Feb. 16, 1954 C. W. KAHLERTH 2,669,363

HOISTING APPARATUS

Filed April 17, 1952

3 Sheets-Sheet 1

Fig. 2.

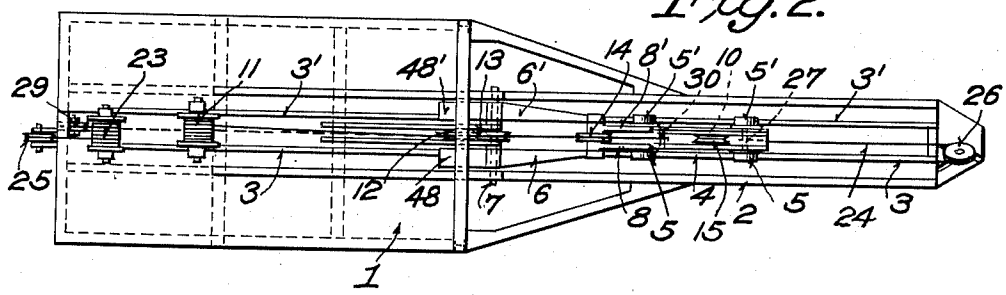


Fig. 1.

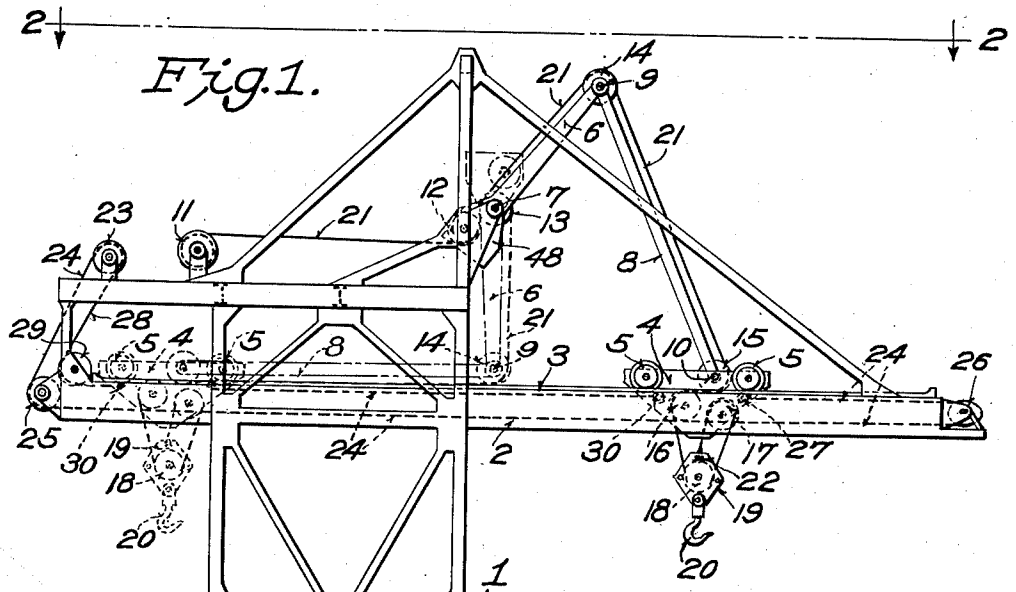
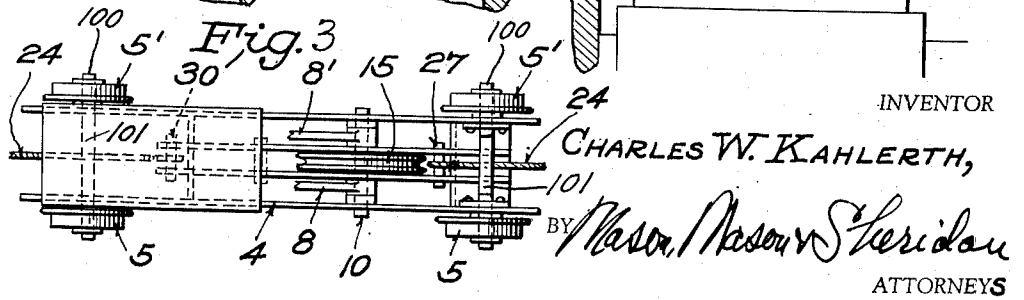


Fig. 3



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Fig. 5

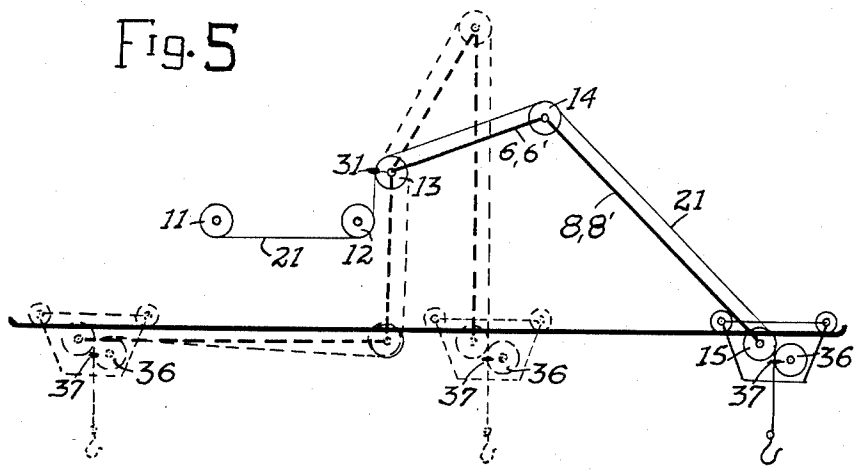
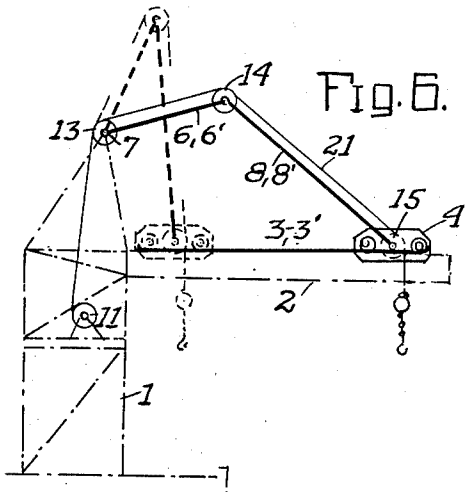
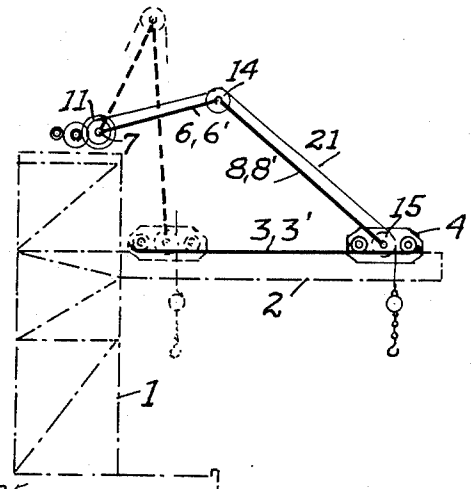


Fig. 6.





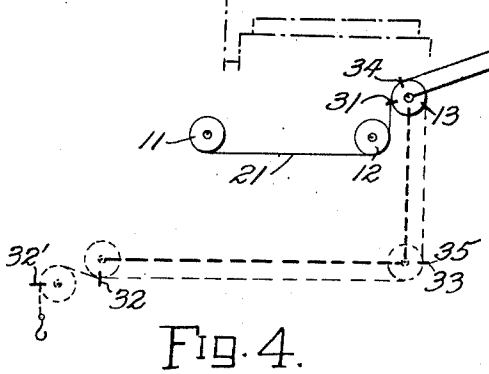


Fig. 4.

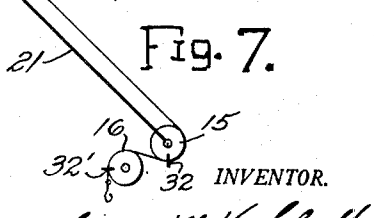


Fig. 7.

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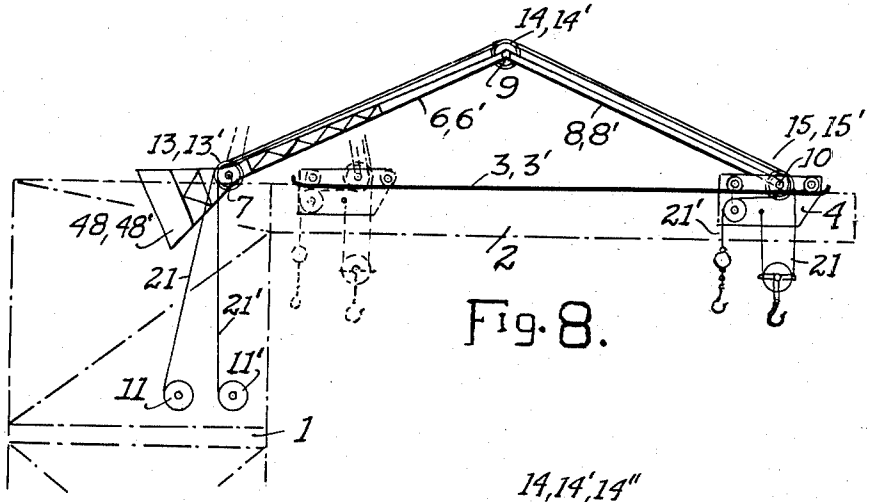


Fig. 8.

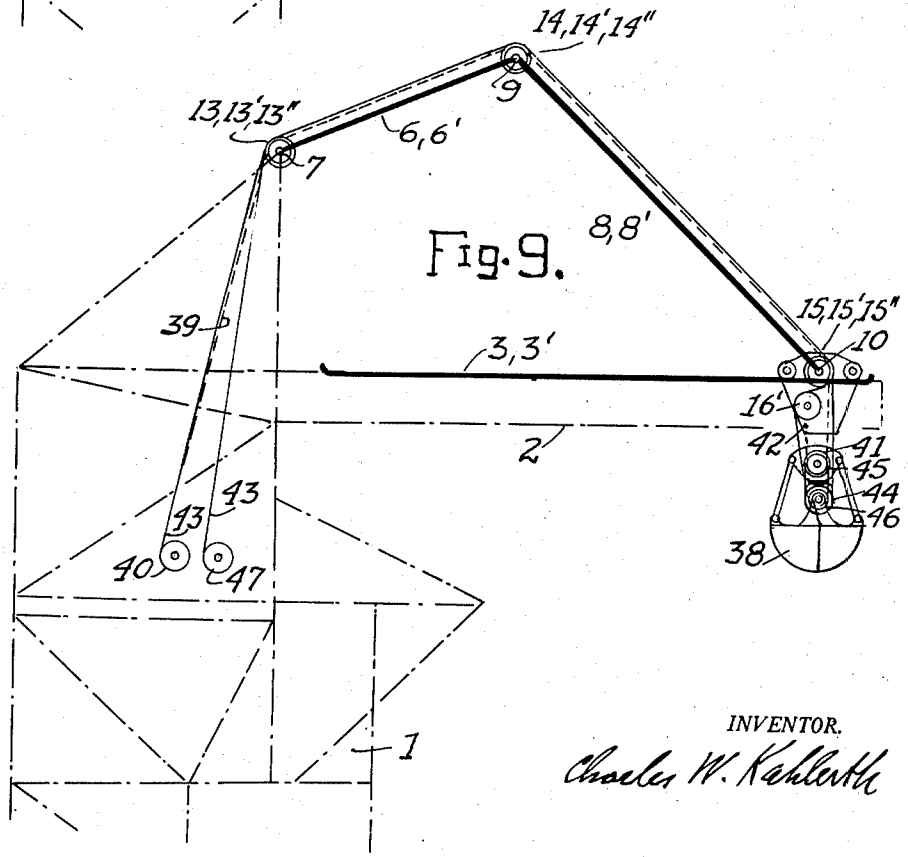


Fig. 9.

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2,669,363

HOISTING APPARATUS

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Application April 17, 1952, Serial No. 282,737

5 Claims. (Cl. 212—77)

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This invention relates to hoisting apparatus of the rope trolley type; that is, the type in which the machinery for hoisting and conveying the load is in a fixed position in relation to the trolley runway and only the load and trolley is moved along its track.

The object of the invention is to provide an apparatus that combines all the desirable and eliminates the disadvantageous features found in systems known to the prior art.

To provide an efficient, very flexible and economical apparatus that will reduce the wear on the hoisting rope and its sheave wheels to a minimum thereby increasing their useful life, reducing maintenance and replacement cost and delays due to replacement of worn parts.

My invention will best be understood by reference to the following description and the drawings in which:

Fig. 1 is a side elevation of a structure embodying one form of this invention.

Fig. 2 is a top plan view of the structure shown in Fig. 1, taken on the line 2—2 of Fig. 1.

Fig. 3 is a top plan view of the trolley, and showing the connecting links broken off.

Fig. 4 is a diagrammatic view of the hoisting rope, sheaves and links showing in full lines one extreme position of the parts, and in dotted lines the parts in the opposite extreme position.

Fig. 5 is a view similar to Fig. 4 of a modified form of the invention.

Fig. 6 is a view similar to Fig. 4 of a further modified form of the invention.

Fig. 7 is a view similar to Fig. 4 of a further modified form of the invention.

Fig. 8 is a side elevation of a further modified form of the invention, and

Fig. 9 is a side elevation of a further modified form of the invention.

Throughout the drawings and specification like reference characters indicate like parts.

Many of the composing parts of this invention are well known and understood by those skilled in the art and require no detailed description or detailed drawings.

Referring now to Figs. 1 and 2, 1 is a suitable structure supporting a runway 2 to which are attached rails 3 and 3'. The ends of the rails are shown curved upwards to form a mechanical limit stop for the trolley 4.

The trolley is arranged to travel on the rails by means of wheels 5 and 5'. Links 6 and 6' are hinged on the structure 1 by pin 7. Links 8 and 8' are hinged to links 6 and 6' by pin 9 and to the trolley by pin 10. 11 is a drum of a

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power driven hoist mounted on the structure. 12 is a guide sheave attached to the structure. 13, 14 and 15 are sheaves mounted on pins 7, 9 and 10. Said pins 7, 9 and 10 are preferably of uniform size. Sheaves 16 and 17 are arranged on the trolley. The hoisting block 19 for supporting the load is equipped with sheave 18 and hook 20. The hoisting rope 21 leads from the drum 11 over sheaves 12, 13, 14, 15 and 16 over hoisting block sheave 18 and trolley sheave 17 with the end of rope fastened to hoisting block at 22. Sheave wheel 12 is so located that the hoist rope 21 will always be in contact with sheave 13 irrespective of the position of links 6 and 6'.

The means for moving the trolley 4 along its rails are here shown as a power driven drum 23 mounted on the structure. Rope 24 leads from this drum over sheaves 25 and 26 and is fastened to trolley at 27. Rope 28 leads from the opposite side of drum 23 over sheaves 29 and is fastened to the trolley at 30, so that the trolley can be moved in either direction depending upon the direction of rotation of drum 23.

As disclosed more fully in Fig. 3, the trolley has front wheels 5, 5' mounted on an axle 100, which has a central U-shaped portion 101 which will permit links 8, 8' to assume a substantially horizontal position, when the trolley has moved to its extreme leftmost position as shown in Fig. 3.

Referring again to Fig. 1, it is obvious that the hook 20 can be raised or lowered by causing drum 11 to be driven in one or the other direction.

When conveying the trolley from the extreme right position towards the left the links 6 and 6' will swing upward until links 8 and 8' assume a vertical position, further motion to the left will cause the links 6 and 6' to swing downward and with trolley in extreme left position the links 8 and 8' are shown parallel to trolley rails. During this trolley motion the hoisting block and hook move parallel to the rails, as long as the hoisting drum is not revolving, as the length of the hoist line between drum and point 32' on trolley sheave 16 remains the same in all trolley positions.

Fig. 4 shows the hoisting rope reeving with trolley in the two extreme positions. 31 is the intersection of a horizontal line through center of sheave 13 with the hoisting rope and 32 of a vertical line through center of sheave 15. 32' is the tangent joint of hoist rope on sheave 16. In the following observations it is assumed

that the hoisting drum 11 is not rotated. It is obvious that the length of rope between drum 11 and point 31 and between 32 and 32' remains the same. The sum of the arcs of contact of the rope on sheaves 13, 14 and 15 between points 31 and 32 is always 270 degrees irrespective of the position of the trolley.

In Fig. 1 the hook is shown as supported by the rope at three different places, but it will be obvious that the rope may be attached to the block at any number of places, or the hook may be directly attached to the end of the hoisting rope as shown in Fig. 4.

When the winding drum 11 is held stationary, the length of cable between the drum and the hook remains constant and the sheaves 12, 13, 15 and 16 do not rotate, as the carriage 4 is moved along the track. The hook will thus move in a horizontal path. The arc of contact of the rope on the sheave 13, 14 and 15 will vary as the hook is moved in a horizontal path, but the total of the arcs of contact of these sheaves remains the same during such movement. The pin of sheave 14 oscillates or rocks in the sheave, but the sheave does not rotate as long as the winding drum remains stationary as will be apparent by referring to Fig. 4.

The numeral 33 indicates the intersection of a horizontal line extending through the center of sheave 14, and 34 and 35 indicate the contact arcs of the hoist line and the sheaves 13 and 14. It will be readily seen that the sum of the arcs of contact, said arcs being indicated by numerals 31 to 35 of pulleys 13, 14 and 15, will always remain as 180 degrees for all positions of the trolley.

A variation of the hoisting rope reeving shown in Figs. 1 and 4 is illustrated in Fig. 5. In Fig. 4 the sheave 16 is shown in an arbitrary horizontal distance from sheave 15. In Fig. 5 a sheave 36 is located horizontally a distance "d" and vertically a distance "$0.57d$" from sheave 15. 37 is the intersection of a horizontal line through center of sheave 36 with the hoisting rope. While the trolley is moving towards the intermediate position shown, that is, when links 8 and 8' assume a vertical position, the length of rope between points 31 and 37 remains exactly the same.

When the trolley is moved further to the left the rope will start bending around sheave 36 and when in extreme left position with links 8 and 8' horizontal the length of rope will for all practical purposes be the same as before. Therefore, with the rope reeving shown in Fig. 4 the path of the hook will be perfectly horizontal and with the one shown in Fig. 5 horizontal for all practical purposes. In the hoisting apparatus shown in Fig. 6 the trolley does not travel beyond the vertical position of link 8 and 8'; therefore, the sheave 16 in Fig. 4 or the sheave 36 shown in Fig. 5 is not required. The hoisting drum location also eliminates the sheave 12.

The structure shown in Fig. 7 is similar to that shown in Fig. 6, except that in the Fig. 7 structure, the hoisting drum is located in the position of sheave 13 of Fig. 6, thus displacing or eliminating sheave 13. In order that the hook move in a horizontal path, the drum 11 and sheaves 14 and 15 should be of the same diameter.

Fig. 8 shows two separate hoisting ropes 21 and 21' that are operated by two independently driven drums 11 and 11'. One of the hooks is supported by two parts of the rope at spaced places thereon for handling heavy loads, while the second hook is attached by its rope end for handling lighter loads. A separate sheave is provided at each of the pivots 7, 8 and 9, said sheaves being indicated by the numerals 13, 13'; 14, 14' and 15, 15'. These sheaves are shown in the figure as of different diameters for purposes of clarity, but they may be of the same diameter.

Fig. 9 illustrates another form of the invention in which the hoisting apparatus is employed for handling bulk material by means of a clam shell bucket. The bucket 38 is preferably of the four line type. Each of the pivots 7, 9 and 10 supports three sheaves 13, 13'; 14, 14', 14'' and 15, 15', 15''. The hoisting or holding rope 39, shown in dotted lines, leads from the drum 40 over sheaves 13, 14, 15 and over sheave 41 in the head bucket. Its end is attached to the trolley frame at 42. The closing line 43, shown in full lines, has one end which leads from drum 40 over sheaves 13', 14', 15'', over sheave 44 located at the bucket jaws hinge, over sheave 45 in the head of the bucket, over sheave 46 at the bucket jaws hinge, and then back to drum 47 by passing over sheaves 15'', 14'', 13''.

Both drums 40 and 47 are independently power-driven and controlled in a manner well known to those skilled in the art. Recapitulating, point 32' in Fig. 4 and point 37 in Fig. 5 are the points at which the hoist rope ends its contact with the trolley sheaves. Hereinafter the length of hoist rope between drum and the above contact point will be designated as the length of hoist rope between drum and trolley.

The characteristic features of this invention are:

First, the length of the hoisting rope between drum and the trolley remains exactly or substantially the same for all positions of the trolley. Therefore, when the hoisting drum is not rotated, the hook or load will describe a horizontal path when conveying the trolley in either direction. Since the hook or load is neither hoisted nor lowered, the force required for conveying the trolley, regardless of the load handled is only that required to overcome friction and the inertia of the various moving parts. The hoist line pull on the trolley is at all positions counteracted by the equivalent compression in links 8 and 8'. The effect of the weight of links 6, 6', 8 and 8' can be balanced by weight 48 and 48' shown in Fig. 1, Fig. 2 and Fig. 3. All this results in a mechanically light trolley conveying machinery, small driving power and small size trolley ropes. If this rope should break, the load will not drop.

Second, the hoisting rope sheaves are turning only when hoisting or lowering hook or load and are not rotated by the motion of the trolley in either direction. This reduces wear on both ropes and sheaves to a minimum, resulting in longer life for rope and sheave, reducing maintenance, replacement cost and delays due to replacement of worn parts.

Third, the apparatus is very flexible in its use as the load can be supported on any desired number of parts of line to suit conditions.

Fourth, the entire independence of hoisting and trolley mechanism, permits independent or simultaneous hoisting or lowering and conveying of trolley in either direction. The hoisting and trolley speeds can be selected independent of each other to best suit conditions.

While various hoisting apparatus and systems

known possess some of the features pointed out above, none of them combines all the features and advantages disclosed by this invention.

While this invention is primarily intended and herein shown for hoisting apparatus with horizontal runways, it is understood that it can also be used with inclined runways, in which case the force required to operate the trolley, will in addition to friction and inertia of moving parts, depend upon the load handled and the grade of the incline.

While the invention has been shown and described in particular forms, it is to be understood that the same, as to many of its features, is applicable to hoisting apparatus and systems other than the particular ones here shown.

It is also to be understood that deviations may be made from the relative arrangements of parts, all without departing from the spirit of the invention.

I claim:

1. A hoisting mechanism comprising a supporting structure, said structure having a runway supported thereon, a trolley on said runway, means for moving the trolley on the runway, a power driven hoisting drum mounted on said supporting structure, a hoisting rope wound on the drum, link means pivotally connected to each other, one end of one of said link means being hinged to said supporting structure and one end of the other of said link means being hinged to said trolley, load hoisting means suspended from said hoisting rope on said trolley, sheaves mounted at the pivotal connection of said link means and on said trolley, said hoisting rope leading from said hoisting drum over said sheaves on the link means and trolley to said load hoisting means, whereby to permit the travel of the trolley within its working range with the link means moving in accordance with the movements of the trolley to maintain the length of hoisting rope constant between the drum and trolley during movement of the trolley.

2. A hoisting mechanism comprising a supporting structure, said structure having a runway supported thereon, a trolley on said runway, means for moving the trolley on the runway, power driven hoisting drums mounted on said supporting structure, hoisting ropes wound on the drums, link means pivotally connected to each other, one end of one of said link means being hinged to said supporting structure and one end of the other of said link means being hinged to said trolley, load hoisting means suspended from said hoisting ropes on said trolley, sheaves mounted at the pivotal connection of said link means and on said trolley, said hoisting ropes leading from said hoisting drums over said sheaves on the link means and trolley to said load hoisting means, whereby to permit the travel of the trolley within its working range with the link means moving in accordance with the movements of the trolley to maintain the lengths of hoisting ropes constant between the drums and trolley during movement of the trolley.

3. The structure of claim 1 in which one of said links and said drum move about a common center.

4. The structure of claim 2 in which said sheaves are mounted in pairs on said hinge means.

5. The structure of claim 1 wherein said load hoisting means are suspended from a plurality of points on said trolley.

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