gripper element from being collapsed longitudinally by accidentally engaging the side of the bricks as the tines are pushed into the slots in the lower tier. The gripping elements are easily replaced by removing the end blocks 20 from the tines 9.

I have thus described a highly practical commercial embodiment of my lift fork together with several modified details so that others may reproduce the same with such modifications as are desired without further description.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A structure of the class described having a vertically movable carriage, a lift bar provided with a plurality of pairs of tines of channel section, the tines of each pair being spaced with the channels thereof facing, pairs of plates welded to the tops of the tines in vertically disposed position and bolted to opposite sides of said lift bar, inner retainer plates bridging the flanges of each tine at the inner ends thereof and having outer edges curving outwardly from the tine to which they are connected, an air manifold pipe supported by the webs of said tines and said inner retaining plates, nipples having smooth outer ends projecting from said manifold into the channels of the tines, end blocks having curved tapered ends removably secured within the outer ends of said tines and having outer retaining plates secured thereto in spaced relationship with the web of the tine to which they are secured, a pneumatic expansible work gripping tube positioned within the channel of each of said tines with its ends behind said retaining plates, said tubes being of generally flattened cross section and having flexible gripping faces along the exposed sides thereof projectable from the tines, end members in the ends of said tubes, the inner end members defining apertures receiving the ends of said nipples, expander rods positioned in each of said tubes and having end pieces engaging said end members to prevent longitudinal collapse of said tubes and manually controllable means for supplying air under pressure to said manifold.

2. A lift fork for a lift truck having a vertically movable carriage with a generally horizontal lift bar comprising, a plurality of pairs of tines of channel shaped cross section, the tines of each pair being spaced with the channels thereof in facing relationship, a pair of connecting plates secured to the tops of the tines of each pair of

tines in vertically disposed position and spaced longitudinally and bolted to opposite sides of said lift bar, inner retainer plates bridging the flanges of each tine at the inner ends thereof, an air manifold pipe supported by the webs of said tines and said inner retaining plates, nipples projecting from said manifold into the channel section of each tine, end blocks having wedge like ends secured within the outer ends of said tines and having outer retaining plates secured thereto in spaced relationship with the web of the tine to which they are secured, a pneumatic expansible clamping tube positioned within the channel section of each of said tines with its ends retained behind said retaining plates, said tubes being of flattened cross section and having gripping faces completely along the exposed sides thereof between said retaining plates projectable from the channels of the tines when expanded, end members sealingly engaged in the ends of said tubes, said end members and the walls of said tubes located therearound substantially filling the transverse cross sectional area between the channel walls and retaining plates of said tines in the at rest nonexpanded condition of the tubes, the inner end members defining apertures receiving the ends of said nipples, and manually controllable means for supplying air under pressure to said manifold.

3. A lift fork for a lift truck having a vertically movable carriage with a generally horizontal lift bar, comprising a pair of tines of channel shaped cross section mounted on said lift bar in spaced relationship with the channels thereof facing each other, an air supply pipe, nipples projecting from said pipe into the channels of said tines, an expansible clamping tube positioned within the channel section of each of said tines with its ends retained behind retaining plates, said tubes having flattened grip faces along the exposed side thereof projectable from the channels of the tines, end members for said tubes, the inner end member elements defining apertures receiving said nipples, expander rods positioned in said tubes and having plate like end portions engaging said end members to prevent longitudinal collapse of said tubes, and manually controllable means for supplying air under pressure to said manifold.

4. A lift fork for a lift truck having a vertically movable carriage with a generally horizontal lift bar, comprising a pair of tines of channel shaped cross section positioned in spaced relationship with the flanges thereof facing each other, a pair of connecting plates secured to the top flanges of said tines in vertically disposed and longitudinally spaced position and bolted to the opposite sides of said lift bar, inner retainer plates bridging the flanges of said tines at the inner ends thereof, an expansible work gripping tube positioned within the channel section of each of said tines with its ends retained behind retaining plates, said tubes having grip faces completely along the exposed sides thereof between said retaining plates, and manually controllable means for simultaneously supplying fluid under pressure to said tubes.

5. A lift fork for a lift truck having a vertically movable carriage with a generally horizontal lift bar, comprising a pair of tines of channel shaped cross section positioned in spaced relationship with the flange thereof facing each other and secured to said lift bar, inner retainer plates bridging the flanges of said tines at the inner ends thereof, a manifold pipe supported by the webs of said tines and said inner retaining plates, nipples projecting from said manifold into the

channel section of said tines, end blocks removably secured within the outer ends of said tines and having outer retaining plates in spaced relationship with the webs of said tines, an expansible clamping tube positioned within the channel section of each of said tines with its ends retained behind said retaining plates, said tubes having grip faces along the exposed sides thereof, end elements in the ends of said tubes, the inner end elements defining apertures receiving said nipples, and expander rods positioned in said tubes and engaging said end elements to prevent longitudinal collapse of said tubes.

6. A lift fork for a lift truck having a vertically movable carriage, comprising a pair of tines of channel shaped cross section positioned in spaced relationship with the channels thereof facing each other, a manifold, nipples projecting from said manifold into the channels of said tines, an expansible work clamping tube positioned within the channel section of each of said tines, said tubes having integral gripping surfaces along the exposed sides thereof projectable from the open sides of the channels, end elements filling and sealing the inner cross section of the ends of said tubes, the inner end elements defining apertures receiving said nipples, and expander rods positioned in said tubes and engaging said end elements to prevent longitudinal collapse of said tubes.

7. Tine structure for a lift fork comprising, a longitudinally recessed load carrying member, a retaining plate rigidly bridging a short portion of the recess of said load carrying member at the inner end thereof, an end block removably secured to an outer end of said load carrying member and having a plate extending inwardly therefrom for a short distance along the face of the recess of said load carrying member, an elongated expansible gripping element positioned within the recess of said load carrying member and having its ends retained behind said plates, and an integral gripping surface on the exposed side of said gripping element projectable from said load carrying element, the ends of said element being of substantial thickness and height and substantially filling the transverse cross sectional area of the recess in said member behind said plates in the at rest unexpanded condition of said element.

8. An expansible gripping element for the tines of a lift fork comprising a tube of self-sustaining extensible elastic material of generally flattened hollow cross section in the at rest nonexpanded condition of the tube, a gripping face on one side of said element, a bellows fold in a wall of said element, end portions closing the ends of said tube, one of said end portions defining an aperture for grippingly receiving an air supply nipple, and a rod positioned within said tube and having plate like end portions engaging said end portions to prevent longitudinal collapse of said gripping element.

9. An expansible gripping element for the tines of a lift fork comprising a tube of self-sustaining extensible elastic material of generally flattened hollow cross section in the at rest nonexpanded condition of the tube having a gripping face on one side thereof, bellows folds in the top and bottom walls of said element adjacent to said gripping face thereby, end portions closing the ends of said tube, one of said end portions defining an aperture for receiving an air supply nipple, and a rod positioned within said tube and engaging said end portions to prevent longitudinal collapse of said gripping element.

10. An expansible gripping element for the tines of a lift fork comprising a tube of self-sustaining extensible elastic material of generally flattened hollow cross section in the at rest non-expanded condition of the tube and having an integral gripping surface on one side thereof, end portions closing the ends of said tube, one of said end portions defining an aperture for receiving an air supply nipple, and a rod positioned within said tube and engaging said end portions to prevent longitudinal collapse of said gripping element.

11. An expansible gripping element for the tines of a lift fork comprising a tube of self-sustaining extensible elastic material of generally flattened hollow cross section in the at rest non-expanded condition of the tube and having an integral gripping surface on one side thereof, end plugs of approximately the same size as the inner cross section of said tube bonded within and closing the ends of said tube, one of said end plugs defining an aperture for receiving an air supply nipple.

12. In a lifting fork the combination of a pair of tine members of channel cross section disposed in spaced parallel facing relation, a resilient expandible elongated load gripping element disposed within the channel of each of said tine members and provided with a gripping face on its exposed surface, said gripping elements having bellows folds in the top and bottom wall thereof adjacent their gripping faces, plates bridging the flanges of said tines at the ends thereof for retaining said gripping elements within said channels and means for supplying fluid under pressure to said elements whereby they may be expanded to project their gripping faces from the channels into engagement with a load disposed between them, the ends of said elements being of substantial thickness and height and substantially filling the transverse cross sectional area of the recesses in said members behind said plates in the at rest unexpanded condition of said elements.

13. In a lifting fork the combination of a pair of tine members of channel cross section disposed in spaced parallel facing relation, a resilient expandible elongated load gripping element disposed within the channel of each of said tine members and provided with an integral gripping surface on its exposed side, means for retaining said gripping elements within said channels and means for supplying fluid under pressure to said elements whereby they may be expanded to project their gripping surface from the channels into engagement with a load disposed between them, said gripping elements in their deflated unexpanded condition being in supporting contact with the inner surfaces of the webs and flanges of said tines whereby expansion of the elements is accomplished primarily at their gripping faces.

14. A lifting fork comprising an elongated tine member of channel section, an elongated expansible gripping element disposed within the channel and having an integral gripping surface projectable from said channel, retaining plates bridging the flanges of said tine member at the ends thereof and retaining the ends of said gripping element, and means for supplying fluid under pressure to said gripping element whereby said gripping surface may be projected from the tine member to load gripping position, said gripping element in its deflated unexpanded condition being in supporting contact with the inner surfaces of the web and flanges of said tine member whereby expansion of the element is accomplished primarily along its gripping face.

15. In a lifting fork the combination of an elongated tine member of channel section, a hollow resilient transversely expansible elongated load gripping element of self-sustaining material located within the channel provided with an integral gripping surface on its exposed side, said gripping element having bellows folds in the top and bottom wall thereof adjacent its gripping face, plates bridging the flanges of said tine member at the ends thereof and engaged with the ends of said element for retaining said gripping element within said channel, and means for supplying fluid under pressure to said gripping element whereby it may be expanded to project its gripping surface from said channel, the end of said gripping element being of substantial thickness and height and substantially filling the transverse cross sectional area of the recesses in said member behind said plates in the at rest unexpanded condition of said element.

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