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Eftefield

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[54] **HOEING APRON MECHANISM WITH LOAD COMPENSATING TORSION BAR**

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[52] **U.S. Cl.** .....**37/4,** 37/126 AD, 37/129, 37/DIG. 5

[51] **Int. Cl.** **B60p 1/50**

[58] **Field of Search**...37/4, 126 R, 126 AA, 126 AD, 37/129, DIG. 5, DIG. 15, 126 AE

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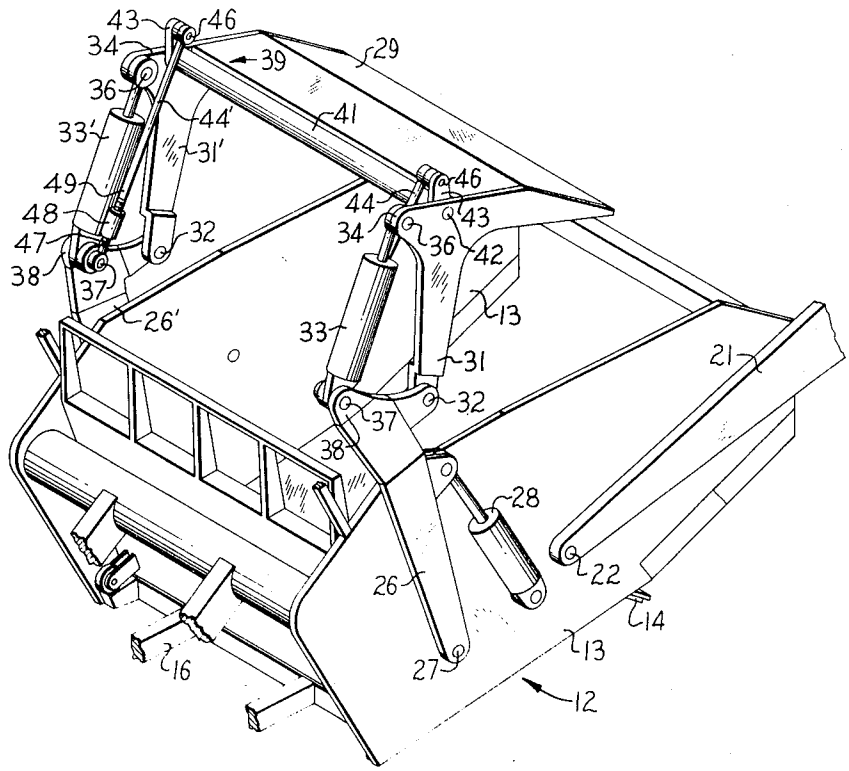
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[57] **ABSTRACT**

A scraper is provided with a manipulatable apron for drawing material into the bowl to assist loading as the scraper moves forward. The apron is pivoted to a pair of arms which are, in turn, pivoted to the bowl sidewalls and fluid cylinders provide for controlled flexing at each pivot joint. A torque tube extends along the top of the apron and is linked to both of the arms by struts to avoid the undesirable effects of unequal loading at the sides of the structure and to unitize the arms without requiring cross-bracing or other obstructions across the top of the bowl.

8 Claims, 3 Drawing Figures



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FIG. 1

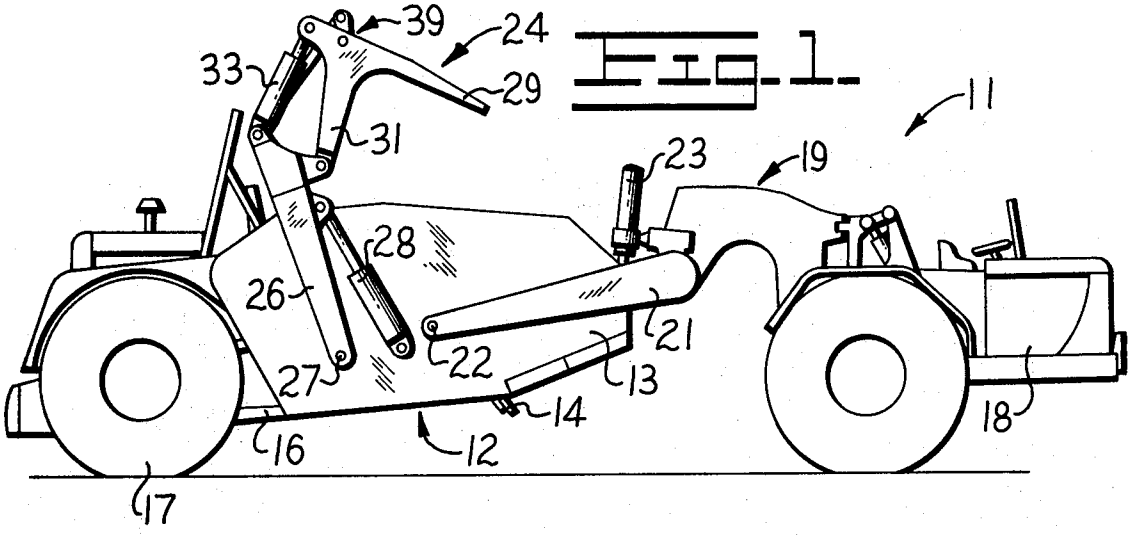
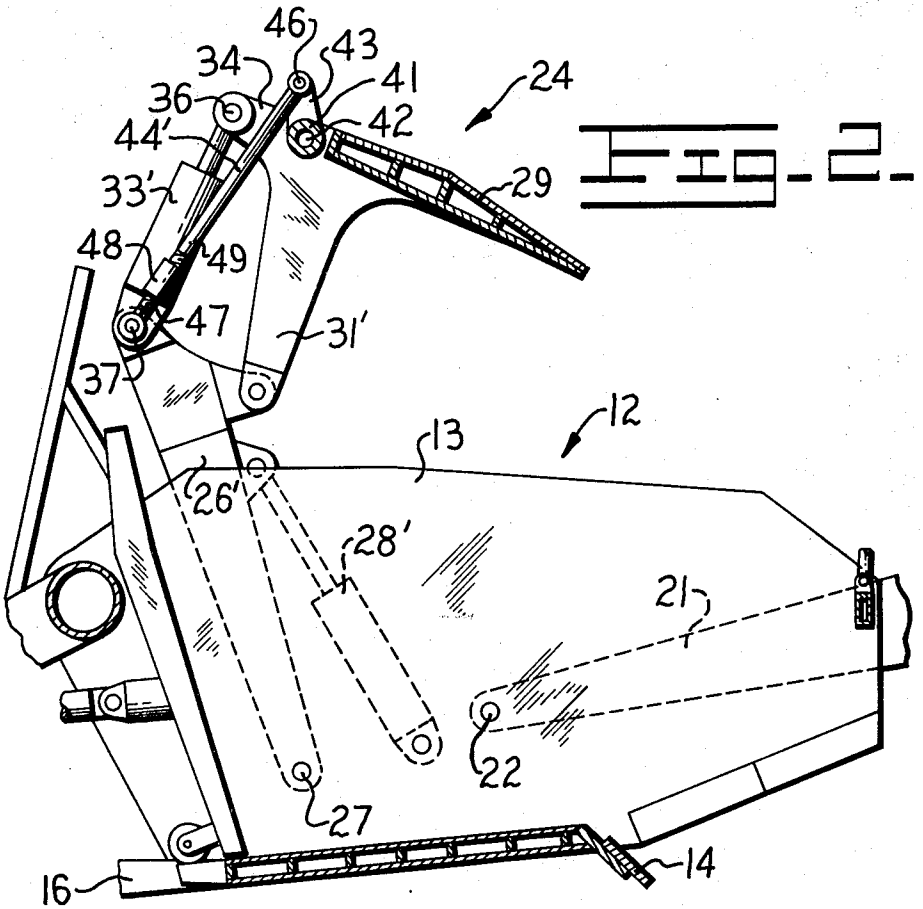


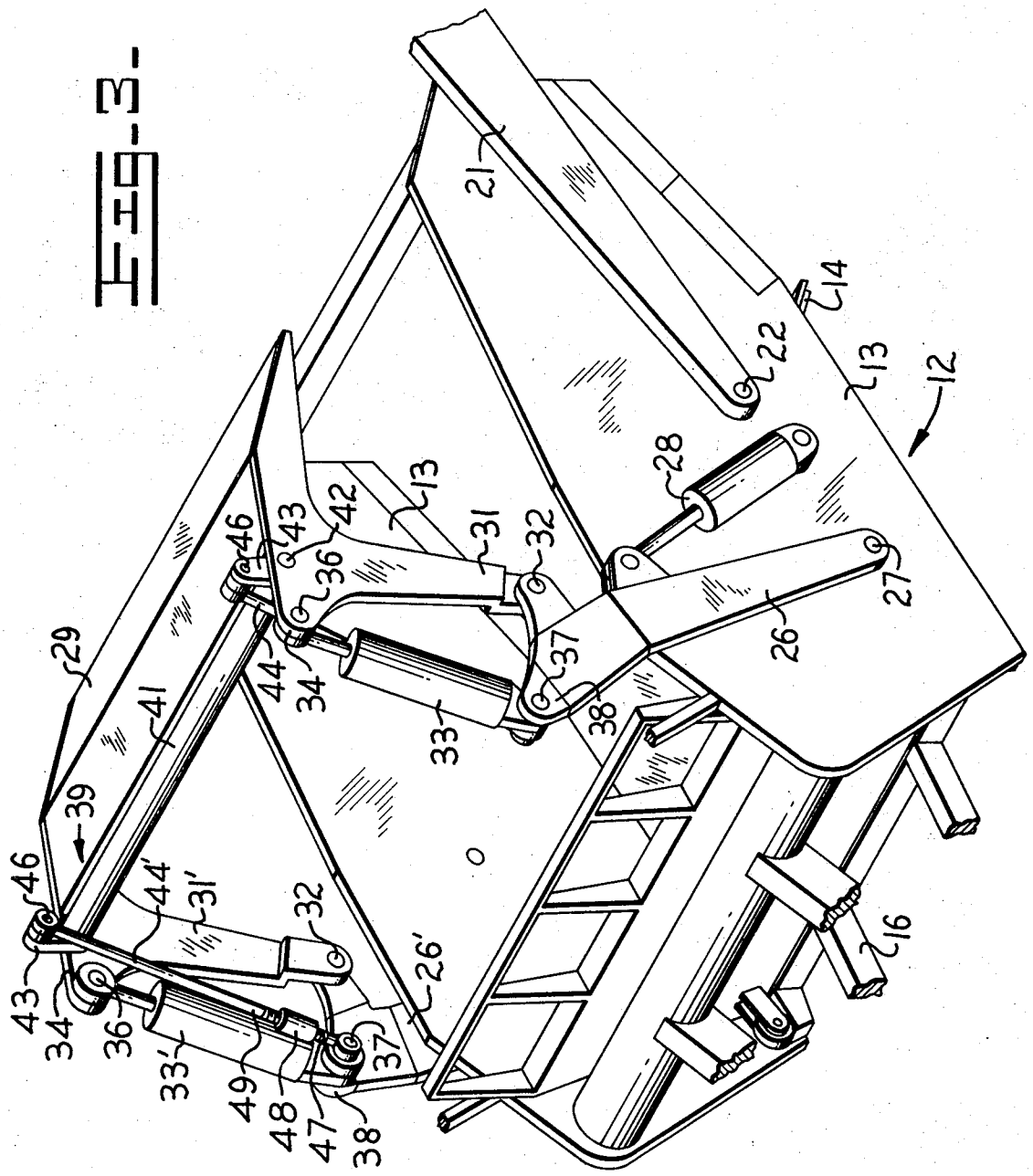
FIG. 2



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FIG. 3



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HOEING APRON MECHANISM WITH LOAD COMPENSATING TORSION BAR

BACKGROUND OF THE INVENTION

This invention relates to powered scrapers for excavating and transporting earth or like material, and more particularly to self-loading mechanisms for assisting the movement of material into the bowl of a scraper.

The movement of earth into the bowl of a scraper encounters increasing resistance as the bowl fills due to the back pressure of the previously loaded material. As a consequence, the full load carrying capacity of scrapers often cannot be realized unless supplementary tractive power, additional to that of the scraper itself, is provided during the final phase of the loading operation. To avoid the need for pusher tractors or other costly supplemental power, a variety of self-loading mechanisms have been developed.

One of the more versatile and efficient self-loading devices is a hoeing apron. An apron of this kind is carried at the front of the bowl by multi-jointed powered support means and may be raised or lowered and swung forward and backward to execute a kind of hoeing movement for forcibly drawing earth into the bowl. An apron of this kind may reach out to draw rocks and other objects into the bowl and may be positioned to retain earth in the bowl during the hauling stage of the scraper cycle.

As heretofore constructed, hoeing scrapers have had an undesirable structural complication which has added to bulk, weight and cost, while limiting capacity. In particular, the apron is pivotally connected to a pair of arms which are in turn pivoted to opposite sidewalls of the bowl and motors are provided on each arm for controlling flexing about the two pivot axes. To assure uniform movement of the arms at each side of the bowl and to avoid binding from unbalanced forces on the apron, at the pivot joints and other portions of the structure, it has been necessary to connect the top of the arms with one or more cross-braces which extend transversely above the bowl.

Cross-bracing of this kind, which must sweep forward and backward as the arms are pivoted, prevents heaping of material in the bowl as the cross-bracing tends to strike off or remove any earth encountered in the course of the sweeping movement.

The cross-bracing has equally serious indirect disadvantages. To unitize the two arms adequately, the brace must be of massive construction, adding to the bulk and weight of the scraper and contributing to an undesirable degree of top heaviness of the vehicle as a whole. In unitizing the arms without any convenient means of adjustment, it becomes necessary to manufacture much of the apron support structure and certain other scraper components as well to undesirably close tolerances or to custom fit parts, thereby adding substantially to manufacturing cost.

SUMMARY OF THE INVENTION

This invention links the two supporting arms of a manipulatable apron to equalize load forces thereon without requiring any direct bracing therebetween across the top of the bowl. This is accomplished by means of a torsion bar rotatably carried by the apron and linked to each support arm whereby a forward or rearward force on one arm is transmitted in part to the other.

Accordingly, it is an object of this invention to improve the load carrying capacity of scrapers of the type having a manipulatable apron for assisting loading of material.

It is another object of the invention to provide a scraper having manipulatable apron loading mechanism which does not obstruct the top of the bowl and which is of compact and lightweight construction.

It is still another object of the invention to provide for relaxed manufacturing tolerances in certain components of a hoeing scraper.

The invention, together with further objects and advantages thereof, will be better understood by reference to the following description of a preferred embodiment in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

FIG. 1 is a side elevation view of a scraper having a manipulatable apron for loading material and for performing certain other functions;

FIG. 2 is an elevation section view of the bowl and self-loading mechanism of the scraper of FIG. 1, and

FIG. 3 is a perspective view of the bowl and loading mechanism of the scraper of FIGS. 1 and 2.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing and particularly to FIG. 1 thereof, salient elements of a scraper 11 of a type to which the invention is applicable include a load carrying bowl 12 having sidewalls 13 and a transversely extending cutting edge 14 along the open forward face of the bowl. The back end of bowl 12 may be supported by means of a frame 16 riding on rear wheels 17 while a two-wheeled tractor unit 18 supports the forward end of the bowl through a draft frame 19 including draft arms 21 which are fastened to the bowl sidewalls at ball and socket joints 22. Fluid operated lift cylinders 23 are connected between the draft frame 19 and bowl 12 to provide for raising and lowering the bowl and cutting edge 14 about the axis of rear wheels 17.

With the cutting edge 14 lowered into engagement with the ground, forward motion of the scraper 11 causes a superficial layer of earth to be guided up over the cutting edge and into the bowl 12.

As discussed above, the back pressure of previously loaded material tends to inhibit and eventually block the entrance of additional material into the bowl 12. To provide for a positive and forcible loading action whereby the full capacity of the bowl 12 may be utilized, a hoeing apron self-loading mechanism 24 is provided. Referring now to FIGS. 1 and 2 in conjunction, the self-loading mechanism includes a pair of arms 26 and 26' disposed adjacent opposite sidewalls 13 of bowl 12 at the outer surface thereof. Pivot joints 27 couple one end of each arm 26 and 26' to the adjacent bowl sidewall for pivoting about a common axis which is transverse to the bowl. Fluid operated cylinders 28 and 28' are connected between arms 26 and 26' respectively and the adjacent bowl sidewall 13 to provide for controlled pivoting movement of the two arms about the axis of pivot joints 27.

Referring now to FIG. 3, a blade-like apron **29** is disposed transversely with respect to the bowl **12** and has rearwardly extending support members **31** and **31'** at each side. Members **31** and **31'** are fastened to inwardly angled upper ends of arms **26** and **26'** respectively by pivot connections **32** whereby the apron may be pivoted with respect to the arms about the common axis of the pivot connections **32**.

To provide for powered control of such pivoting movement, a pair of fluid cylinders **33** and **33'** are connected between the apron **29** at opposite sides and the top-most portions of arms **26** and **26'** respectively. To provide for connecting cylinders **33** and **33'** between the apron **29** and arms **26** and **26'**, each side of the apron has an upward extension **34** with a pivot connector **36** to which one end of the cylinder is coupled. Similarly, pivot connectors **37** couple the other end of the cylinders to an upwardly extending bracket **38** at the top of arms **26** and **26'**.

Thus, by appropriate operation of the two sets of fluid cylinders **28** and **33**, the apron **29** may be raised or lowered above cutting edge **14** and may be swung forward or backward relative thereto. By combining these motions, the apron may be made to undergo a repeated hoeing or raking action to force earth over the cutting edge and back into the bowl **12**. The apron **29** may also serve the more conventional function of such an element by being moved forward and downward whereby the lower edge of the apron is immediately above the cutting edge **14** to form a front closure for the bowl when the scraper is loaded and carrying earth away from the excavation area.

In the absence of additional structure to be hereinafter described, unbalanced forces on the apron **29** could create undesirable effects such as lateral movement of the apron and consequently binding if the apron is above the bowl. To relieve this problem without requiring cross-bracing extending over the top of the bowl between arms **26** and **26'**, a torsion bar assembly **39** is provided.

Torsion bar assembly **39** has a hollow torque tube **41** extending between support members **31** and **31'** of the apron immediately above the upper edge thereof and in parallel relationship therewith. Torque tube **41** is rotatable relative to members **31** and **31'** and is held thereon by retaining pins **42** which are transpierced through members **31** and **31'** and extend a short distance into the ends of the torque tube. Torque tube **41** has a radially extending crank arm **43** at each end adjacent one of the apron members **31** and **31'** and one of a pair of struts **44** and **44'** is pivotably coupled to the upper end of each crank arm **43** by connectors **46**. The opposite ends of struts **44** and **44'** are pivoted to the upper ends of arms **26** and **26'** by the previously described connectors **37**.

One of the struts, strut **44'** in this instance, is of adjustable length to provide a convenient means for compensating for manufacturing variations in the apron and supporting structure. This is a highly advantageous aspect of the construction as it greatly reduces the need for extremely precise tolerances in the manufacture of various components of the scraper. For this purpose, one portion **47** of strut **44'** may be threaded and engaged in a rotatable internally threaded sleeve **48** threaded on the adjacent end of the other portion **49** of strut **44'**.

In operation, the above described structure transmits forces between the two sides of the apron and associated support structure to avoid severe bending moments without requiring any significant obstruction of the region above the top of the bowl. For example the apron movement for drawing earth into the bowl generally involves simultaneous extension of both sets of cylinders **28** and **33**. If, during this motion, one side of the apron experiences greater resistance than the other, the force of the cylinders at that side is counteracted more than the force of the cylinders at the opposite side thereby tending to twist the apron out of the transverse relationship to the bowl. This cannot occur to any significant extent in the present construction. Any incremental movement of one side of the apron out of synchronism with the other exerts a torque on tube **41** tending to force the other side of the apron in a similar direction. In effect, forward and rearward forces on the apron are evenly distributed between the two sides thereof irrespective of the point of origin of the forces on the apron.

Many modifications of the invention are possible. For example, because of the load balancing effect of torsion bar mechanism **39**, it is possible to provide motors such as cylinders **28** and **33** at only one side of the scraper without necessitating unduly massive construction of the self-loading mechanism components.

What is claimed is:

1. In a scraper having a bowl with an opening for receiving material, loading assist mechanism comprising:

a pair of spaced apart arms each being disposed at a separate side of said bowl and being pivotable relative thereto;

an apron for drawing material into said bowl, said apron being supported by said arms and being pivotable relative thereto,

motor means for controlling pivoting movement of said apron relative to said arms,

a torsion bar assembly having a torsion bar extending parallel to said apron and supported thereon for free rotation relative thereto, said assembly having members fixedly attached at each end of said bar which extend radially with respect to the axis of rotation of said torsion bar, and

a pair of struts each strut being pivotably coupled at one end to one of said radially extending members of said torsion bar assembly and each being pivotably coupled to one of said arms at the the other end thereof.

2. The combination defined in claim **1** wherein said members at each end of said torsion bar extend along parallel radii of said axis of rotation of said bar and wherein said pair of struts are co-planar.

3. The combination defined in claim **1** wherein said apron is comprised of a substantially flat blade-like member having an upper edge and support members at each side of said blade member and wherein said torsion bar extends between said support members of said apron adjacent the upper edge of said blade member.

4. The combination defined in claim **1** wherein said struts are pivotably connected to said arms at points spaced from the pivotable connection of said apron to said arms.

5. The combination defined in claim **1** further comprising means for selectively changing the length of at least one of said struts.

6. The combination defined in claim 5 wherein said one of said struts has a first threaded portion engaged with a telescoping relatively rotatable internally threaded second portion whereby relative rotation between said first and second portions provides for said changing of the length of said strut.

7. In a scraper having a body with a bowl which has an opening at the forward portion and a cutting edge thereat, mechanism for assisting the movement of material over said cutting edge and into said bowl comprising:

a pair of arms each having an end pivoted to a separate side of said scraper body and having a free end which may be swung forward and backward relative to said bowl opening,

first motor means coupled between said scraper body and at least one of said arms for controllably swinging said arms,

an apron having a blade extending transversely relative to said bowl and having a support member at each side of said blade which extends rearwardly therefrom and is pivoted to said free end of one of said arms whereby said apron is supported by said arms and is pivotable relative thereto,

second motor means coupled between said apron and at least one of said arms for controllably pivoting said apron relative thereto,

a torsion bar assembly having a torsion bar extending parallel to said blade of said apron and being freely rotatably supported on said apron, said assembly having a radially extending element fixedly attached to said torsion bar adjacent each side of said apron, and

struts extending from said radially extending portions at each end of said torsion bar to said free ends of said arms and being pivotably coupled to said arms whereby said torsion bar transmits a force exerted against one side of said apron to the other side thereof.

8. The combination defined in claim 7 wherein said second motor means comprises a fluid cylinder connected between said apron and said free end of one of said arms, said connection of said cylinder to said apron being spaced apart from the connection of said torsion bar thereto, said connection of said cylinder to said free ends of said arm being coaxial with said connection of said struts thereto.

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