United States Patent

Donahue et al.

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[45] **May 2, 1972**

[54] CONVEYOR MECHANISM

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[52] **U.S. Cl.** **198/165,** 271/76

[51] **Int. Cl.** **B65g 15/14**

[58] **Field of Search** 198/165; 271/76

[56] **References Cited**

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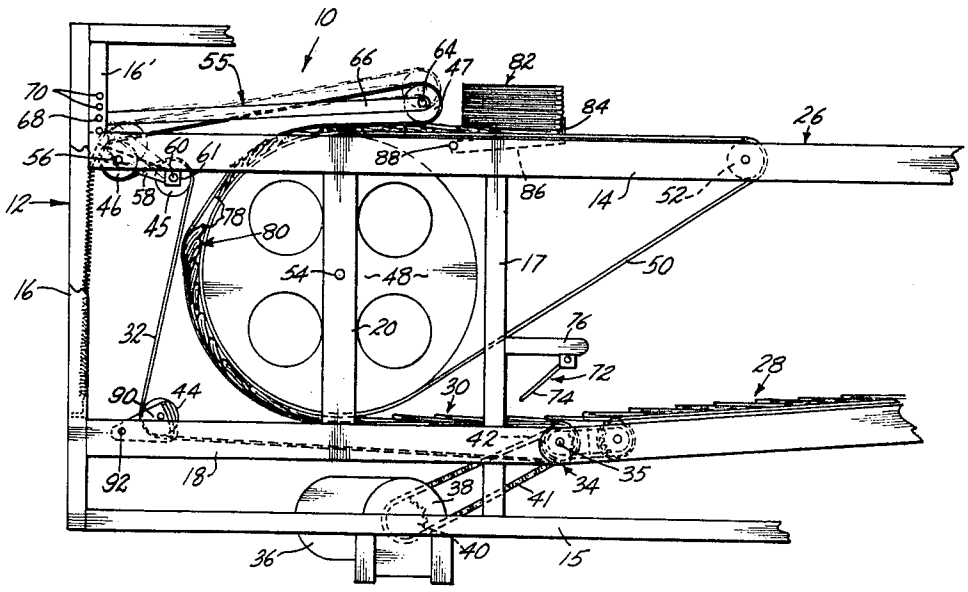
[57] **ABSTRACT**

Overlapping signatures are transported between upper and lower belts, wherein the upper belt passes around three pulleys, the first of which is supported at the free end of a vertically swingable first arm extending generally horizontally from its pivot. The second pulley is carried on a second, vertically swingable arm. Springs pull downwardly on the free end of the second arm to tension the belts. The third pulley is journaled on the pivot axis of the second arm. The belts pass over the third pulley, under the second and over the first. The line of pull of the belts extends from the top of the second pulley to the top of the first pulley at an angle to the horizontal such that a downward component of force is exerted on the first pulley, urging it downwardly against the signatures. The first pulley rises and falls with the first arm to accommodate variations in thickness of the line of signatures. The second pulley rises and falls approximately the same distance as the first to accommodate the length of the upper belt to the increased bulk of bunched-up signatures traveling on the conveyor, while maintaining the same angle of pull on the first pulley, with respect to the horizontal, so that the downward component of force remains the same.

5 Claims, 3 Drawing Figures



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SHEET 1 OF 2

FIG. 1.

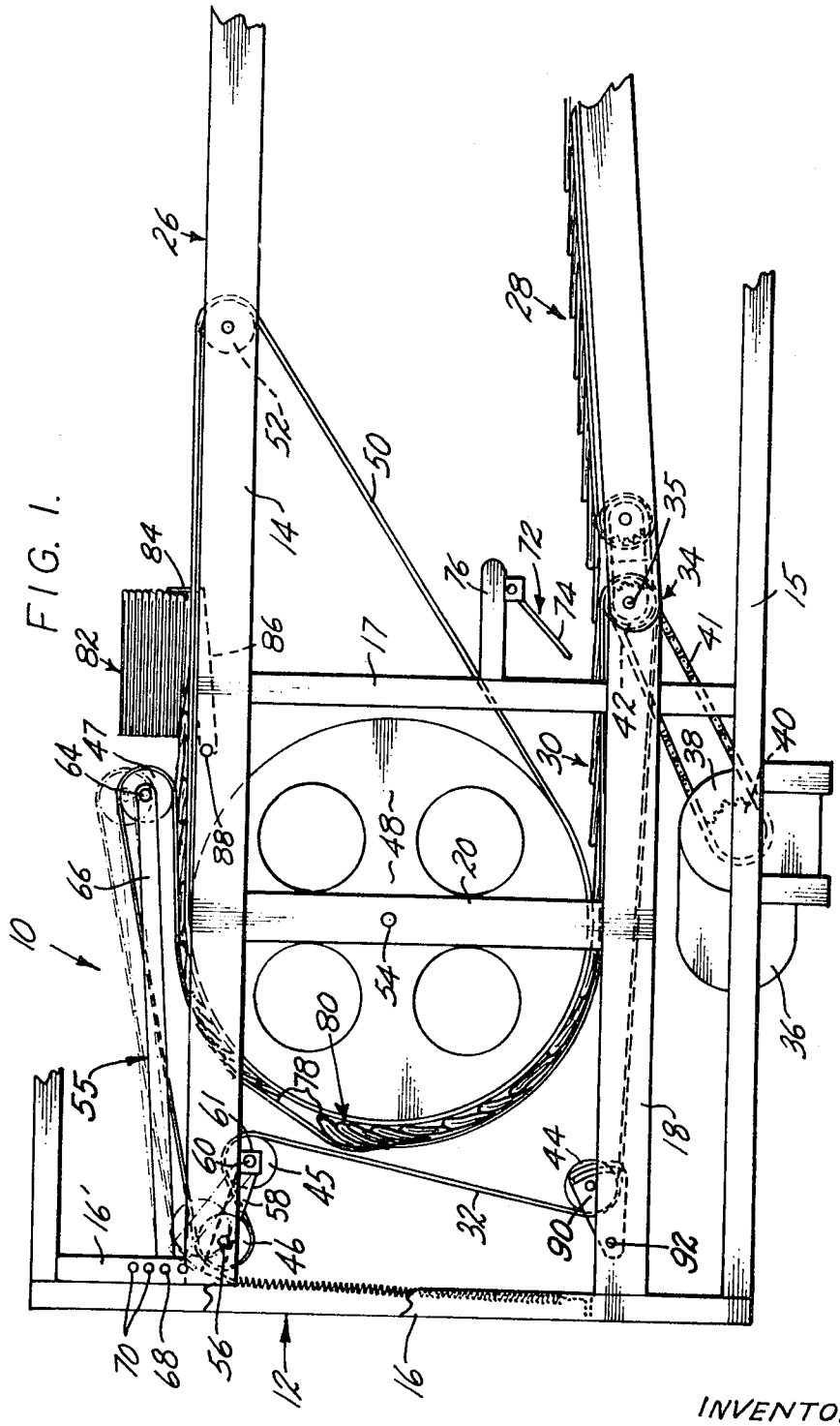

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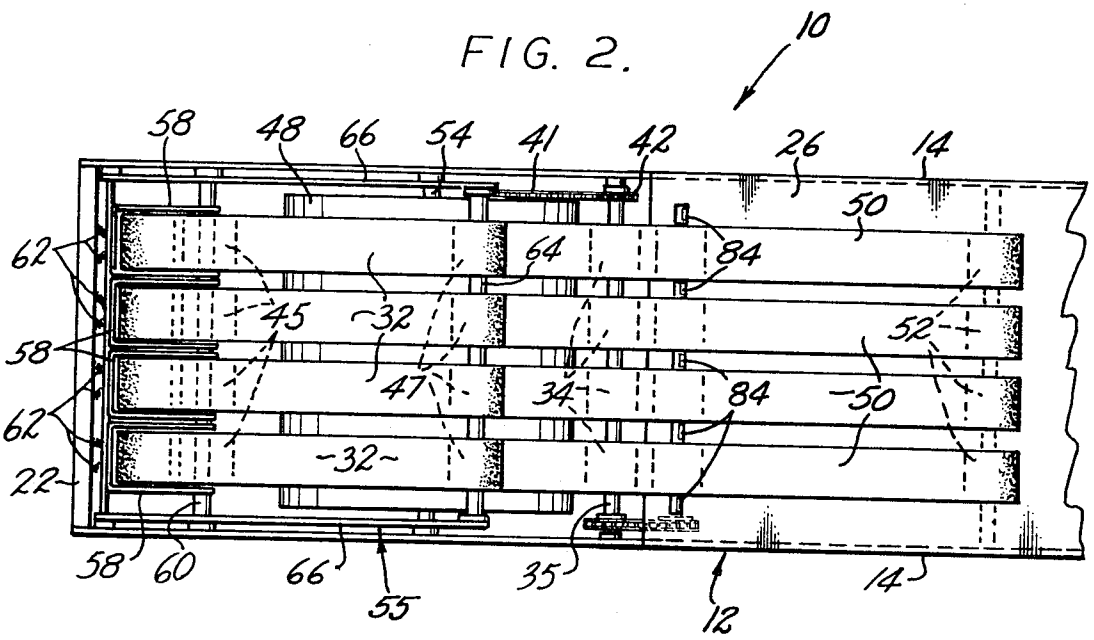
FIG. 2.



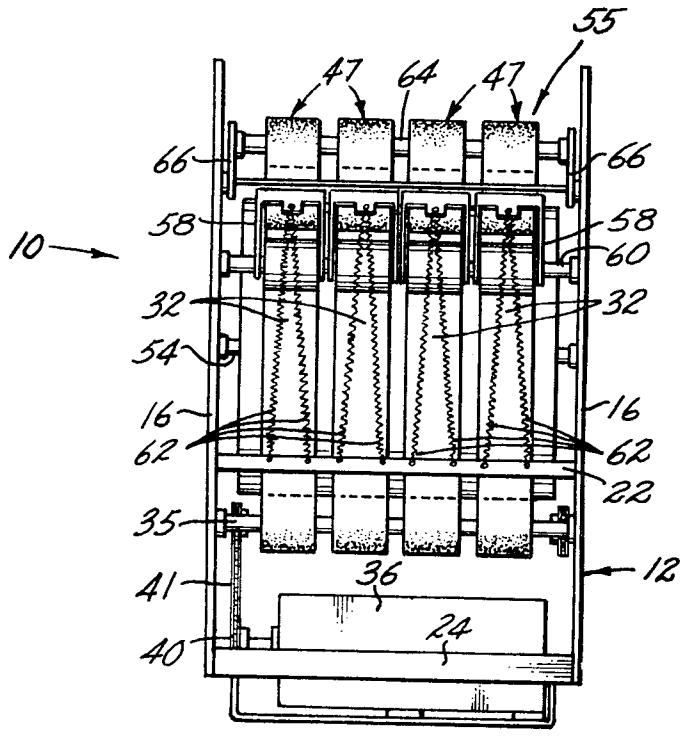


FIG 3

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CONVEYOR MECHANISM

BACKGROUND OF THE INVENTION

The present invention relates generally to belt conveyors, and more particularly to a tension-equalizing device for use with a belt conveyor passing around a drum or other unyielding support, in which articles of varying bulk are confined between the belts and the drum. The invention is in the nature of an improvement on the machine shown and described in our pending application, Ser. No. 753,177, filed Aug. 16, 1968, to which reference may be had.

The machine of the said application is a counter-stacker, that takes a line of "shingled" papers as they are delivered by a sheet, or web-fed perfecting press (or other machine), inverts the line by passing it around one side of a horizontal drum from the bottom side to the top thereof, and stacks the papers as they come off the top of the drum. In the process, the papers are counted by a photoelectric (or other type) counter, and when a predetermined count has been reached, the line of papers is halted at one point to open up a gap in the line. The halted papers are then released, and as the open gap approaches the stacking station, a sensor detects the passage of the gap and retracts a limit stop as the last paper is inserted into the stack, allowing the completed stack to move along the table with the conveyor belts to another location, while the limit stop is inserted up through the gap to engage and stop the first paper in the line beyond the said gap.

Halting the line of papers to open up the said gap causes the shingled papers to pile up, or bunch together at that point, owing to the fact that the papers are coming along on the conveyor in a steady stream up to the point where their travel is interrupted. When the line of papers is released and allowed to travel along on the conveyor, the accumulated bunch of papers forms a bulky mass that presents problems in passing around the drum, because of the fact that the papers are confined between a first set of conveyor belts that lie against the outer surface of the drum, and a second set of conveyor belts that overlie the papers. The extra bulk of the accumulated bunch of papers spreads the outer belts away from the inner belts, and this causes the outer belts to be stretched. Such stretching, repeated over and over again, results in permanent stretching and loosening of the belts, which ultimately leads to breakdown and failure of the belts.

The belts may also be stretched if the machine is changed over from thin papers to thick, bulky papers without first adjusting the belts to slacken them so that they can handle the bulkier papers. This sometimes happens inadvertently when employees are working under great pressure, or when conditions are such that they is a tendency for errors to occur.

SUMMARY OF THE INVENTION

The primary object of the invention is to provide a conveyor system for transporting a line of overlapping signatures or the like, wherein the signatures are confined between upper and lower conveyor belts and are carried along thereby, and in which means is provided for holding the upper belts down against the signatures with a constantly uniform pressure, regardless of any momentary change in the bulk of the line of papers, as when a bunched-up group of signatures passes along the conveyor. At the same time, the device of the invention provides additional slack in the upper belts so as to accommodate the extra bulk of any bunched-up masses of signatures, such as occurs when a continuously flowing stream of signatures is halted at a given point to open up a gap in the line, as in the case of the counter-stacker machine of our pending application Ser. No. 753,177.

Another object of the invention is to provide an apparatus of the class described, which is simple and inexpensive to manufacture, and which is almost completely trouble-free.

These and other objects and advantages of the invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment thereof, with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a counter-stacker embodying the invention;

FIG. 2 is a top plan view of the same; and

FIG. 3 is an end view of the machine.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, the counter-stacker on which the invention is employed is designated in its entirety by the reference numeral **10**, and is shown more or less schematically, with only as much structural detail of the machine as is needed for an understanding of the invention. For a more complete and detailed description of the machine, reference may be had to our pending application, Ser. No. 753,177, filed Aug. 16, 1968.

The counter-stacker **10** comprises a frame **12** consisting of horizontal top and bottom side members **14** and **15** connected together by vertical posts **16** and **17**. The frame **12** also includes intermediate horizontal members **18** and vertical members **20** together with other miscellaneous structural members, including cross members **22** and **24** at one end of the frame. Lying on top of the two top side members **14** and bridging the space between them is a horizontal table surface **26**, which constitutes the loading table.

Connected to the right-hand ends of frame members **18** and projecting laterally therefrom is a first conveyor **28**, the outer end of which is disposed to receive a continuous line of overlapping, or "shingled" papers from the final unit of a sheet, or web-fed perfecting press (not shown) or any other machine that delivers sheets in a generally similar manner.

At its left-hand end, the first conveyor **28** delivers its load of papers onto a second conveyor **30**, consisting of four laterally spaced belts **32** which are trained around pulleys **34** mounted on a transverse shaft **35**. Shaft **35** is rotatably supported in suitable bearings on the frame members **18**, and is driven by a variable speed electric motor **36**, having an integral speed reduction gear box **38**, the output shaft of which has a sprocket **40** driving a chain **41**. Chain **41** is also trained around a driven sprocket **42** on shaft **35**.

The endless conveyor belts **32** are trained around four groups of idler pulleys **44**, **45**, **46** and **47**, in addition to pulleys **34**, and one course of the conveyor belts is wrapped around one-half the circumference of a horizontal drum **48**. The belts **32**, where they pass around the drum **48**, overlie another group of four laterally spaced conveyor belts **50**, which also pass around drum **48** and around idler pulleys **52**. Drum **48** is of a relatively large diameter and extends substantially the full width of frame **12** adjacent one end thereof. Idlers **52** are much smaller in diameter than drum **48**, and the tops of the drum and the idlers are substantially tangent to the plane of the table top **26**. In passing from the top of drum **48** to the idlers **52**, the belts **50** slide over the top of table **26**.

Drum **48** is mounted on a shaft **54**, the ends of which are journaled in bearings mounted on the inner sides of frame members **20**. Drum **48** is driven by frictional engagement of the conveyor belts **32**, which are driven, in turn, by motor **36** through chain **41** and sprockets **40**, **42**.

The tension-equalizing apparatus of the present invention is designated in its entirety by the reference numeral **55**, and comprises the structural assembly supporting and cooperating with the idler pulleys **45**, **46**, **47**, and belts **32**, as will now be described. Each of the idler pulleys **46** is rotatably mounted on a separate shaft **56** extending between the sides of a U-shaped arm **58**. At their right-hand ends (as seen in FIG. **1**) the arms **58** are pivoted for vertical swinging movement on a transverse shaft **60** the ends of which are supported in brackets **61** fixed to the undersides of frame members **14**. Shaft **60** supports the idler pulley **45**. Belts **32** are passed over the tops of idler pulleys **45** and under pulleys **46** in a generally S-shaped path. Each of the arms **58** has a pair of tension springs **62** connected to its free ends, as best shown in FIG. **3**, and these pairs of springs extend downwardly from the arms in diverging relationship and are anchored at their bottom ends to cross bar

22. The springs 62 pull downwardly on the outer ends of arms 58, thereby taking up any slack in belts 32, while permitting them to yield when carrying thick, folded papers, or bunched-up groups of papers around drum 48, as will be explained in more detail presently.

Idler pulleys 47 are mounted side-by-side on a shaft 64 extending transversely across the width of the machine, the ends of said shaft being mounted on the outer ends of arms 66. Arms 66 are pivotally connected at their left-hand ends (FIG. 1) to vertical frame members 16' which are fixed to the sides of posts 16. The pivotal connection of arms 66 is accomplished by means of a pivot rod 68, which is passed through any aligned pair of several vertically spaced holes 70 in members 16' on opposite sides of the frame.

The geometry of apparatus 55 is best shown in FIG. 1. It will be noted that arm 66 extends generally horizontal toward the right from its pivot 68, whereas arms 58 extend to the left from their posts 60. The arms 58 may extend substantially horizontally from pivot 60, or be inclined upwardly at an angle, as shown. The belts 32 extend from the top of pulleys 46 to the top of pulleys 47, and the plane of the belts for this particular stretch is inclined up from the horizontal to angle of the order of 10°. The purpose of this inclination is to provide a downward component to the tension force exerted by the belts on the pulleys 47. This downward component of force causes a downward pressure to be exerted on the pulleys 47, which augments the weight of the said pulleys and arms 66 in holding the conveyor belts down against the top of the papers. At the same time, pulleys 47 and belts 32 are able to lift up, as necessary, to allow for the thickest accumulation of papers to pass under them.

The novel feature of the invention is the arrangement of the pulleys 46 and arms 58, whereby the pulleys 46 raise up substantially the same distance that the pulleys 47 rise, thereby maintaining the line of pull of belts 32 at substantially the same angle to the horizontal, whatever the elevation of pulleys 47. This results in a constant uniform downward pressure of the pulleys 47 and belts 32 against the signatures on belts 50, regardless of any transient overload, as when a bunched-up accumulation of signatures passes around the drum between belts 32 and 50.

As described in our pending application, the line of signatures (or other sheets) is periodically interrupted by an interceptor 72, which is actuated by a mechanism (not shown) when a predetermined number of signatures has passed under the interceptor. The interceptor consists of a rod 74 that is supported on a bracket 76 projectingffrom one side of frame member 17 above the right-hand end of conveyor 30. The free end of rod 74 is swung downwardly by the said mechanism and engages the leading edge of one of the signatures, thereby halting the forward travel of the signatures at that point and causing a gap 78 to open up in the line of papers as the papers downstream from the interceptor continue to move along the conveyor 30. At the same time that rod 74 swings downwardly, supporting members (not shown) extending lengthwise of the conveyors 28 and 30 to the right of the interceptor 72 and lying just below the top surfaces of the belts, are raised up at their left-hand ends, forming an inclined ramp, the elevated end of which terminates a short distance to the left of the interceptor. The purpose of the inclined ramp is to lift the signatures clear of the conveyor belts, so that they are no longer driven thereby at that point. The on-coming signatures propelled by the conveyor 28 are caused to slide up the inclined ramp, and are crowded toward the interceptor, forming a bunched-up accumulation of papers 80, which is released by the interceptor 72 and the simultaneous lowering of the inclined ramp after the gap 78 has been opened up to the desired width.

After leaving the interceptor 72, the line of shingled papers passes around the drum 48 and comes out onto the tabletop 26, where it is formed into a stack 82 by stop fingers 84. Stop fingers 84 are mounted on the ends of arms 86, which are pivoted on the frame at 88, and the stop fingers project upwardly through openings in tabletop 26. As the signatures come up to stack 82, they are inserted into the bottom of the stack and are finally stopped by the stop fingers.

The apparatus 55 allows the bunched-up mass 80 of signatures to pass around the drum 48 without over-stressing the belts 32, and at the same time, the rollers 47 and belts 32 are held down against the signatures with a constant, uniform pressure at all times. Springs 62 keep belts 32 under fairly uniform tension, and allow the belts to accommodate variations in the thickness of the signatures without the necessity of adjusting the machine. Gross adjustments of the machine can be effected by moving the pivot axis 68 for arm 66 into one of the higher or lower holes 70. Belts 32 can also be adjusted by means of adjustable brackets 90, which support pulleys 44. Brackets 90 are pivoted at 92 for vertical swinging movement, and have means for adjusting the position of the brackets to increase or decrease the distance between pulleys 44 and pulleys 45.

While we have shown and described in considerable detail what we believe to be the preferred embodiment of our invention, it will be understood by those skilled in the art that the invention is not limited to such details, but might take various other forms.

We claim:

1. A conveyor mechanism for transporting articles of varying thickness, comprising:

upper and lower belts which, for at least a portion of their length, travel along parallel paths in the same direction and at substantially the same speed, said articles being confined between said belts and carried along thereby;

the upper of said belts being trained around two pulleys, one of which lies directly above the lower belt, and the other pulley being spaced horizontally from said one pulley and slightly below the latter;

a third pulley located alongside and closely adjacent said other pulley, said upper belt passing up over the top of said third pulley to the bottom of said other pulley, and thence from the top of said other pulley to the top of said one pulley;

said upper belt extending upwardly from said other pulley to said one pulley at an angle to the horizontal so that tension in said belt causes a downward component of force to be exerted on said one pulley tending to pull the latter downwardly against said articles on said lower belt;

first means supporting said one pulley for free vertical movement toward and away from said lower belt so that said one pulley can lift up as necessary to allow said articles to pass beneath it;

second means supporting said other pulley for vertical movement with respect to said third pulley;

spring means connected to said second supporting means and exerting a downward pull thereon so as to tension said upper belt;

said other pulley rising vertically on said second supporting means simultaneously with and for substantially the same distance as said one pulley, whereby the line of pull exerted by said upper belt on said one pulley has substantially the same angle with respect to the horizontal irrespective of the elevation of said one pulley, thereby maintaining a substantially constant downward component of force acting on said one pulley.

2. A conveyor mechanism as in claim 1, wherein said one pulley is mounted at the end of an arm, said arm being pivoted for vertical swinging movement, and normally extending generally horizontally from its pivot.

3. A conveyor mechanism as in claim 2, wherein said other pulley is mounted at the end of a second arm, said second arm being pivoted for vertical swinging movement, and normally extending in a generally horizontal direction from its pivot.

4. A conveyor mechanism as in claim 3, wherein said third pulley is journaled for rotation about the pivot axis of said second arm.

5. A conveyor mechanism as in claim 4, wherein said spring means is connected to the outer end of said second arm and exerts a downward pull on the arm.

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