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APPARATUS AND METHOD FOR HANDLING A LOAD SUPPORTED ON A PALLET

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Fig. 3.

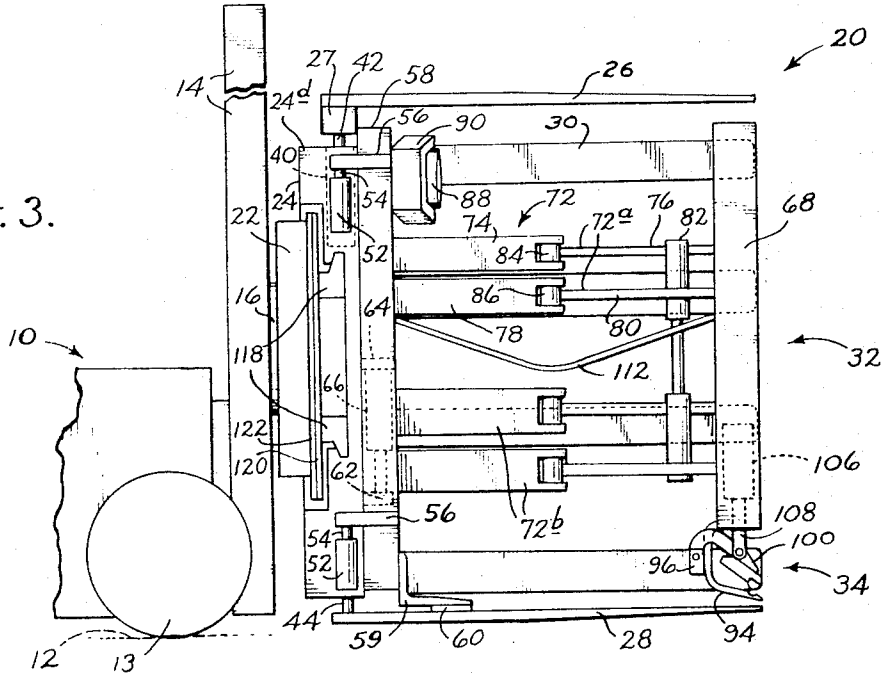


Fig. 4.

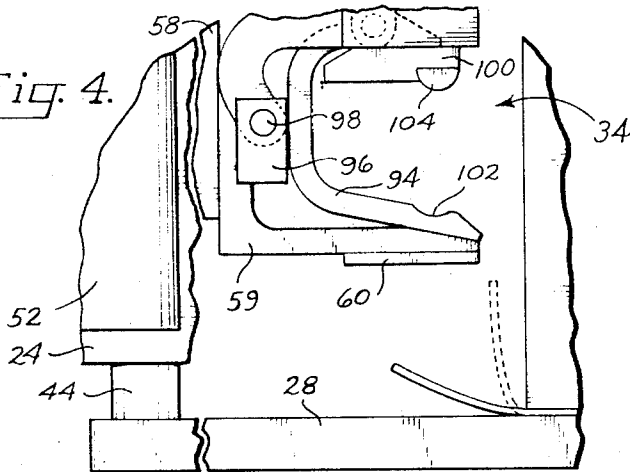
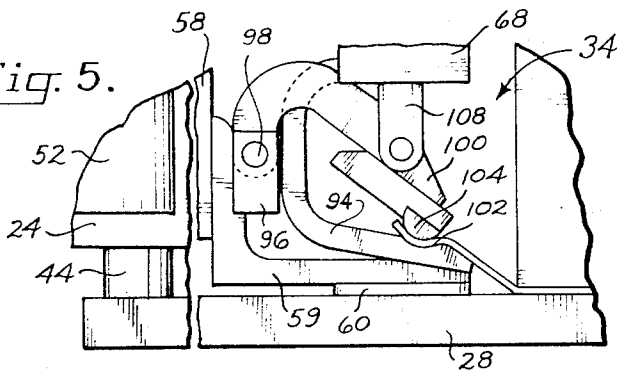


Fig. 5.



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APPARATUS AND METHOD FOR HANDLING A LOAD SUPPORTED ON A PALLET

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10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for inverting a load supported on a pallet having horizontal support forks which may be inserted under the pallet and lifted, clamp forks opposing the support forks which project over the load with the support forks under the pallet, and stabilizing forks to one side of and normal to the support and clamp forks. The clamp and support forks may be moved toward each other to grip the load and a pallet therebetween, and the stabilizing forks act to support the load from the side. The forks are mounted on a common mounting frame which is connected through a rotator to a vehicle, and on operation of the rotator the mounting frame and forks are rotated about a horizontal axis to invert the load and pallet. A pusher frame with jaw mechanism is also mounted on the mounting frame between the support and clamp forks. The pusher frame is adapted to push loads from the forks and the jaw mechanism is adapted to pull loads onto the forks.

This invention relates to load-handling apparatus and method, and more specifically, to load-handling apparatus with novel means for gripping a load, inverting the load, and discharging it from the apparatus.

A well-known method of handling loads involves the use of pallets which have a load support platform supported over the ground by elevators which rest on the ground. A load to be moved is placed on the support platform of the pallet. This enables the forks of a fork lift vehicle to be inserted under the platform, whereby the pallet and load may be lifted with the forks subsequently raised. The load may now be moved, and re-deposited on the ground by lowering the forks. Such a load-handling method is convenient, but has drawbacks. During shipping and to maintain the load on the pallet requires shipping the load with the pallet. This means either loss of the pallet, or introduces the problem of its return. Alternatively, the load must be manually removed from the pallet before shipment, which may be costly.

A general object of this invention is to provide novel apparatus for handling a load supported on a pallet, which apparatus is versatile in operation and permits economies in load shipment and storage.

More specifically, an object of the invention is to provide such novel apparatus, which has opposed forks adapted to grip a pallet and load therebetween as a unit, rotator means adapted to rotate the forks about a horizontal axis to invert the load and pallet to place the pallet on top of the load, and unloading means for pushing the load and pallet from between the opposed forks and onto a supporting surface. With the load inverted and the pallet then resting thereon, the pallet may be easily removed.

A related object is to provide such apparatus with stabilizing forks which support the load and pallet to keep them from falling from their position gripped between the opposed forks while they are being inverted.

A further object is to provide novel apparatus which

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is adapted to transfer a load from a position resting on one pallet to a position resting on another pallet.

Another object is to provide a novel method for transferring a load from a position resting on one pallet to a position resting on another pallet, by placing one pallet and the load resting thereon on a support element, placing the other pallet on top of the load, gripping the load and the two pallets between the support element and a clamp element opposing the support element, and rotating the support and clamp elements about a horizontal axis to invert the load and pallets.

A still further object is to provide a novel method of handling a load resting on a pallet, wherein a support element is inserted under the pallet, the load and a pallet are clamped between the support element and a clamp element positioned over the load, the load, pallet, clamp and support elements are rotated as a unit about a substantially horizontal axis to invert them, and then the load is pushed off by a pusher element.

A further object of the invention is the provision, in load-handling apparatus having a pair of opposed forks adapted to receive and grip a load therebetween, of a jaw mechanism which is movable longitudinally of the forks, which jaw mechanism is actuatable to grasp an edge of a sheet-type pallet and upon being moved longitudinally inwardly along the forks to pull the sheet-type pallet and load supported thereon to a position between the forks.

These and other objects and advantages are attained by the invention and the same is described below in connection with the accompanying drawings, wherein:

FIG. 1 is a side elevation view of apparatus as contemplated, having a mounting frame mounted on the forward end of a vehicle, clamping forks mounted on and projecting forwardly of the mounting frame, elongated support forks mounted below the clamping forks, stabilizing forks mounted to one side of the clamping and support forks, and a movable pusher frame between the forks which is retracted to a position adjacent the mounting frame;

FIG. 2 is a side elevation view of the apparatus illustrated in FIG. 1, with the mounting frame inverted, which places the clamping forks below the support forks, the view illustrating jaw mechanism mounted along one edge of the pusher frame;

FIG. 3 is an illustration similar to FIG. 2, but showing the movable pusher frame extended to a position adjacent the forward ends of the forks;

FIG. 4 is a side elevation view, on a somewhat larger scale, of the jaw mechanism, such being shown in an open position; and

FIG. 5 further illustrates the jaw mechanism, but shows it in a closed position and gripping an edge of a sheet-type pallet.

Referring now to the drawings, and first more particularly to FIGS. 1, 2, and 3, at 10 is shown generally the forward end of an industrial vehicle which is supported above the ground or support surface 12 on wheels 13. Tiltably mounted on the forward end of the vehicle is a vertical mast 14. A carriage 16 is mounted for vertical movement on the mast and load-handling apparatus as contemplated is shown generally at 20. Such is mounted on the carriage for movement therewith.

Describing apparatus 20, in broad terms it comprises a power-operated rotator or means 22 secured to the carriage, and a mounting frame 24 mounted on the rotator. Elongated horizontal support elements or forks 26 which, with the apparatus in the position illustrated in FIG. 1, are located adjacent the bottom of the mounting frame, and elongated horizontal clamp elements or forks 28 are mounted on the mounting frame opposite support forks

26. The apparatus also includes elongated stabilizing means or forks 30 mounted on the mounting frame to one side of the clamp and support forks, unloading means 32 positioned between the clamp and support forks and movable longitudinally thereof, and a jaw mechanism 34 which is operatively connected to the unloading means adjacent the clamp forks.

Mounting frame 24 is an elongated upright structure extending transversely of the longitudinal axis of vehicle 10. The frame is bounded on opposite sides by side 24c (facing the viewer in FIG. 1) and side 24d (facing the viewer in FIG. 2). Structure between these sides (not shown) is employed in securing the frame to rotator 22.

In the embodiment of the invention disclosed, there are two laterally-spaced support forks 26 at the base of frame 24 in FIG. 1 (the nearer fork having been broken away in FIG. 1 to reveal the farther fork). These project forwardly of the mounting frame, and the upper surfaces of these forks lie substantially in the same plane. Interconnecting the forks is a bar 27.

A ram 40 is provided directly inwardly of each side of frame 24 for moving the forks up and down under power. Each ram includes an extensible rod 42 which extends downwardly in FIG. 1 below the mounting frame and is secured at its base to bar 27. The cylinder of each ram is suitably fixed to the mounting frame. The usual pressure fluid system (not shown) is provided for the purpose of actuating the rams.

Laterally-spaced clamp forks 28 project forwardly of the mounting frame, and are secured at their butt ends to a bar 44. Bar 44 in turn is fastened to the end of frame 24 opposite the end adjacent support forks 26, or to the top end of the frame in FIG. 1. The forks have their lower surfaces lying in substantially a common plane, which substantially parallels the plane of the upper surfaces of forks 26. While two support forks have been described, ordinarily a somewhat greater number of forks (for instance six), and more closely spaced forks, are present as clamping forks, since these also may function to support a flexible, sheet-type pallet, and a greater continuity in the support for such a pallet is desirable.

Stabilizing forks 30 are shown disposed in a vertical plane in FIG. 1 and located somewhat laterally outwardly of side 24c in frame 24. These stabilizing forks also project forwardly of the mounting frame and have their butt ends interconnected by a bar 50. It is preferred that the stabilizing forks be adjustably mounted on the mounting frame for movement toward and away from side 24c. For this purpose, a series of fluid-operated rams may be provided having their rod ends 48 secured to bar 50 and their cylinder ends (not shown) suitably affixed to the mounting frame inwardly of side 24c.

Shown directly in front of mounting frame 24 in FIG. 1 is a subframe 58. This subframe, like the mounting frame, is an elongated upright structure extending transversely of the axis of the vehicle. The mounting for the subframe on the mounting frame is such as to afford a limited amount of relative vertical movement. To this end tubular guides such as guides 52 may be provided secured to the sides of the mounting frame receiving guide rods 54 which are movably up and down in the guides. Lugs 56 joined to the exposed ends of the guide bars and joined to the subframe interconnect the rods and subframe. Other forms of guide structure for the subframe will, of course, suggest themselves to those skilled in the art.

Power-operated means is further included for shifting the subframe up and down relative to the mounting frame under power. As shown in FIGS. 2 and 3 a lug 62 rigidly secured to and projecting forwardly of mounting frame 24 has connected to it the rod end of a fluid-operated ram 66. The cylinder end of the ram is secured by way of a brace member 64 in the subframe to the subframe.

Referring now to FIGS. 2 and 3 which show the apparatus inverted, secured to the forward side of subframe

58 along its bottom edge in these figures, and adjacent clamp forks 28, is a gripping shoe 59. This gripping shoe comprises an elongated gripper bar having a substantially L-shaped profile which extends across clamp forks 28. Fastened to the bottom surface of the gripper bar is an elongated pad 60 extending substantially the length of the bar. The gripper shoe and pad move with movement of the subframe vertically of mounting frame 24, toward and away from clamp forks 28.

Unloading means 32 comprises a movable pusher or pusher frame 68 disposed substantially perpendicular to and intermediate the support and clamp forks, and extending across the clamp and support forks. Mounting the pusher frame on subframe 58 is extensible means shown generally at 72, which is operable to move the pusher frame longitudinally of the support and clamp elements.

More specifically, extensible means 72 comprises pantograph structure with upper and lower sections which are best illustrated in FIGS. 2 and 3, and indicated at 72a, 72b. These sections are similar in construction. Thus, section 72a comprises four rigid arms 74, 76, 78, and 80, jointed in parallelogram form, such joints being indicated at 82, 84, and 86. Arms 74, 78 project out from and have their rear ends joined to upright torsion shafts (not shown) which are journaled adjacent the sides of subframe 58. The forward ends of arms 76, 80 are slidably received within horizontal runways (not shown) provided in the back of pusher frame 68. Similar pantograph structure is discussed in some detail in U.S. Patent 3,197,053.

Power-operated means is provided for producing extension and retraction of extensible means 72. Thus, and with reference to FIGS. 2 and 3, adjacent each side of the subframe is a double acting ram 88, having its rod end suitably connected to the subframe, and its cylinder end pivotally connected between the legs of a bifurcated lever 90. These levers are, in turn, joined to the torsion shafts mounting arms 74, 78. On extension of the rams, the levers 90 are swung away from the subframe causing rotation of the torsion shafts and swinging of arms 74, 78 to extend the pantograph structure. Contraction of the rams serves to collapse the structure. Similar rams and associated structure are also described in the above-mentioned U.S. patent.

The pusher frame, by reason of its mounting on the subframe through extensible means 72 is guided independently of any structure on the support or clamp forks, and it is moved vertically with the subframe as the subframe is raised and lowered. The pantograph structure described enables extension of the pusher frame to a position over the forward or tip ends of the clamp and support forks, so that a load may be pushed by the pusher frame from between these forks.

Jaw mechanism 34 is at the base of the pusher frame, and comprises a lower jaw member 94, which is an elongated member paralleling gripper bar 59. An upper portion of member 94 (see FIGS. 4 and 5) extends to the base of the pusher frame and is secured thereto. Fastened to the backside of lower jaw member 94 are blocks 96, with one positioned adjacent each end of the lower jaw member. Pivotally mounted on blocks 96 by pivot connections 98, is an upper jaw member 100.

Lower jaw member 94 has an upper clamping face containing a groove 102 running along the length thereof. The upper jaw member is provided with a complementing ridge 104. On pivotal movement of the upper jaw member about the pivot axis provided by pivot connections 98, ridge 104 moves into groove 102 to produce firm gripping contact therebetween. The jaw mechanism is thus able to grip the edge of a sheet-type pallet as is illustrated in FIG. 5.

A double-acting ram 106 (see FIGS. 2 and 3) mounted adjacent each side of the pusher frame lowers the upper jaw member when extended. Such rams have their cylinder ends suitably secured to the pusher frame and their

rod ends 108 pivotally connected to the upper jaw member. Fluid under pressure for actuating ram 106 is provided from the usual supply system (not shown) connected to the rams through conduit means 112.

Mounting frame 24 is supported on the vehicle carriage through rotator 22. Referring to FIGS. 2 and 3, the back of the mounting frame is fastened to bars 118 and these bars are secured to a plate 120 extending behind the bars. Rotator 22 includes the usual power-operated mechanism for effecting rotation of plate 120 about a generally horizontal axis extending about the longitudinal axis of the vehicle and relative to plate 122 disposed directly behind plate 120. Thus, with operation of the rotator the mounting frame and all the structure supported thereon may be rotated from the position shown in FIG. 1, where the support forks are positioned at the base of the apparatus, first to place the stabilizing forks under any load clamped between the clamp and support forks, and thence, on further operation of the rotator, to invert the apparatus entirely, as shown at FIGS. 2 and 3, where the support forks are adjacent the base of the apparatus and the clamp forks are on top.

The apparatus of the invention, of course, can be used in the handling of loads supported on the usual pallet with a raised support platform and on a flexible sheet-type pallet, such as cardboard pallets, in a more or less conventional manner. Thus, to pick up and transport a load on a pallet having a raised support platform, the apparatus is positioned as in FIG. 1 with the support forks adjacent the ground. These forks may then be inserted under the platform of the pallet and on raising of the forks the pallet is raised. In handling loads deposited on a sheet-type pallet, the apparatus is inverted and placed in the position shown in FIG. 2. To pull a load supported on such sheet-type pallet onto the support forks, the pusher frame is extended and the edge of the sheet-type pallet gripped by jaw mechanism 34. The load and pallet may then be pulled onto the support forks by a retraction of the pusher frame. To discharge the load with the sheet-type pallet, the pusher frame is extended while backing the truck away which has the effect of sliding the pallet and load off the support forks. To discharge the load while retaining the sheet-type pallet, the subframe and pusher frame are raised with jaw mechanism 34 released from the edge of the pallet. This enables the edge of the pallet to slip under the gripping shoe which is also raised on raising of the subframe. The gripping shoe is then lowered on the edge of the pallet to clamp onto it and thus to hold the pallet with the load being pushed off by extension of the pusher frame. In FIG. 5 the edge of a sheet-type pallet is shown gripped in jaw mechanism 34, and in FIG. 4 the edge of the pallet is shown released from the jaw mechanism and as it would appear dropped under the gripping shoe with raising of the gripping shoe.

The principle distinguishing features of the invention reside in the manner in which the apparatus may be employed in the transferring of a load between a pallet of the sheet type and a pallet of the type having a raised platform, and in the handling of a load whereby it may be deposited with the pallet which formerly supported it in a position enabling its free removal from the load. Toward these ends the apparatus is characterized by the inclusion of opposed sets of forks which may be actuated to be brought together for clamping onto a load and the pusher frame disposed between such forks which is actuable to push off a load from either of such forks subsequent to such a load having been gripped and inverted by the forks.

Further explaining, and assuming it is desired to deposit a load carried on a conventional pallet with a raised platform on a boxcar while retaining such pallet, the apparatus is positioned as in FIG. 1 and the support forks moved under the pallet in a conventional manner. The load may then be clamped by moving the support forks toward the clamp forks and, with raising of the carriage, the load may

be inverted (with the stabilizing forks supporting the lateral sides of the load during the inversion) to place the clamp forks under the load. When the load is subsequently pushed off the clamp forks onto the floor of the boxcar (the clamping pressure first having been released by movement of the clamp and support forks away from each other) what formerly was the base of the load becomes the top of the load and the pallet is positioned on the top of the load free for ready removal. In the event that it is desired to deposit the load on the floor of a boxcar with the load supported on a sheet-type pallet, the pallet is placed on top of the load prior to load inversion and clamping of the load between the support and clamp forks. With subsequent inversion of the load and pushing of the load from the clamp forks, the sheet-type pallet slips off the forks to come to rest under the load as newly positioned in the boxcar. This type of loading, of course, is advantageous to the party who subsequently unloads the car as this party may use the sheet-type pallet as an agency for withdrawing the entire load from the car.

An operator who wishes to transfer a load from one supported on a sheet-type pallet to one supported on a conventional pallet with a raised platform may do so readily by pulling the load while on the sheet-type pallet onto the clamp forks using jaw mechanism 34 and by retraction of the pusher frame and jaw mechanism. The operator may then place a conventional pallet with raised platform over the top of the load, and then by clamping the load between the support and clamp forks and inverting the assembly the load then becomes positioned over the pallet having the raised platform. Such is deposited in any location by moving the clamp and support forks away from each other and lowering the support forks to the ground, more or less as a conventional fork lift truck is employed.

It should be obvious from the above description that the apparatus and method contemplated have several unique and distinguishing features and advantages over presently known load-handling apparatus and handling procedures. The apparatus is particularly useful in permitting a manufacturer to transport palletized loads in a factory or warehouse, while permitting the pallets employed to be retained at the time that such loads are shipped to a receiver. This, of course, eliminates the problem of having to return any pallets and of losing pallets on shipment.

It is claimed and desired to secure by Letters Patent:

1. A method of handling a load resting on a pallet, where such pallet is of the type having a raised elevator-supported platform, to permit the removal of said pallet, the method comprising moving a support inwardly under the raised platform of the pallet, clamping the load and pallet between said support and a clamp positioned over the load, inverting the load and pallet by rotating the clamp and support as a unit about a substantially horizontal axis, positioning the clamp adjacent a supporting surface, and after positioning of the clamp and by pushing said load sliding the load off said clamp onto said supporting surface, said clamp and support being moved apart completely to free the pallet which is then on top of the load after inverting of the load and prior to pushing the load off the clamp.

2. A method of transferring a load between a sheet-type pallet that rests directly on the ground and a pallet including a raised platform supported over the ground adapted to have forks inserted thereunder, comprising moving the load while on one of such pallets onto a support, clamping the load and pallet between such support and a clamp positioned over the load, prior to so clamping the load placing the other of such pallets on top of the load, inverting the load and pallets by rotating the clamp and support as a unit about a substantially horizontal axis to place the other of such pallets under the load, positioning the clamp adjacent a supporting surface, and by pushing said load shifting the load and the other of such pallets under the load off said clamp onto said supporting surface.

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3. The method of claim 2, wherein the load is initially supported on the sheet-type pallet and the load on said pallet is moved onto said support by pulling the pallet whereby it slides onto and over the support, and the other of said pallets has a raised platform supported on elevators and the load is pushed off said clamp with said elevators then resting on said supporting surface.

4. The method of claim 2, wherein the load is initially supported on a pallet with a raised platform supported on elevators, and the load is moved onto said support by inserting said support under said platform, the other of said pallets is a sheet-type pallet, and the load is pushed off said clamp by sliding the other pallet off said clamp with the load lodged on said other pallet.

5. The method of claim 1, wherein prior to clamping of the load and pallet a sheet-type pallet adapted to rest directly on the ground is placed on top of the load and the load is shifted off said clamp by sliding the sheet-type pallet off the clamp with the load lodged on the sheet-type pallet.

6. In a vehicle having a mast and a carriage mounted on and movable vertically along the mast, apparatus mounted on and movable with said carriage for handling a palletized load comprising an elongated support element upon which such a load may be supported, an elongated clamp element above and opposing said support element, power-operated means operatively connected to one of said elements which is actuatable to move said one element toward the other of said elements to clamp a load between said elements, power-operated rotator means operatively connected to said support and clamp elements actuatable to rotate said elements as a unit so as to place the clamp element beneath the support element and to invert a load disposed between them, and unloading means for pushing such a load from between said elements comprising a power-operated movable pusher intermediate

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said support and clamp elements operable on actuation to move said pusher longitudinally of said elements, the unloading means being connected to said rotator means whereby the unloading means rotates with the support and clamp elements on actuation of the rotator means.

7. The apparatus of claim 6, wherein said pusher, clamp and support elements are all mounted on a frame, and the frame is operatively connected to said rotator means for rotation upon actuation of said rotator means.

8. The apparatus of claim 7, which further comprises jaw mechanism adjacent said clamp element for clamping onto a sheet-type pallet, which jaw mechanism is movable along the clamp element, and the jaw mechanism is operatively mounted on the frame for rotational movement with the frame.

9. The vehicle of claim 6, wherein with the clamp element beneath the support element, the carriage is lowerable to place the clamp element directly against a supporting surface supporting the vehicle.

10. The apparatus of claim 9, which further comprises stabilizing means providing lateral support for a load gripped between said support and clamp elements.

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