

**2,681,741**

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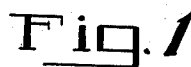
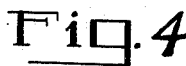


**Fig. 2**

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FORK LIFT TRUCK

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2 Sheets-Sheet 2

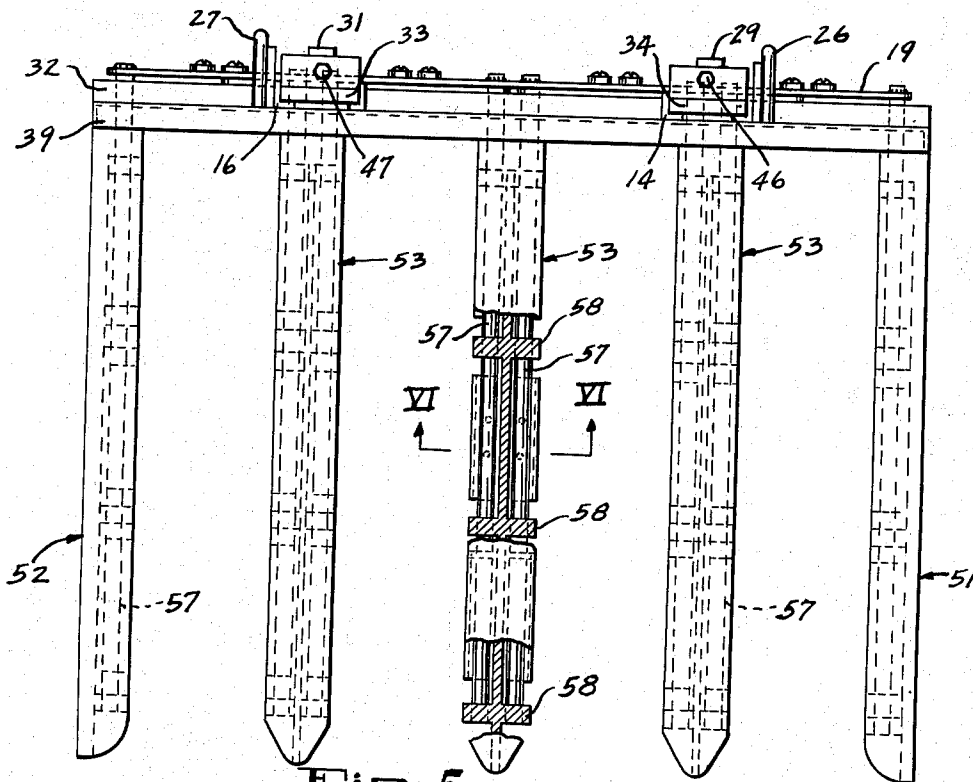


Fig. 5

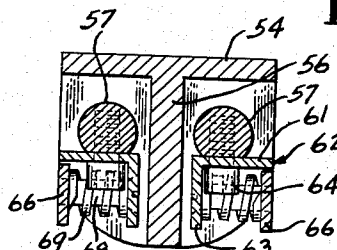


Fig. 6

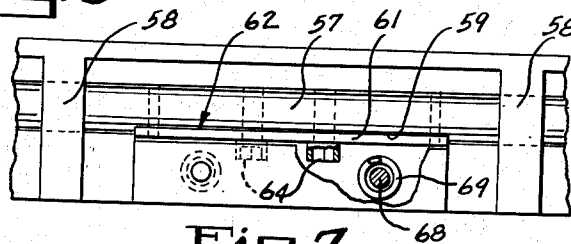


Fig. 7

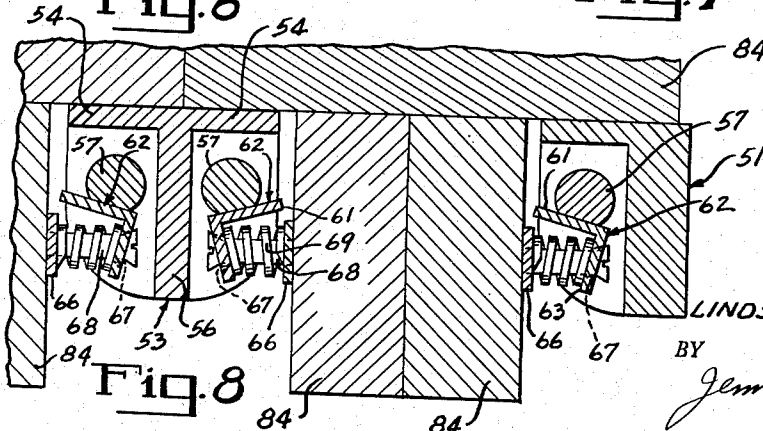


Fig. 8

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## UNITED STATES PATENT OFFICE

2,681,741

## FORK LIFT TRUCK

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My present invention relates to lift forks, and more especially to apparatus for lifting stacks of square or rectangular objects such as bricks or the like.

An object of my invention is to provide a fork lift of the type having a lift frame and a tine frame, there being vertical tubular guide members on the lift frame slidably receiving vertical members on the tine frame thus providing elongated guide means for the relatively movable frames, increasing the strength of the apparatus and decreasing wear on the moving parts.

Another object of my invention is to provide an improved gripper mechanism for engaging and lifting the lowermost or supporting course of bricks simultaneously with the lifting of the main body of the stack of bricks or the like, and grippers which may be used for handling heated objects such as partially cooled bricks in a kiln.

A more specific object of my invention is to provide a tine frame assembly embodying a plurality of tines disposed to be inserted beneath a stack of bricks or the like supported on lower, spaced apart courses, together with outwardly movable grippers adapted to engage between them the lower courses of bricks, thereby to lift the lower courses simultaneously with the lifting of the main body of the stack.

My invention comprehends a gripper structure embodying a rotatable gripper shaft mounted parallel to the longitudinal axes of the tines and having secured thereto one or more mounting brackets for the grippers, the grippers comprising metal plates having springs behind the same for biasing them into contact with the lower bricks, whereby upon lifting the load and rotating the shafts, the grippers on opposite sides of the bricks clamp the bricks of the lower courses therebetween.

A further object is to provide a gripper of the character described in which the mounting brackets for the gripper plates are in the form of angles with one leg thereof secured to the underside of the gripper shafts and with the other leg opposite the bricks to be engaged, there being compression springs interposed between the last named leg and the plate, thus providing apparatus in which the moving parts of the grippers are afforded maximum protection against clogging by dirt and the like.

A still further object of my invention is the provision of a lift fork in which the gripper shafts are positively connected through linkage to a relatively movable portion of the apparatus

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in turn connected to the lifting mechanism, thereby eliminating lost motion connectors, springs and the like in the gripper shaft rocking means, the necessary resilient grip on the bricks being obtained by means of springs directly associated with the gripper plates themselves.

Apparatus illustrating the features of my invention is shown in the accompanying drawings forming a part of this application in which:

Fig. 1 is a side elevational view of my improved apparatus, partly broken away and in section and showing the same in place on a fork lift truck;

Fig. 2 is a rear elevational view with the parts in the position in which the grippers are withdrawn out of gripping position;

Fig. 3 is a fragmental rear elevational view with the parts in the position assumed when the grippers are in gripping position;

Fig. 4 is a detail sectional view taken generally along line IV-IV of Fig. 2;

Fig. 5 is a plan view of the apparatus removed from the lift truck, one of the tines being partly broken away and in section;

Fig. 6 is a detail sectional view taken generally along line VI-VI of Fig. 5 and drawn to an enlarged scale;

Fig. 7 is a fragmental side elevational view looking at a side of one of the tines and with certain of the parts broken away and in section; and,

Fig. 8 is a transverse sectional view through one of the end tines and an adjacent intermediate tine and showing the apparatus placed beneath a stack of bricks and with the grippers engaging the lowermost courses of the same.

Referring now to the drawings for a better understanding of my invention I show my improved apparatus mounted on a fork lift truck indicated generally by the numeral 10. The truck 10 has the usual hoist frame structure 11 carrying a yoke 12. The yoke 12 may be raised vertically by means of a chain 13. While it will be seen that my invention is particularly adapted for use with a fork lift truck, as the description proceeds it will become apparent that it may be used with other forms of lifting mechanism.

My improved apparatus comprises generally a lift frame A and a tine frame B. The lift frame A comprises a pair of box-like, vertically disposed guides 14 and 16. The guides 14 and 16 may be fabricated of plates and welded together to form a rectangular tubular structure. The guides 14 and 16 are cross braced by members 17 and 18, welded or otherwise secured to the sides thereof and thus forming a rigid framework.

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The rigidity of the frame is further increased by means of a cross brace 19 secured to the rear sides of the guides 14 and 16.

Welded to the sides of the guides 14 and 16, near the tops thereof, are rearwardly extending brackets 21 and 22 which may be secured to the movable yoke 12 by bolts. Farther down the guides 14 and 16, I may secure plates 23 and 24 which carry rearwardly extending hooks 26 and 27. The hooks engage in suitable brackets 28 carried by the yoke 12. Near the lower ends of the guides 14 and 16 I may provide rearwardly extending brackets 29 and 31 which bear against the movable yoke 12, thus to take the compressive loads imposed on the framework when raising a stack of bricks as will be explained.

The time frame B comprises a relatively heavy rear cross member 32. Secured to the rear side of the cross member 32 are vertically extending bars 33 and 34 which project slidably through the respective guides 14 and 16. The bars 33 and 34 preferably are set in notches in the rear side of the member 32, whereby the rear sides of the bars lie flush with the rear side of the member 32.

Welded to the top of the member 32, just forwardly of the guides 14 and 16 is a framework consisting of a lower angle 36. Secured to the angle 36 are vertically disposed angles 37 and 38 braced across the top by an angle 39. The upper ends of the bars 33 and 34 are secured to the upper cross member 39 of the angle frame just described, thereby to be braced by the framework. A number of vertical bars 41 are spaced apart from each other as shown and these bars may be braced by a cross member 42.

The projecting upper ends of the bars 33 and 34 are provided with outstanding rearwardly disposed plates 43 and 44, suitably drilled and tapped to receive bolts 46 and 47. The bolts may be held in vertically adjusted position relative to the plates 43 and 44 by means of lock nuts 47a. Outstanding from the rear sides of the guides 14 and 16 are plates 48 and 49 disposed in the path of the lower ends of the bolts 46 and 47.

Secured in any desired manner to the forward side of the plate 32 are end tines 51 and 52. The tines 51 and 52 are angle shaped as viewed in transverse section, Fig. 8. Between the tines 51 and 52 are intermediate tines 53, spaced from each other and spaced from the tines 51 and 52 a distance equal to slightly more than the thickness of two bricks or other objects to be handled by the apparatus. The tines 53 are T-shaped in cross section with the flanges 54 horizontally disposed and with the webs 56 vertically disposed as illustrated in Fig. 8.

On either side of the webs 56 of the tines 53 and on the inside of the vertical portions of the tines 51 are rotatable gripper shafts 57. Since all of the shafts 57 and the grippers thereon are identical a description of one will suffice for all. The shafts 57 are journaled in bearings 58 placed at intervals along the length of the tine, the precise distance being such as to prevent undue deflection of the shafts when lifting the loads. Likewise, it will be noted that the ends of the shafts 57 project through the cross member 32.

The shafts 57 are notched out as indicated at 59, between the bearings 58, thereby providing elongated, flat seats. Secured to the shafts and with their horizontal flanges 61 resting on the seats 59 are gripper supporting brackets 62 in the form of lengths of angle iron. The vertical or

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depending flanges 63 of the angles are placed adjacent the webs 56 of the tines 53 or the vertical portion of the outer tines 51 and 52, as the case may be. Thus the brackets have an open side adjacent the bricks or other objects to be engaged, all as clearly illustrated in the detail sectional views, Figs. 6 and 7 of the drawing. The brackets may be removably held on their seats by means of hollow head set screws 64.

The grippers proper are in the form of flat plates 66 which preferably are substantially the depth of the leg 63 of the bracket 62, and substantially the length thereof. The depending legs 63 may be provided with suitable holes 67 for loosely passing headed pins or the like 68. The pins 68 may be flat headed, very similar to flat headed machine screws, and the holes in the leg 63 may be countersunk to receive the heads. The ends of the pins 68 may be passed through suitable holes in the gripper plates 66 and welded therein, thus to secure them rigidly to the plates 66.

Loosely surrounding each of the pins 68 is a compression spring 69. The springs are of such length that they hold the plates 66 outwardly of the legs 63 of the bracket 62 to the distance permitted by the pins and in position for contacting the bricks to be engaged thereby.

The ends of the shafts 57 projecting through the cross member 32 are provided with arms 71 fixedly secured thereto as by welding. Pivotally connected to each of the arms 71 is the lower end of a link 72. The upper ends of the links 72 are pivotally connected at 73 to the cross member 19, which as will be remembered is carried by the lift frame. Thus, when the lift frame A moves upwardly relative to the time frame B, the shafts 57 are rocked to the positions indicated in Fig. 8, and as will be more definitely described in connection with the operation of the apparatus.

Welded to the sides of the guides 14 and 16 are brackets 74 and 76. Fastened in the brackets are the upper ends of tension springs 77 and 78. The lower ends of the springs may conveniently be secured to the time frame A by means of lugs 79 and 81 welded to the lower angle 36. The combined force of the springs 77 and 78 is such that when the apparatus is raised by lifting the lift frame A, the time frame B is held yieldingly raised relative thereto, that is, in the position shown in Figs. 1 and 2 of the drawings.

If desired, the hollow guides 14 and 16 may be provided with lubricant fittings 82 and 83 for supplying lubricant to the inside of the guides, around the bars 33 and 34 therein.

From the foregoing the method of constructing and using my improved fork lift may now be explained and understood. As is customary, the bricks 84 are stacked with the lower rows thereof spaced apart as indicated in Fig. 8. Ordinarily, the lowermost, spaced rows comprise two bricks standing on edge and are spaced far enough apart to permit the tines to enter therebetween and beneath the upper courses of bricks forming the main body of the stack. In using my improved apparatus, the hoist frame 12 is raised with the tines slightly off the ground and the fork lift truck is maneuvered into position to place the tines in the spaces between the lower or supporting courses of bricks 84. In this position it will be apparent that the springs 77 and 78 hold the frames A and B in the position shown in Figs. 1 and 2 so that the shafts 57 are in the position illustrated in Figs. 5 and 6 of the drawings, that is, with the grippers withdrawn

into the tines. With the tines beneath the stack to be moved, power is supplied to raise the hoist frame 12 upwardly, thus bringing the tines up to the courses of bricks immediately overlying the lowermost courses, ready for lifting the load. As soon as the tops of the tines engage the main body of the stack, continued upward movement of frame A relative to the tine frame B causes the links 72 to pull upwardly on their respective arms 71, thus rocking the shafts 57 to the positions shown in Fig. 8. In this position it will be seen that the gripper plates 66 engage against the sides of the bricks 84 of the lowermost courses, gripping the bricks and securing them for lifting. The apparatus is raised upwardly, with the bricks thus clamped, raising the entire stack with the gripper plates 66. Further, the plates 66, springs 69 and pins 68 are substantially housed within the confines of the angle brackets 62, thus affording considerable protection against clogging with dirt and the like. The shafts 57 are rotated positively due to the direct connection of the arms 71 and links 72 with the cross member 19. All of the resiliency necessary to afford a yielding but firm grip on the lower courses of articles to be lifted is provided by the springs 69. Through the use of the form of gripper mechanism just described I am enabled to eliminate springs and lost motion connectors between the shafts 57 and the relatively movable frame portions which actuate the shafts.

It will be noted that the enclosed housings forming the guides 14 and 16 closely surround the bars 33 and 34. This construction given added strength to the apparatus as a whole, serving to adequately transmit the lifting force to the load to be lifted. By this arrangement I am enabled to provide a large area of frictional contact between the guides and the bars. I eliminate a considerable amount of wear which has been found to take place when the frame members A and B were supported for sliding movement relative to each other on rollers and the like.

In actual operation I have found that my improved apparatus is satisfactory in every way. I have eliminated the expensive and complicated gripping elements comprising rubber members and the like, complicated toggle and linkage arrangements and hence in large measure the major sources of mechanical difficulties with apparatus of this general type. Further, when handling brick it is desired to be able to run the apparatus into the kiln before the bricks have completely cooled. For this use the plates 66 of metal or the like are considerably more efficient than rubber grippers because of the fact that the heat soon destroys rubber. In practice I have found that there is sufficient coefficients of friction between the sides of the plates 66 and the bricks to prevent the same from falling downwardly when the apparatus is raised.

It will be especially noted that when the shafts 57 rock to the position shown in Fig. 8 the lower end of the depending leg 63 of the brackets 62 move toward the bricks to be lifted whereas the inner end of the leg 61 thereof moves away from the brick to be lifted. In this manner, I assure that the plates 66 always engage against the sides of the bricks, gripping them resiliently.

From the foregoing it will be apparent that I have devised an improved lift fork and particularly an improved form of gripper member therefor. The apparatus is very simple of manufacture and operation and the cost of maintaining the same is very low compared to the cost of

maintaining prior apparatus. In the event the grippers become worn, they may be replaced merely by unscrewing the screws 64 and replacing the entire gripper unit including its supporting bracket, the springs, the pins 68 and the plates 66.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. For use as a gripper element of a fork lift having a tine, a shaft mounted for rotation alongside the tine, an angled bracket secured fixedly to the shaft with one leg horizontal and the other vertical when the gripper is in inoperative position, said vertical leg lying adjacent the tine, a plate spaced from and parallel to the vertical leg, a pin secured to the side of the plate adjacent the vertical leg of the angled bracket and passing loosely through said vertical leg, a head on the pin on the side of said vertical leg opposite the gripper plate, a compression spring surrounding said pin between said vertical leg and said gripper plate biasing the gripper plate away from the vertical leg of the bracket, and means to rotate the shaft.

2. In a gripper assembly for association with the tines of a fork lift, a shaft extending alongside the tine, an L-shaped bracket having one leg secured to the underside of the shaft and its other leg projecting below the shaft on the side thereof nearest the tine, a gripper plate corresponding substantially to the length and depth of the said other leg and lying beneath the free end of the first mentioned leg thereby forming a channel shaped unit with the plate as a separate side thereof, headed pins passing loosely through the said other leg of the L-shaped bracket and fixed to the plate, compression springs surrounding the pins between said plate and said other leg and biasing the gripper plate outwardly of the said other leg to the limit of said pins, and means to rock the shaft in a direction to move the lower edge of the plate outwardly toward gripping position.

3. A tine and gripper assembly comprising an upright tine T-shaped in transverse section with the flanges of the T forming the top of the tine and with the web thereof substantially vertical, rotatable gripper carrying shafts mounted on either side of the web of the tine beneath the flanges thereof, gripper assemblies on the shafts each comprising a rigid L-shaped bracket with one leg thereof fixedly secured under the shaft and the other depending therefrom adjacent to and parallel with the web of the tine, a plate parallel to the depending leg of the bracket, pins loosely passing through the depending leg of the bracket and fixed to and outstanding from the gripper plate, heads on the pins bearing against the side of the depending leg opposite the gripper plate, compression springs loosely surrounding the pins and biasing the gripper plate outwardly of the depending leg of the bracket, and means to rotate the shaft in a direction to move the lower edge of the gripper plate outwardly.

4. Apparatus as defined in claim 3 in which the shaft is provided with a flat seat at the point where said L-shaped brackets are placed, and removable fasteners passing through the bracket

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and into the shaft and holding the brackets non-rotatably on the shaft.

5. Apparatus as defined in claim 3 in which the tines are provided with bearings at intervals along the length thereof through which said shafts pass.

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