Jan. 6, 1953 J. F. ROWE 2,624,608

FORK FOR HANDLING BRICKS AND OTHER UNITS

Filed Feb. 25, 1949 5 Sheets-Sheet 1

Fig. 3.

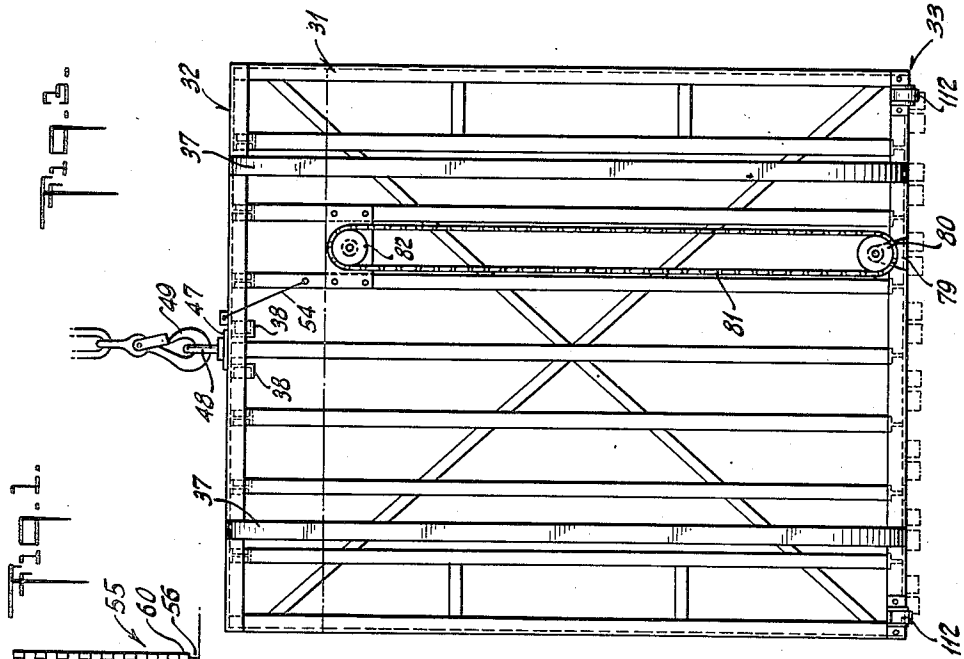

Fig. 1.

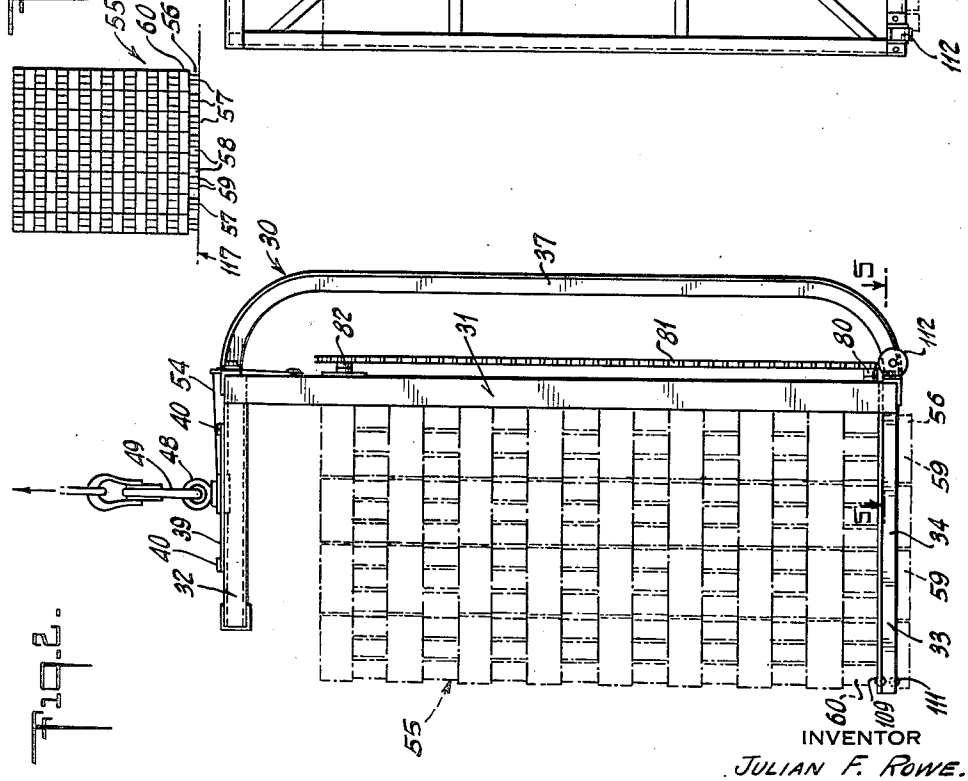

Fig. 2.

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Jan. 6, 1953 J. F. ROWE 2,624,608

FORK FOR HANDLING BRICKS AND OTHER UNITS

Filed Feb. 25, 1949 5 Sheets-Sheet 2

Fig. 4.

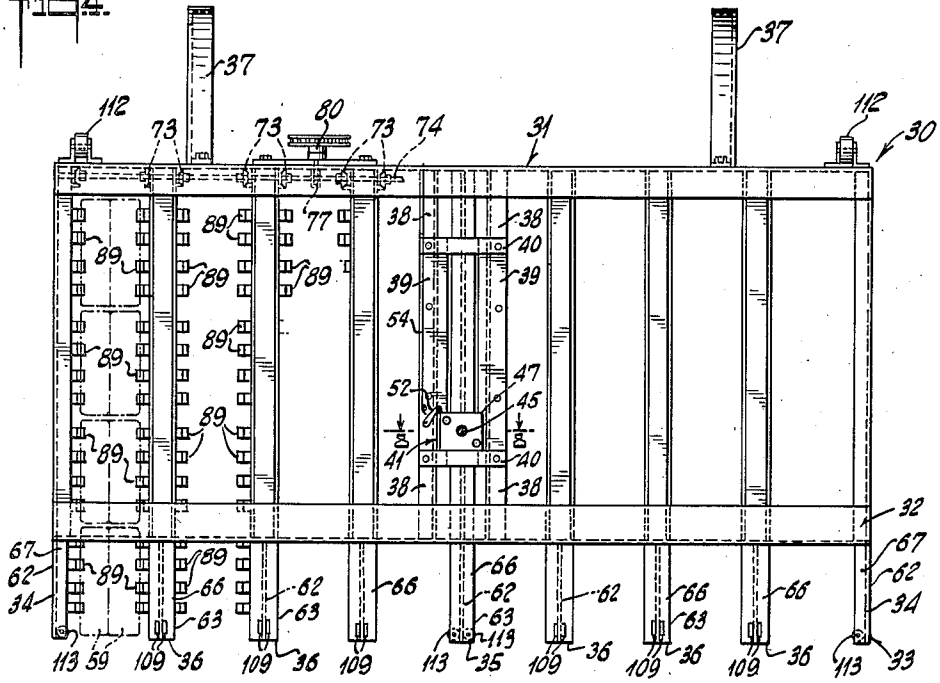

Fig. 5.

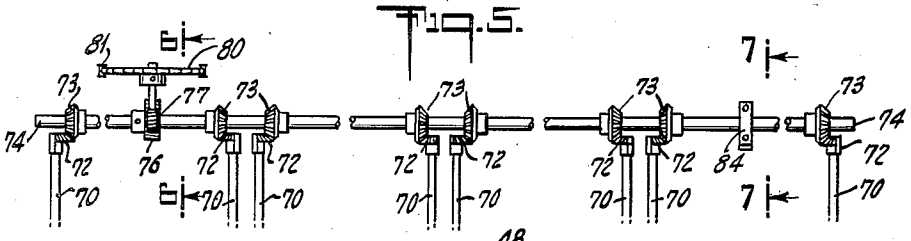

Fig. 6.

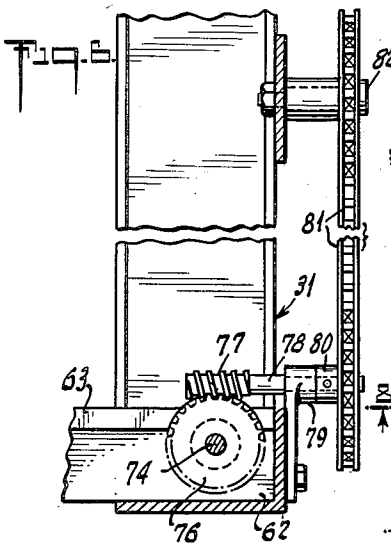

Fig. 8.

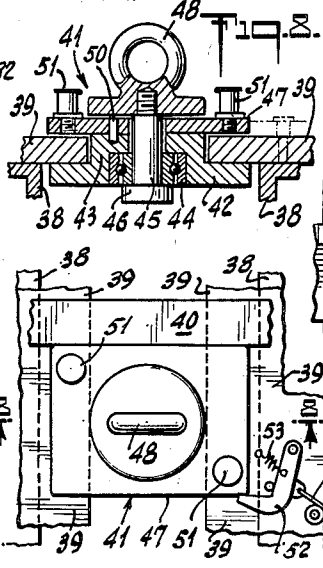

Fig. 7.

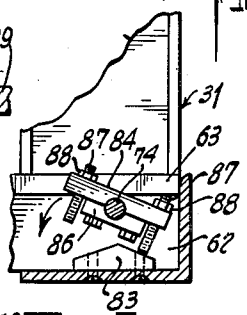

Fig. 9.

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Jan. 6, 1953 J. F. ROWE 2,624,608

FORK FOR HANDLING BRICKS AND OTHER UNITS

Filed Feb. 25, 1949 5 Sheets-Sheet 3

Fig. 10.

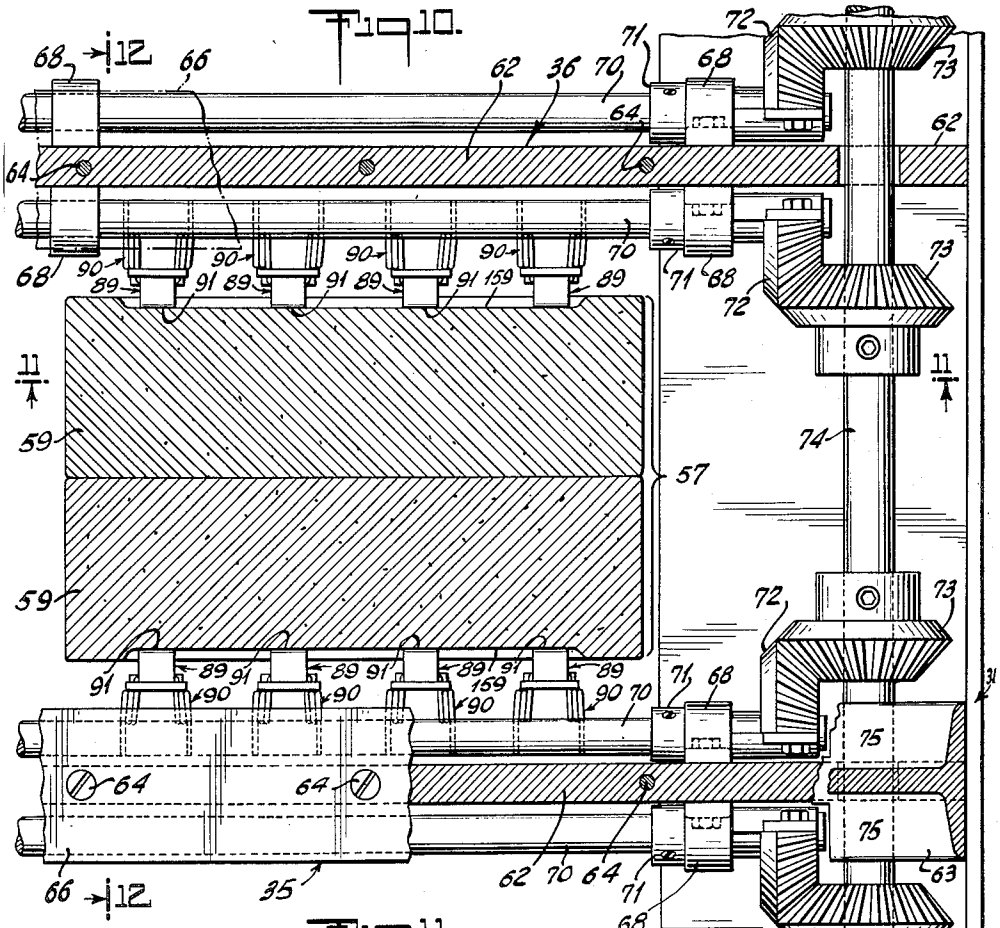
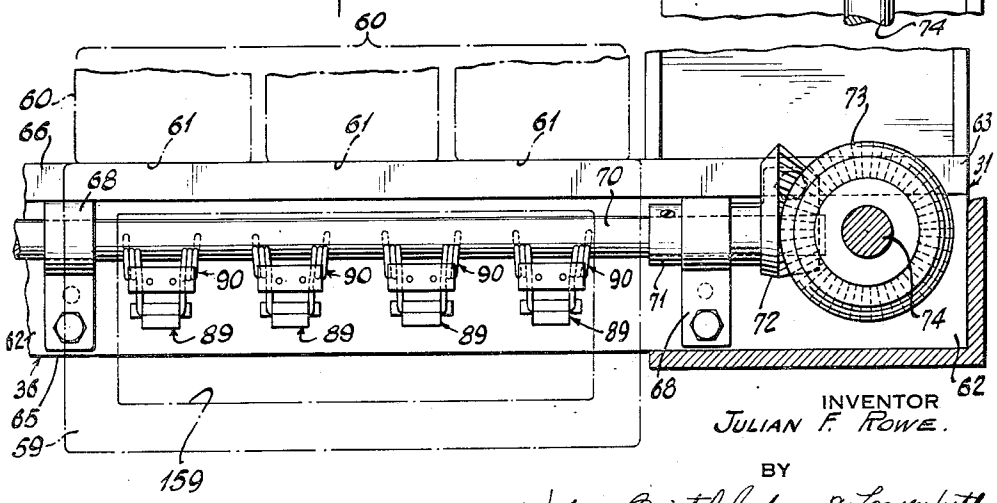


Fig. 11.



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FORK FOR HANDLING BRICKS AND OTHER UNITS

Filed Feb. 25, 1949 5 Sheets-Sheet 4

Fig. 12.

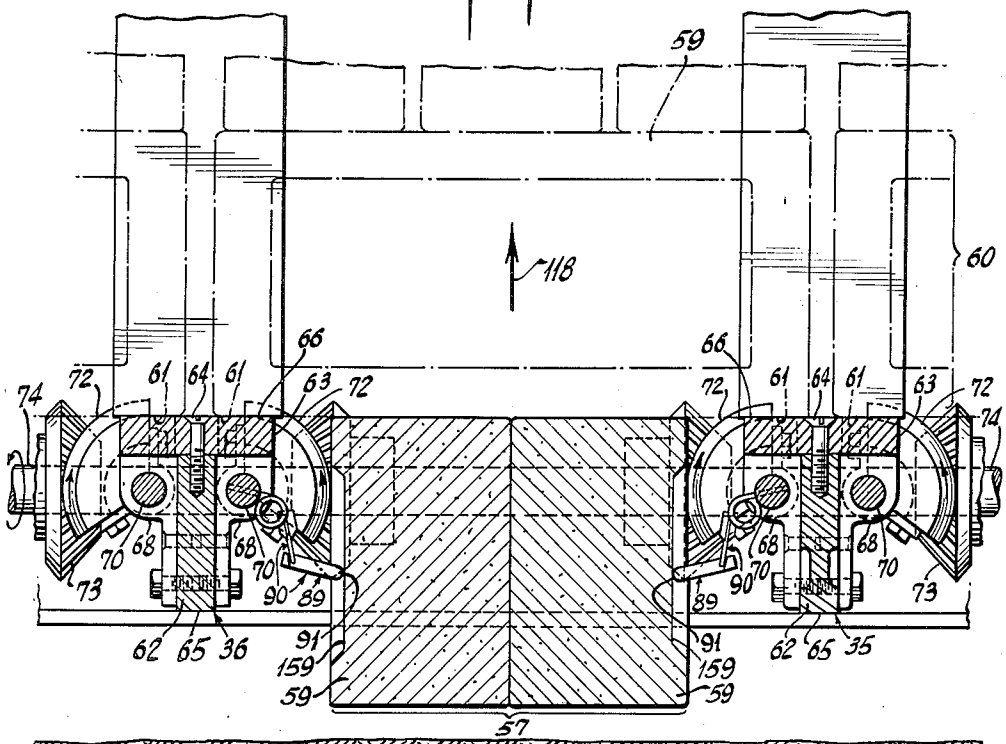


Fig. 13.

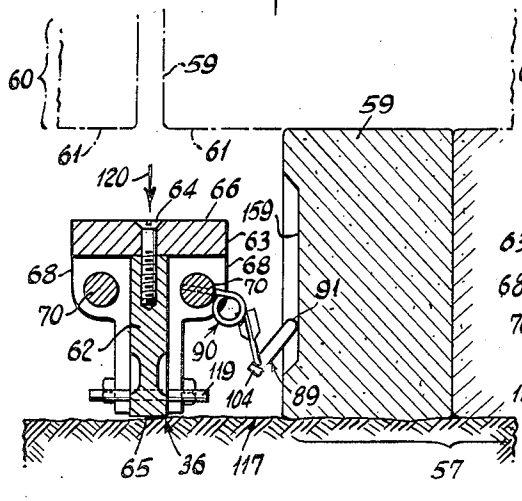
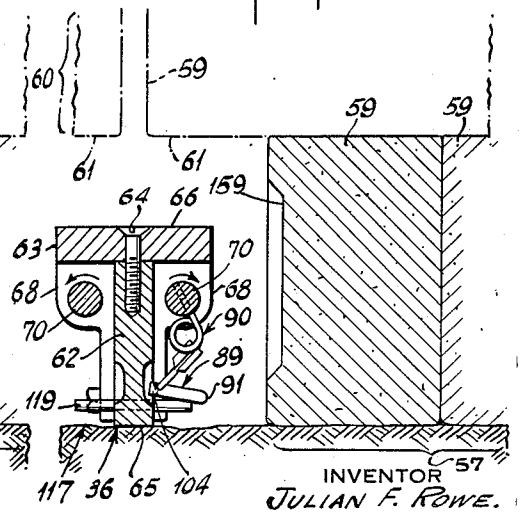


Fig. 14.



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FORK FOR HANDLING BRICKS AND OTHER UNITS

Filed Feb. 25, 1949 5 Sheets-Sheet 5

Fig. 15.

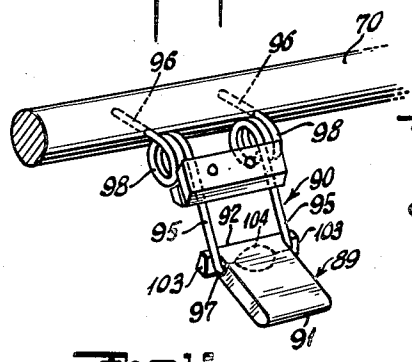


Fig. 16.

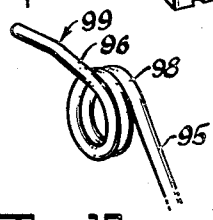


Fig. 17.

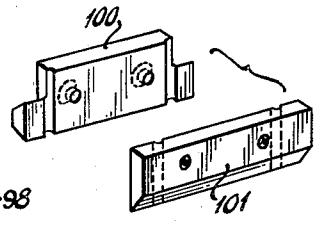


Fig. 18.

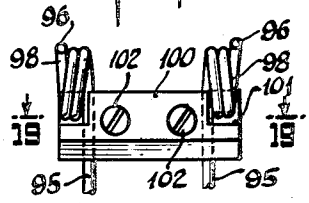


Fig. 19.

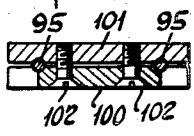


Fig. 20.

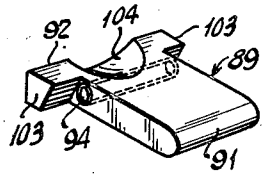


Fig. 22.

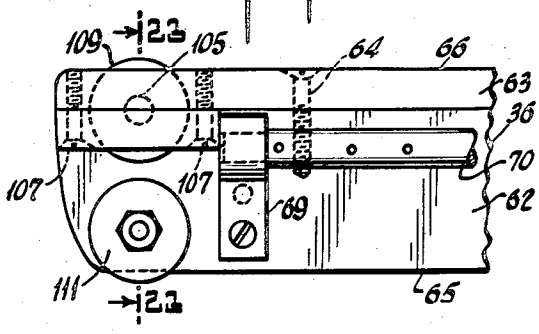


Fig. 21.

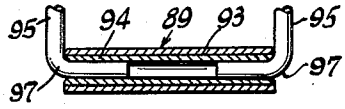


Fig. 23.

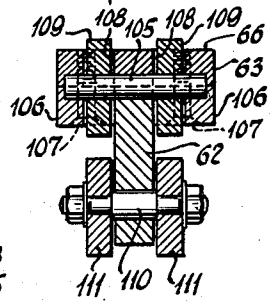


Fig. 24.

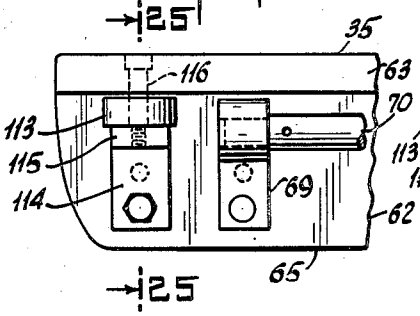
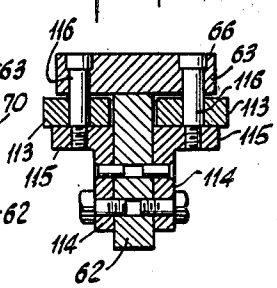


Fig. 25.



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UNITED STATES PATENT OFFICE

2,624,608

FORK FOR HANDLING BRICKS AND OTHER UNITS

Julian F. Rowe, Stewart Manor, N. Y.

Application February 25, 1949, Serial No. 78,303

7 Claims. (Cl. 294—63)

1

The present invention relates to forks for handling bricks and other units in stacks and, more particularly, to improved features of such a device characterized by a plurality of substantially parallel, horizontally-extending, transversely-spaced tines adapted to be inserted between spaced-apart parallel bottom rows of stacked units or other support elements beneath such a stack, with means adapted to be manipulated to position of engagement of those bottom rows of units or elements for releasably clamping them securely to permit lifting and handling of the entire stack as a unitary load.

A general object of the present invention is to provide such a fork structure which is sturdily and simply constructed and manipulated in a ready manner to handle such stacks of brick with the units therein so arranged as to permit transfer of so-stacked green bricks to and from firing kilns, as well as the handling thereof in transportation, such fork construction being characterized by a simple tine design assuring sturdiness while avoiding collection of dirt and chips and permitting ready access to gripping means mounted thereon for easy repair and adjustment, said gripping means being of unique design to assure yielding grip of elements beneath or the units in the bottom layer of the stack, engagement thereof at low points below their centers of gravity minimizing tension required to assure effective gripping, and comprising a plurality of elements assuring high gripping efficiency while permitting ready repair and replacement manipulation of a minimum of units in a very simple manner.

A more specific object of the invention is to provide such a fork device with gripping means comprising a pair of opposed banks of yieldably-mounted dogs rotatable about parallel longitudinal axes to bring them together in opposed engaging positions for clamping parallel elements or rows of units therebetween and preferably pivotally mounted to permit freeing upset when the fork moves downward toward the stack base, and other advantageous features inherent therein, as will more fully appear hereinafter.

A further object of the invention is to provide a structural embodiment of the device which may be readily constructed and which permits efficient use and operation thereof.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements and arrangement of parts, which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

2

Fig. 1 is a front or rear elevational view, to a reduced scale, of a specially arranged pile of bricks for which the fork of the present invention is especially designed to engage, raise and handle;

Fig. 2 is a side elevational view of an embodiment of the fork of the present invention, showing in dotted lines a side view of a stack of bricks similar to that indicated in Fig. 1, but to a larger scale;

Fig. 3 is a rear elevational view of the fork shown in Fig. 2, and in which is indicated by dotted lines the bottom layer of the stack of bricks comprising parallel spaced-apart rows;

Fig. 4 is a top plan view of the fork structure shown in Figs. 2 and 3, with a few of the bricks in the bottom of the stack being indicated in dot-dash lines;

Fig. 5 is a diagrammatic plan view of operating means of the fork, indicating certain gear mechanism thereof operable from a single manual control, with parts being broken away;

Fig. 6 is an enlarged detail section taken substantially on line 6—6 of Fig. 5;

Fig. 7 is an enlarged detail section taken substantially on line 7—7 of Fig. 5;

Fig. 8 is an enlarged detail section, taken substantially on line 8—8 of Figs. 4 and 9, of certain suspending means preferably employed with the fork embodiment shown in Figs. 2, 3 and 4;

Fig. 9 is a detail plan view, with parts broken away, of the supporting means shown in Fig. 8;

Fig. 10 is an enlarged horizontal detail section, with parts broken away, to a scale of about three-fifths full size, of a pair of adjacent tines and gripping means associated therewith manipulated to gripping engagement of two bricks positioned in their normal orientation in a row of the bottom layer of the open stack shown in Fig. 1;

Fig. 11 is a vertical section, with parts broken away, taken substantially on line 11—11 of Fig. 10;

Fig. 12 is an elevational section taken substantially on line 12—12 of Fig. 10;

Fig. 13 is a detail section of one tine of the fork indicating relative positions of parts during downward movement of each dog across a brick face;

Fig. 14 is a view similar to Fig. 13, showing complete retraction of each dog to permit withdrawal of the fork from the stack;

Fig. 15 is a perspective detail view, with parts in section, of gripping means of the fork embodiment shown in the preceding figures, indicating the construction and mounting of a gripping dog on its operating rotatable shaft and the yielding means preferably employed to mount the former on the latter;

Fig. 16 is an enlarged perspective view of a por-

tion of the mounting means employed to support a dog on the shaft, as shown in Fig. 15;

Fig. 17 is a perspective exploded view of certain clamping means employed to hold together parts of the dog mounting means shown in Fig. 15;

Fig. 18 is an end view, with parts broken away, of the yielding mounting means shown in Fig. 15;

Fig. 19 is a sectional view taken substantially on line 19—19 of Fig. 18;

Fig. 20 is an enlarged perspective view of one of the clamping dogs, inverted to show the bottom side thereof;

Fig. 21 is an enlarged sectional view, with parts broken away, of dog structure at a pivotal mounting thereof to its yielding supporting means;

Fig. 22 is a side elevational view, with parts broken away, of the advance end of one tine;

Fig. 23 is a sectional view taken substantially on line 23—23 of Fig. 22;

Fig. 24 is a view similar to Fig. 22 of another tine; and

Fig. 25 is a sectional view taken substantially on line 25—25 of Fig. 24.

Referring to the drawings, like numerals identify similar parts throughout and, as will be seen therefrom, the preferred embodiment of the present invention comprises a fork frame 30, which, as will be seen from Fig. 2, is substantially C-shaped in side elevation. Accordingly, the fork 30 comprises a substantially vertical back framework panel 31, a top horizontal framework panel 32, and a bottom panel 33, made up of a plurality of transversely-spaced horizontally-extending tines, which, as will be best understood from Fig. 4, includes two end tines 34, 34, a middle tine 35, and intermediate tines 36—36.

The C-shaped framework 30 is provided, in accordance with one feature of the present invention, with means to facilitate its handling and servicing. For this purpose, as shown in Figs. 2, 3 and 4, the back panel 31 is equipped preferably with a pair of bowed members 37, 37 shaped in the nature of rockers, which may also serve as bars to provide convenient hand holds and mechanism guards. The members 37, 37 extend out to the rear of the back panel 31 to protect operating mechanism mounted thereon, and to prevent the latter from being damaged during the swinging of the fork by a crane in the handling of bricks or other units. The guard members 37, 37 are, as shown in Fig. 2, curved at both ends so that the fork may be rocked to a prone position on its back for ready access from the bottom of tine panel 33 to parts for servicing, thereby eliminating the necessity of providing a special separate cradle. Such members also support the remaining portion of the fork device above the ground when rocked to such prone position to avoid fouling mechanism parts with dirt.

The supporting means for the fork may be a lift truck slide or other suitable means, such as that which will permit crane-cable suspension at different points for adjustment thereof to bring the center of gravity of the fork and its load to the vicinity of the point of suspension. As will be seen from Figs. 2, 3, 4, 8 and 9, such suspension means may comprise a pair of horizontal, laterally spaced channels 38, 38 fixed into the top panel framework 32. Preferably the channels 38, 38 have removably attached or bolted thereto a pair of laterally spaced, longitudinally-extending rail plates or straps 39, 39 which, if desired, may be tied together by transverse stop straps 40, 40, bolted thereto at selected positions to be adjustable therealong. A carriage 41 is slidably mounted on the rails 39, 39, as is best seen from Figs. 4, 8 and 9.

Carriage 41 preferably comprises a bottom riding plate 42 with its side edges adapted to slide along beneath rail straps 39, 39. Centrally of the bottom plate 42 there is preferably provided an upwardly cupped boss 43, within which a ball bearing unit 44 is mounted, rotatably receiving therethrough a suitable stud bolt 45 having a head 46 disposed beneath the bearing unit. Above the rails straps 39, 39 is mounted a cross plate 47, through a hole in which the stud bolt 45 is extended, with its threaded shank engaged in a ring plate 48 for engagement by any suitable suspending means, such as a crane hook 49. The bearing boss cup 43 suitably spaces the bottom plate 42 from the top cross plate 47 to provide parallel grooves slidably receiving the rail straps 39, 39. A pin 50 extending through top plate 47 into a recess in boss 43 may be employed to prevent relative rotation between the top and bottom plates, and opposed sides of the boss may be flatted off to ride adjacent edges of rails 39, 39 to prevent relative rotation with swivelling permitted by stud bolt 45 and bearing 44. Grease cups 51, 51 may be mounted on top plate 47 to facilitate the sliding action of carriage 41. As a result, the carriage 41 is slidable along rail straps 39, 39 between the limits defined by the adjustable stop 40, 40.

A selected position of carriage 41 substantially at the center of gravity of the fork, when fully loaded, substantially adjacent the front stop strap 40 as shown in Fig. 4, is preferably defined by a latch 52, pivotally mounted on one of the rail straps 39 and preferably biased by a spring 53 to the latching position shown in Fig. 9. A trip cord 54 is preferably guided along suitable rollers or pulleys to the back of the fork for ready access. Thus, if a load is imposed on the fork nearer the ends of its tines, sliding of the carriage 41 toward the rear is limited by latch 52. A pull on the cord 54 will remove the latch 52 from the path of carriage 41 so that the latter may be slid farther toward the back of the fork for counterbalance of the fork frame when unloaded or of any partial load that may be placed on the tines toward the fork back, with that latch defining the proper position of the point of suspension for a normal full load, such as a stack of bricks. Obviously such a latch 52 may be employed in cooperation with a plurality of notches in one edge of top plate 47 to be selectively indexed therein for determining different positions of the point of suspension.

For a better understanding of the tine and gripping construction of the fork 30, it will be hereinafter described in connection with the handling of a self-palletized stack of bricks, such as that depicted at 55 in full lines in Fig. 1, and in dotted lines in Fig. 2. As is well understood in the trade, such stack of bricks includes as a bottom layer 56 a plurality of laterally-spaced apart, longitudinally-extending rows 57—57, with adjacent rows defining therebetween tine-receiving longitudinal spaces 58—58. Each bottom row 57 preferably is formed by arranging a plurality of bricks 59—59 back-to-back and end-to-end, as best seen in Fig. 4, and, as is usual, with their panel faces 159—159 facing outward. However, some in the trade reverse the positions of the two series of bricks in a bottom row, with their panel faces facing toward each other. Regardless of which practice may be followed, the gripping means of the present invention effectively accom-

plish the desired clamping of the bottom rows between opposed pairs of engaging means thereof. In the open stack 55, the second layer 60 of bricks 59—59 is made up of transverse rows laid cross-wise of the longitudinal bottom rows 57—57 to be supported by the latter, with the lower edges of the bricks in that second layer providing support faces 61—61 at the top of longitudinal tine-receiving spaces 58—58 for support engagement, as will be more fully explained hereinafter.

As will be apparent from Figs. 4, and 10 to 14 inclusive, the middle tine 35 and the intermediate tines 36—36 are all of similar construction, substantially T-shape in cross section, except for certain guide roller means mounted on the free ends thereof to be described hereinafter in connection with Figs. 22 to 25 inclusive. The two end tines 34, 34 can likewise be T-shape cross section, but need not be, in view of the fact that no brick engaging means are to be mounted on the outer sides thereof. Thus, as a matter of economy of material and simplicity of construction, the two end tines 34, 34 preferably are angle members.

Each of the substantially T-shaped tines 35 and 36 may be made up of T stock but are preferably built up from a vertical web plate 62 and a transverse flange plate 63, with the two suitably fastened together in any suitable way, such as by means of welding or by screws 64—64. Each web plate 62 has a bottom edge surface 65, with the plurality thereof substantially determining a plane of rest for ground engagement if and when no other means are provided for ground support. Top face 66 of each of the transverse flange plates 63 provides a support surface upon which support faces 61—61 of the bricks 59—59 in second layer 60 may rest for support of the major load of the stack 55. Each of the two end tines 34, 34 may be made of angle stock but preferably is made up of a similar web plate 62 to which is fastened by welding, or by screws similar to 64, a narrower flange plate 67. The roots or anchoring ends of the tines 34, 34, 35 and 36—36 are suitably fixed to the back panel framework 31 of the fork, such as by means of welding or bolting. Each web plate 62 may have a narrow laterally-extending ledge on either side thereof near its bottom edge surface 65, preferably with the upper surface thereof sloped downwardly and outwardly to avoid dirt and chip collection and for that reason true I-beam sections are to be avoided. Such narrow ledges may be employed to support abutment means such as blobs of welding metal to limit downward swing of dogs in retraction similar to the functioning of certain abutment pins hereinafter described.

Gripping means for engagement of bricks or similar units are mounted longitudinally of the tines 34, 35 and 36—36 adjacent the web plates 62—62 thereof, and preferably in the recess provided by the overhang of transverse flanges or flange plates 63—63 and 67, 67. Accordingly, the middle tine 35 and the intermediate tines 36—36 will each be equipped with a pair of such gripping means, one on each side thereof, and each of the end tines 34 will be provided with one such gripping means mounted on the inner side thereof. The gripping means of the present invention are dependent for operation on and include rotatable shafts adapted to be oscillated through radial angles. Accordingly, there will here be first described such oscillatable shaft structure, supporting means therefor, and the means for oscillating the same.

Each of the vertical web plates 62 for the tines 35 and 36—36 is provided on opposite sides thereof at intervals with suitable shaft-supporting bracket bearings 68—68, and, of course, similar bearings are provided on the inner sides of web plates 62, 62 of end tines 34, 34, each preferably removably bolted into position. All of these bearings 68—68 are alike, except those near the ends of the tines. The latter bracket bearing 69, as will be seen from Figs. 22 and 24, is of a thrust type to prevent longitudinal outward shift of rotatably supported shaft structure. Each series of bearings 68—68 and 69, distributed along one of the web plates 62, rotatably supports an oscillatable shaft 70, and preferably a thrust collar 71 on each shaft adjacent the inner bearing 68 in the vicinity of the tine root prevents inner longitudinal shift of the shaft.

The inner end of each shaft 70 carries fixed thereto a beveled gear segment 72 meshed with a beveled gear 73 keyed to a cross shaft 74 suitably rotatably supported in or back of the back panel framework 31. Preferably the cross shaft 74 is provided with one continuous key-way extending from end to end for the purpose of keying thereto the plurality of pivotal gears 73—73 at selected points, and to permit adjustment of the latter axially of the shaft so as to accommodate wear of the teeth of segmental gears 72—72 and those beveled gears. Although it is possible to use in the place of segmental gears 72—72 full beveled gears similar to 73—73, the segmental gears are preferred since shafts 70—70 are not to be fully rotated but merely to be oscillated to accomplish the desired gripper operation, and in order to simplify construction permitting shaft mounting closely adjacent the sides of the tine web plates 62—62. Preferably opposed notches 75, 75 are provided in each projecting edge of transverse flange plate 63 to receive the opposed pair of gear segments 72, 72, as will be seen from the lower left hand portion of Fig. 10. A similar notch is provided in the inner projecting edge of each flange plate 67.

Cross shaft 74 is adapted to be oscillated by means of a gear 76 fixed thereto, meshed with a worm 77, as best seen in Figs. 5 and 6. The worm 77 is fixed on a stub shaft 78 rotatably mounted in a bracket bearing 79 mounted on the back panel framework 31 near the bottom thereof. Stub shaft 78 carries beyond bearing 79 a sprocket wheel 80 fixed thereto, about which is lapped a continuous chain 81, in turn lapped about an idle sprocket 82 mounted for free rotation on the back panel framework 31 near the top thereof, as is best seen from Figs. 2 and 3. Accordingly, the extended runs of the chain 81, lapped about sprockets 80 and 82 and extending substantially between the vicinities of the top framework panel 32 and the panel of tines 34, 34, 35 and 36—36, provides ready access from various positions for manual engagement to operate the gripper mechanism. Adjustable limited oscillation of the cross shaft 74 and attendant limited adjusted oscillation of gripper shafts 70—70 and dogs 89—89 is assured, as is best seen in Fig. 7, by provision of a suitable stop device which preferably comprises a pair of clamping plates 84 and 86, each provided with a semicircular groove to receive the shaft 74, those plates being suitably bolted together for frictionally gripping the shaft. Plate 84 is longer than plate 86 so that the ends thereof may carry a pair of ad-

justable extending stop screws 87, 87, threadedly mounted through threaded holes in the plate and equipped with suitable lock nuts 88, 88. As shown in Fig. 7, the projecting ends of the stop screws 87, 87 are adapted alternately to engage the abutment block 83 for limiting oscillating motion of cross shaft 74.

The oscillatable shafts 70—70 of the gripper mechanism are provided in the preferred embodiment with banks of gripper means, each comprising a dog 89 yieldably mounted for swing therewith by means of resilient arm structure 90, as best seen in Fig. 15. Each dog 89 preferably is in the form of a T-shaped plate having an engaging nose 91 and a butt 92, with the latter preferably provided with a transversely-extending through hole 93, as best seen in Figs. 20 and 21, and in which is received a bearing sleeve 94. The yieldable arm structure 90 is preferably made up of a pair of spring arms 95, 95, each having an anchoring end 96, a dog-engaging end 97 turned laterally to be received in the bearing sleeve 94, as shown in Fig. 21, and an intermediate helical coiled spring section 98. As shown in Fig. 16, the anchoring end 96 of each spring arm 95 is preferably bent at 99 so that it will be frictionally gripped in a rigid manner when driven into a straight hole extending diametrically through shaft 70, as indicated in dotted lines in Fig. 15. This simple mounting, while assuring rigid fixation to the shaft 70, will permit ready removal of each arm 95, such as by driving or pulling with a special tip slide hammer or by hooking an anvil element into coiled section 98 and tapping thereagainst, for purposes of repair or replacement. Each pair of spring arms 95, 95 are rigidly held together by a pair of clamping plates 100 and 101, as shown in Figs. 15, 17, 18 and 19, suitably held together by means of screws 102, 102.

Each dog 89 has at its butt 92 laterally-extending, swing-limiting stops or abutments 103, 103, which are adapted to engage against portions of the spring arms 95, 95 in swing of the dog about the laterally-turned ends 97, 97 of those spring arms. Accordingly, downward swinging motion of the dog 89 is limited approximately to the cocked position shown in Fig. 15, with pivoting upset or uncocking being permitted by the mounting structure shown in Fig. 21. For a purpose to be more fully explained hereinafter, the bottom side of the butt 92 of each dog 89 is provided with a notch 104, most readily seen in Fig. 20.

The articulation of the dogs 89—89 to their mounting arms 90—90 is important to the action of the gripping means with respect to cocking and uncocking or upset thereof, as will hereinafter more fully appear, but it is to be understood that such desired operation and the yielding gripping provided by the spring arm structures 90—90 is not limited in the practice of the present invention to the precise structure shown in the drawings. For example, the dog supporting arms might be rigid members to which the dogs 89—89 are articulated or pivotally mounted. Such rigid arms, in turn, might be hingedly mounted to the sides of the gripper shafts 70—70, with suitable spring devices being employed to bias them outwardly to positions similar to those assumed by spring arms 90—90, such spring devices permitting some yielding lag with rotation of the gripper shafts to engaging positions as the dog noses 91—91 are engaged against brick faces. Obviously the action of such a modified form of gripper mechanism would be similar to that of the structure shown by way of example in the drawings. Further, the dog and supporting arm structure of the embodiment shown in the drawings may be replaced by simple elongated dog plates or fingers considerably longer than the dogs 89—89, each to reach from a side of a gripper shaft 70 to the cocked position of dog nose 91. Such elongated dogs would preferably be pivotally mounted to the side of each gripper shaft 70 and spring biased in the manner proposed above in connection with the employment of rigid dog-supporting arms. Such elongated, single-piece dog elements also could be hook shaped, similar to the outline, as viewed from the side of the dog 89 and its supporting arm 90 when in a cocked position, so that the engaging nose would be directed upward toward brick faces in the same general orientation of the nose 91 of dog 89. Obviously other variations of such structure which will readily occur to one skilled in the art and which inherently will perform similar functions may be employed within the scope of the present invention. As a result of a practice of any such embodiments of the yieldably mounted gripping dogs, the latter are floatingly mounted along the sides of oscillatable gripper shafts.

The free or outer end of each of the intermediate tines 36 is, as best seen in Figs. 22 and 23, preferably provided on its upper side with suitable vertical roller structure to facilitate sliding thereof beneath the bottom surfaces 61—61 of the bricks in second layer 60 when the tines are inserted in the spaces 58—58 in the bottom layer 56. This roller structure may comprise a cross shaft 105 seated in opposed mating grooves in the underside of transverse flange plate 63 and the top side of two bearing blocks 106, 106 mounted on opposite sides of web plate 62 by means of suitable screws 107—107 threadably engaged in threaded holes in the flange plate. The latter is provided with a pair of slots 108, 108 aligned with the outer faces of web plate 62 and in which are rotatably mounted rollers 109, 109 on shaft 105. It will be noted that each roller 109 has a segment or peripheral portion thereof exposed above the top bearing surface 66 of the tine on which it is mounted so as to serve as the desired anti-friction means.

Each of tines 36 is also provided at its free end with additional anti-friction means to facilitate its travel over a ground surface. Such means may comprise a cross shaft 110 mounted transversely through a hole in web plate 62, with projecting ends thereof rotatably supporting a pair of rollers 111, each of which has a segment or peripheral portion extending down below the ground surface-engaging edge 65 of the tine. Thus, while the top rollers 109—109 facilitate entry of the tines 36—36 in the spaces 58—58 of the stack of bricks 55, the bottom rollers 111—111 facilitate motion of the fork across the ground surface. This roller support of the fork at the free ends of the tines, or the front end of the fork, may be supplemented by a pair of rear rollers 112, 112, as shown in Figs. 2 and 3, rotatably supported on, and extending slightly below the bottom edge of the back panel framework 31 so that the fork may be rolled forward and backward along ground surface on rollers 111—111 and 112, 112.

Entry of the tines in the spaces 58—58 of the stack of bricks 55 may be further facilitated by horizontal rollers supplementing vertical rollers 109—109. Such horizontal rollers are shown in Figs. 24 and 25 at 113, 113. For this purpose, middle tine 35 may be provided at its free end with

a pair of brackets 114, 114 suitably fixed or bolted to opposite sides of web plate 62, with a transverse flange 115 thereof having an internally threaded hole threadably receiving an externally threaded end portion of a shaft bolt 116 seated in a hole extending through transverse flange plate 63. Each of the horizontal rollers 113 is rotatably mounted on its associated bolt shaft 116 in the space provided between the bottom side of transverse flange plate 63 and the top side of bracket flange 115, and it will be noted that segments or peripheral portions of those two horizontal rollers extend laterally beyond the side edges of the transverse flange plate so as to provide anti-friction devices for engagement of the sides of space 58 in the center of the bottom layer 56 of stack 55. As indicated in Fig. 4, similar horizontal rollers are provided on the inner sides of the free ends of the end tines 34, 34.

It will be understood that some of the intermediate tines 36—36 may be equipped with more of the horizontal rollers 113—113 in lieu of the vertical rollers 109, 109, and that various other arrangements of such anti-friction rollers as may readily occur to one skilled in the art may be employed. However, the arrangement indicated in Fig. 4 is preferred since it has proven to be efficient in the functioning intended, and to avoid crowding of parts. The tines may be equipped with separate noses suitably mounted thereon, such as by bolting thereto, to facilitate mounting of such anti-friction rollers, particularly when it is desired to case harden or heat treat the major portions of the tines.

In operation of the embodiment of the fork disclosed in the drawings, particularly with reference to the handling of bricks loosely stacked as proposed in Figs. 1 and 2, either for the purpose of conveying them when green to and from a firing kiln or for handling them in transportation subsequent to firing, the fork 30 will be lowered, by slacking off on the suspending means, until the forward ends of the tines 34, 34, 35, and 36—36 are located substantially opposite and aligned with the spaces or recesses 58—58 between the bottom rows 57—57 in the stack 55, but with the fork preferably free of the ground and suspended to permit swinging by its suspending means and the fork handler into position. The fork handler will then, by grasping the guard rockers 37, 37, work the fork fully forward simultaneously with swing of the suspending means, such as the crane boom, with the tines being received in the recesses 58—58. During this forward sliding of the tines into the recesses 58—58, the rollers 109—109, 111—111 and 113—113 on the tines, and the real rollers 112, 112 substantially eliminate frictional drag or fork contact with brick faces and/or ground surface 117. Thus, scraping damage of brick faces is minimized. After the fork is so positioned beneath stack 55, lift is applied thereto in the direction of the arrow 118 shown in Fig. 12, through its suspending means, such as a lift truck slide on which it may be mounted, or crane hook 49 engaged in fork suspending ring 48, until the fork is raised to a position relative to the stack 55 of bricks 59—59 therein, similar to that indicated in Figs. 2 and 12. Thus, the bricks 59—59 laid cross-wise in the second layer 60 bridge across top supporting surfaces 66—66 of the fork tines 34, 34, 35 and 36—36, and in turn support the major weight of the bricks in the stack thereabove.

The fork handler then grasps one of the runs of the continuous chain 81, pulling thereon to rotate cross shaft 74 so as to oscillate gripper shafts 70—70 from retracted to engaging positions respectively indicated in Figs. 14 and 12. As a result, with such oscillation of gripper shafts 70—70, the yieldable dog-supporting arms 90—90 will be swung outwardly and upwardly therewith to raise and swing the dogs 89—89 in like manner. If the dogs 89—89 have been uncocked with retraction by engagement with abutment means, such as pins 119—119, they will in upward swing fall to cocked positions shown in Fig. 12 by virtue of the weight of their noses 91—91. The engaging noses 91—91 of the cocked dogs 89—89 will then be swung into engagement with the faces of the bricks 59—59 in bottom layer 56, and including surfaces of the panels 159—159 thereof. The resilient yielding of the arms 90—90, which is preferably of a limited nature due to the shape of the arms and dogs as contrasted with a fully resilient yielding characteristic, provides individual gripping force to each dog on the irregular surfaces of the brick faces when the gripper shafts 70—70 are so rotated to engaging positions, thus assuring sufficient distribution of engagement pressure as to obtain effective gripping of the bricks in the bottom layer 56 for lifting, as shown in Fig. 12. On application of additional lift, brick stack 55 is moved as a unit to desired location.

In order to release the load, consisting of the stack 55 of bricks, from the fork 30, the latter is lowered until the bottom edges of the rows 57—57 of bricks 59—59 in the bottom layer 56 come to rest upon a supporting surface, such as ground surface 117, with the weight of the remaining bricks in the stack, in the second layer 60 and all those thereabove which had been supported by the upper surfaces 66—66 of the tines, being then borne by those rested bottom layer bricks. The brick handler will then apply reverse pull to a run of the chain 81 so as to reverse rotation of the gripper shafts 70—70 to their retracted positions indicated in Fig. 14. This lowers and retracts mounting arms 90—90 and brings the dogs 89—89 inward toward the tine webs 62—62.

Since the fork 30 is to be freed from the stack of bricks 55 by withdrawing the tines 34, 34, 35 and 36—36 back out of the spaces 58—58, such dog retraction should not only free the dogs 89—89 from engagement of the brick faces in the bottom layer 56, but also should avoid a lowering of the dog noses 91—91 to below the plane substantially defined by the bottom edges 65—65 of the tine webs 62—62, so as to prevent them from digging into ground surface 117 upon tine withdrawal. For this purpose, the tine webs 62—62 are preferably provided with the mentioned abutment means, such as transverse pins 119—119 extending through holes to opposite sides of the webs. Such abutment means provided by the opposite ends of pins 119—119 are located opposite opposed pairs of dogs 89—89 so that the dogs will ride above the projected ends of the abutment pins with uncocking pivotal action of the dogs, as shown in Fig. 14. Notches 104—104 in the butts of the dogs 89—89 are to provide clearance for the projecting ends of the abutment pins 119—119, should the dogs be retracted when occasionally stuck upwardly in uncocked positions, such as the position indicated in Fig. 13.

After lowering of the stack 55 to rest upon ground surface 117, the fork 30 may be then further lowered slightly until tines 34, 34, 35 and

36—36 are substantially centered in the spaces 58—58 so that, with assisting backing motion by the fork suspending means, the handler may work the tines clear of the load. Such withdrawal, of course, is facilitated by the anti-friction rollers 109—109, 111—111 and 113—113 and 112, 112, as in the case of facilitating tine insertion.

In practice, the lifting means frequently lowers the fork 30 with its load so rapidly as to allow the stack 55 to contact ground surface 117 violently with a jolt. As a result, the fork may be permitted to drop down to contact with the ground surface, in the direction of arrow 120 as suggested in Fig. 13, with an attendant separation of the upper surfaces 66—66 of the tines from the bottom surfaces 61—61 of the bricks in the second layer 60, before dog retraction of Fig. 14 can be accomplished by the handler. In such cases, the upsetting action of the dogs 89—89 which is permitted by their structure and that of their supporting arms, results in uncocking due to frictional contact of the dog noses 91—91 with brick surfaces 159—159. This permitted uncocking of the dogs assures that their noses 91—91 will be freed from contact with the brick surfaces, as indicated in Fig. 13, thus preventing scraping damage to brick surfaces or distortional bending or fracture of the structure of the dogs and their supporting arm structures 90—90, which might otherwise result from an attendant jamming capable of producing excessive back pressure.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

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

1. A lifting fork for handling stacks of brick units and other rectangular elements comprising, in combination; a frame having a plurality of horizontally - extending, transversely - spaced tines; a pair of said adjacent tines defining therebetween a longitudinally-extending, units-receiving space; a pair of opposed, longitudinally-extending, transversely-spaced units-gripping means mounted in the space on opposite sides thereof with one supported on one of said pair of tines and the other on the other of said pair of tines; each of said means comprising a rotatable shaft having its axis arranged substantially parallel to said tines, a bank of a plurality of disconnected downwardly-depending dogs arranged along said shaft each having an outwardly-extending engaging nose, yieldable dog-mounting means mounted on and extending laterally and downwardly from one side of said shaft to be rotated thereby, said yieldable dog-mounting means securing said dogs to and floatingly mounting them on said shaft along one side thereof and below it so that the noses of each bank of dogs are opposed to the noses of the other bank of dogs below their carrying shafts, each bank of dogs being rotatable with its carrying shaft out into the space to be swung upwardly toward the opposed bank of dogs for yielding engagement by the opposed banks of dogs of opposite sides of units disposed in the space when said pair of shafts are rotated in opposite directions; and operating means to rotate said shafts simultaneously in opposite directions at least through radial angles between downward dog-retracted positions and upper lateral engaging positions.

2. The fork structure as defined in claim 1 characterized by the provision of spring biasing of said dogs to permit yield thereof after upward swinging engagement of units with further shaft rotation.

3. The fork structure as defined in claim 2 characterized by the provision of said dogs and mounting means as articulated members with each mounting member mounted at one end on said shaft and extending out and down away therefrom to the point of articulation with a butt end of the dog member mounted thereon.

4. The fork structure as defined in claim 3 characterized by the provision of said dog-mounting means in the form of downwardly-extending spring arms fixedly mounted on said shaft.

5. The fork structure as defined in claim 3 characterized by pivotal mount of the butt of each dog on said yieldable mounting means for free upward swing of each nose permitting dog uncocking upward rotation of said dog upon fork descent relative to load units before downward retractive swing of said mounting means, and the provision of stop means to limit downward swing of each dog nose relative to its mounting means to retain said dog in cocked engaging position on upward swing of said mounting means.

6. The fork structure as defined in claim 5 characterized by the provision of said tines of certain dimension with bottom edges thereof substantially determining a plane of rest, said shafts being mounted a substantial distance above said plane sufficient to prevent said dog-mounting means being swung down therebelow when said dogs are swung down to retracted positions above said plane.

7. The fork structure as defined in claim 6 characterized by the provision of abutment means to be engaged by said dogs as they are swung down to retracted positions to cause them to be rotated in an uncocking direction a said mounting means is swung down to the limit of its retraction thereby assuring raising of said dog noses to positions above said plane.

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