

[54] **FLUID PULSATOR WITH SPRAYER**

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[51] Int. Cl.² **B05B 1/08**

[58] Field of Search 239/101, 102, 4; 137/150, 137/624.14; 222/492-494, 513, 514, 518

[56] **References Cited**

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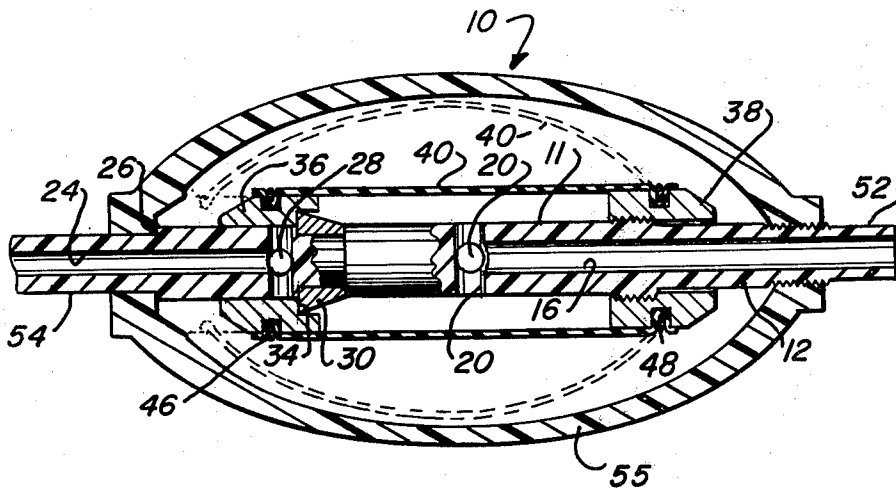
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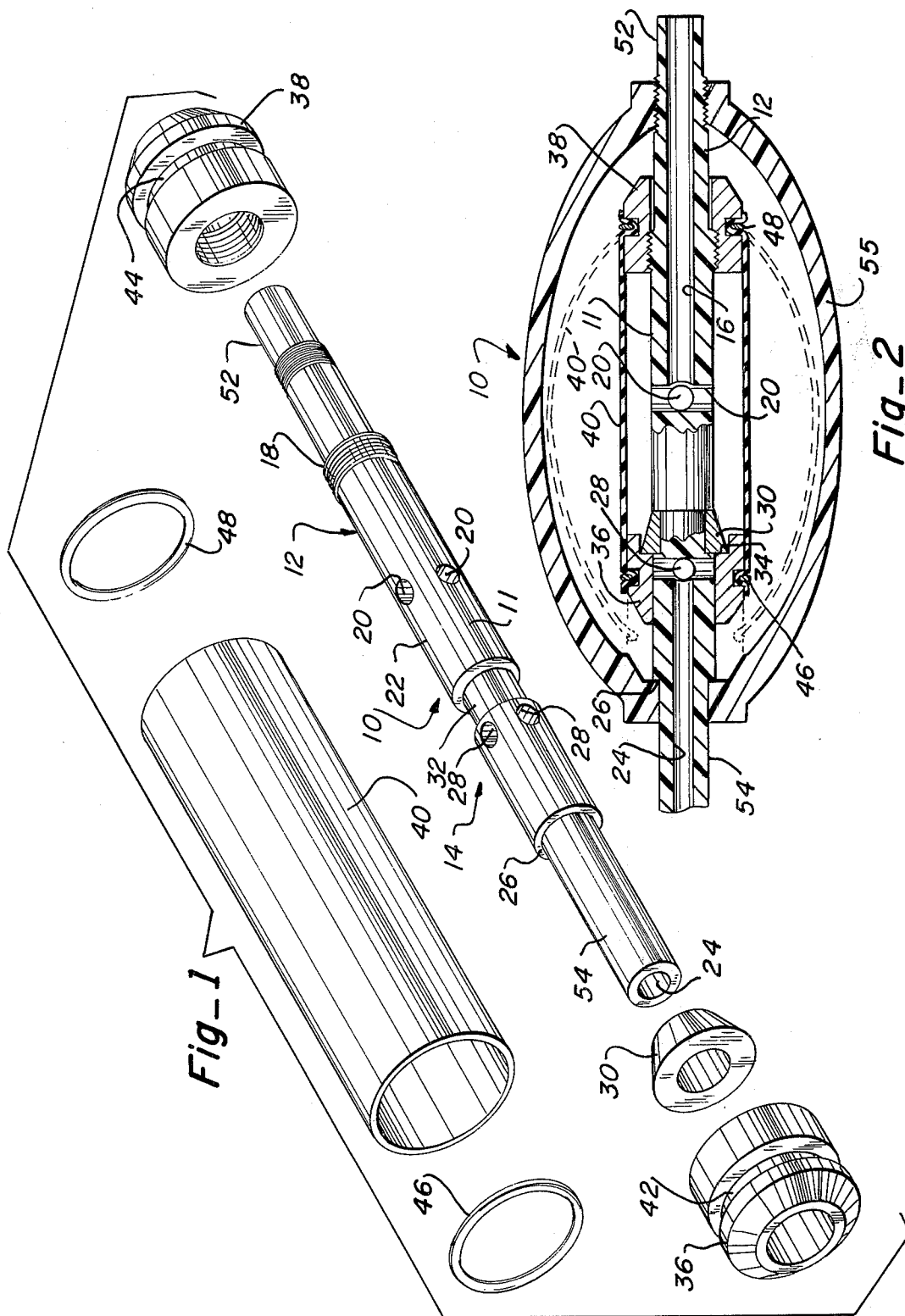
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[57] **ABSTRACT**

A pulsating fluid is delivered for use in any of a variety of such devices as hygienic appliances and shower-heads. An elongated stem has separated inlet and outlet regions each with a respective fluid channel. Included at the outlet region is a valve. A longitudinally elastic sleeve encircles the stem and has its opposing ends sealingly secured individually to respective ones of the inlet region and the valve. The sleeve repetitively responds to fluid under pressure admitted to the inlet to operate the valve into an open condition and then responds to release of the fluid through the outlet so as to operate the valve to a closed condition.

10 Claims, 6 Drawing Figures





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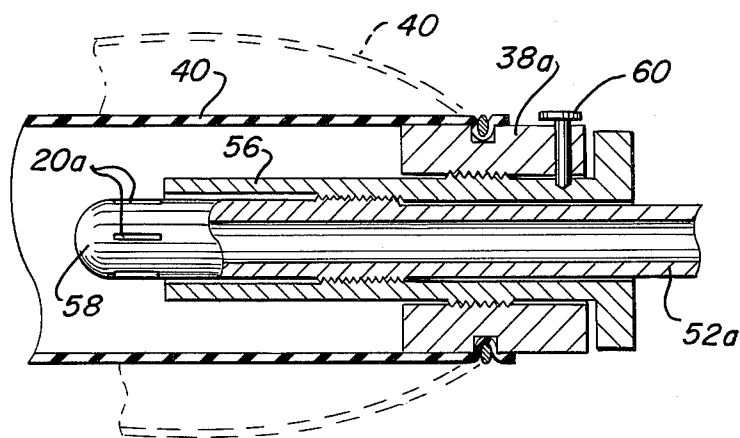


Fig. 3

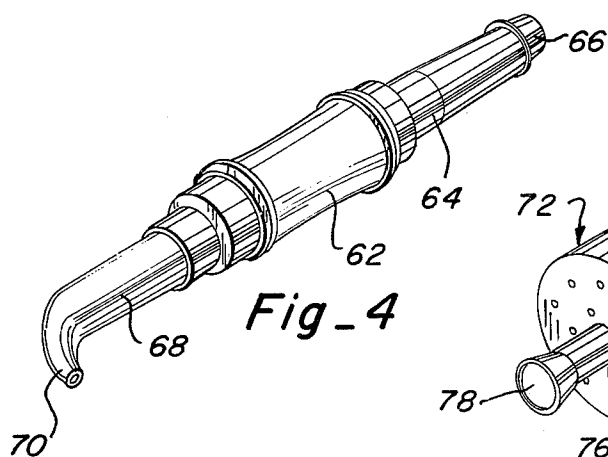


Fig. 4

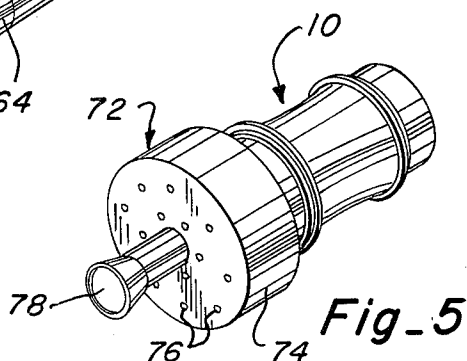


Fig. 5

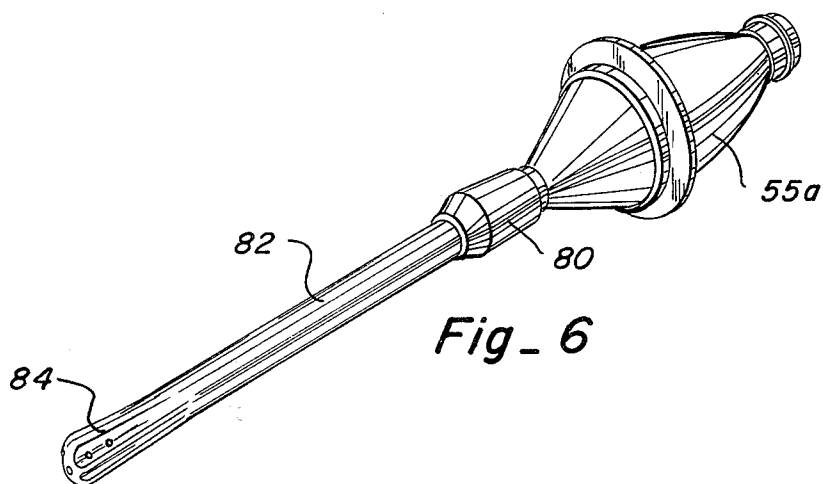


Fig. 6

FLUID PULSATOR WITH SPRAYER

The present invention pertains to a fluid pulsator. More particularly, it pertains to a device for accepting a fluid, such as water, under pressure and delivering it in pulses of flow.

A wide variety of apparatus is known for responding to fluid under at least more or less constant pressure and delivering a pulsating flow. Motor-driven units often employ a reciprocating pump that delivers a pulse of water or the like for each stroke of a piston. Mechanical choppers, such as rotating shutters, have been employed for a similar purpose. In some cases, however, the inclusion of a motor or other driving device results in undesired complexity and cost. Accordingly, effort has previously been directed to the end of dispensing with motors or other moving parts to as great an extent as possible.

One known approach to the latter end involves the use of an accumulator in which the fluid pressure builds up until sufficient to cause the actuation of an outlet check valve. As primarily envisioned for supplying pulsating water, the pressure builds up by compressing air entrapped within a rigid accumulator tank. Unfortunately, that technique has required the need to maintain an upright orientation of the accumulator tank. Consequently, it is not available for many kinds of hand-held devices. Also, it tends to involve rather cumbersome apparatus.

More recently, a pulsating effect has been obtained through the use of a so-called fluidic flip-flop that depends upon certain characteristics inherent in a fluid stream for causing that stream to be attracted alternately first to one side and then to the other of a transmission channel. In a different approach, a collapsible-walled flexible tube is encased within a rigid chamber and so constructed that it exhibits what has been called a "fluttering tube effect." In operation, what appears to be a kind of wave motion occurs in the tube wall so that a restricted area progressively moves along the length of the tube in a manner to pinch off the incoming stream into a series of pulses. Of course, such approaches are attractive in at least minimizing the inclusion of moving parts. However, they involve quite sophisticated design and a rather refined selection of materials. Also, they may not as readily accommodate variations in such parameters as incoming fluid pressure, type of fluid and so forth.

It is, accordingly, a general object of the present invention to provide a fluid pulsator that is extremely simple and flexible in matters of design, selection of materials and adaptation for varied utility.

A specific object of the present invention is to provide a new and improved fluid pulsator in which the pulse rate may be very simply adjusted.

Another object of the present invention is to provide a new and improved fluid pulsator the design of which may be easily varied to accommodate different pulse rates, fluid-flow volumes and usage adaptations.

A fluid pulsator constructed in accordance with the present invention includes an elongated stem that has an inlet region and an outlet region individually at respective opposite ends. A first channel in the inlet region communicates between the corresponding end and a first port in the intermediate sidewall of the stem. A second channel in the outlet region communicates between a second port in that intermediate sidewall and the corresponding end of the stem. Valve means,

including a valve and valve seat, are disposed on the stem at the outlet region with the valve and the valve seat being located effectively in the path of the second channel. Finally, a longitudinally elastic sleeve encircles the stem with its opposing ends sealingly secured individually to respective ones of the valve means and the end of the stem at the inlet region. Repetitively, the sleeve first responds to fluid under pressure admitted through the first channel to operate the valve means to an open condition and then responds to release of the fluid through the second channel to operate the valve means to a closed condition.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements, and in which:

FIG. 1 is an exploded perspective view of one embodiment of a fluid pulsator;

FIG. 2 is an assembled cross-sectional view of the pulsator of FIG. 1;

FIG. 3 is a fragmentary cross-sectional view showing a modification of a portion of the pulsator of FIGS. 1 and 2;

FIG. 4 is a perspective view of a particular adaptation of the pulsators of any of the foregoing figures;

FIG. 5 is a perspective view of a different adaptation thereof; and

FIG. 6 is another perspective view of a still different adaptation of such pulsators.

In FIGS. 1 and 2, a fluidic pulsator 10 includes an elongated stem 11 that has an inlet region 12 and an outlet region 14 generally at respective opposite ends of the stem. A first or inlet channel 16, located in inlet region 12, communicates between one end 18 of stem 11 and a plurality of ports 20 disposed in the intermediate sidewall 22 of stem 11. An outlet channel 24, generally within outlet region 14, communicates between the other end 26 of stem 11 and another plurality of ports 28 formed in the sidewall of stem 11.

A valve 30, in the form of a circular ring or collar, is situated in a circumferential channel 32 cut into the sidewall of stem 11 generally also in outlet region 14 and specifically toward ports 20 from ports 28. A valve seat 34 is milled or otherwise formed into a barrel 36 that is slidable upon stem 11 in the output region. Threaded onto inlet region 12 is a collar 38.

Encircling stem 11 is a longitudinally elastic sleeve 40. Its opposing ends are sealingly secured individually to respective ones of the valve assembly and the inlet region. More specifically, circumferential slots 42 and 44 are formed respectively in the external surfaces of barrel 36 and collar 38. Retaining rings 46 and 48 fit over the respective opposite ends of sleeve 40 so as to secure the sleeve in slots 42 and 44. Finally, inlet and outlet conduits 52 and 54 project outwardly from respective ends 18 and 26 of stem 11, in effect forming extensions of the inlet and outlet channels.

Conveniently, stem 11, barrel 36 and collar 38 are all formed from a machinable plastic. Conduits 52 and 54 may be integral with stem 11 or threadably secured separate parts. Valve 30 is molded of a reasonably hard rubber so as to form a water-tight seal when urged

against seat 34. On the other hand, sleeve 40 is of a soft rubber that exhibits a high degree of elasticity so as to be rather readily stretched longitudinally of the sleeve. Retaining rings 46 and 48 may be formed of a soft metal so as to be readily shaped in order to compress the underlying regions of sleeve 40 securingly and sealingly into the respective ones of slots 42 and 44.

For use, inlet conduit 52 is coupled as by a flexible hose to a source of water or other fluid under pressure. In the home, this may simply be an ordinary water faucet. In response to the admission of the water through channel 16 and out ports 20, sleeve 40 stretches and accumulates a supply of the incoming water. At the same time, sleeve 40 has been stretched sufficiently between retaining rings 46 and 48 so as to force seat 34 against valve 30 and thereby cover and close outlet ports 28. The accumulation of the incoming water within sleeve 40 continues until the pressure exerted on the sleeve is sufficient to extend it longitudinally whereupon barrel 36 is forced away from valve 30 and outlet ports 28 are thereby uncovered to permit the accumulated water to be dumped out outlet channel 24. When the pressure previously accumulated within sleeve 40 is then relieved sufficiently, the original tension within the walls of the sleeve serves to cause barrel 36 again to be moved inwardly to move seat 34 back against valve 30. At that point, of course, the flow of water from outlet channel 24 is terminated. This process is repetitive with the result that a series of pulses are produced in the fluid flow at the exit from outlet channel 24.

It will be observed that sleeve 40 serves both as a pressure accumulator and a valve actuator. Once assembled, the amount of tension longitudinally within the walls of sleeve 40 may be adjusted simply by the extent to which collar 38 is threaded onto inlet region 12. By stretching sleeve 40 to a greater extent in the off condition when valve 30 is engaged against seat 34, the output pulse rate is decreased for a given incoming water pressure. Alternatively, an increase in the pulse rate may be achieved by increasing the incoming water flow rate as by further opening the valve in a faucet to which the device is connected.

During operation, sleeve 40 tends to expand radially as well as longitudinally. Desirably, such radial expansion is restrained by means of a rigid tube 55 that encircles sleeve 40 and entirely encloses the device by extending between respective conduits 52 and 54 fixed at the inlet and outlet openings. Such restraint substantially limits the movement of the wall of sleeve 40 to a direction parallel to the axis of stem 11.

In the modification of FIG. 3, inlet collar 38a is modified so as threadably to receive an inwardly projecting sleeve 56. Inlet ports 20a are formed near the closed inner end of conduit 52a. Upon disengaging a latch pin 60, permitting longitudinal movement of sleeve 56 relative to collar 38a, sleeve 56 may be turned on its threads so as to be moved longitudinally in adjustment of the amount by which ports 20a are exposed or open. In this manner, the inlet flow rate may be adjusted independently of any external valve. As already indicated, such adjustment of the internal flow rate also serves to adjust the output pulsation rate.

In the adaptation of FIG. 4, the central portion 62 is a fluid pulsator which may be constructed entirely like that described above with respect to FIGS. 1 and 2. Further included is a first pipe 64 secured at one end

to inlet conduit 52 so as to be in communication with inlet channel 16. A slip-on type hose fitting 66 is formed on the other end of pipe 64. Another pipe 68 is secured at one end to outlet conduit 54 and in communication with outlet channel 24. A fluid-constricting nozzle 70 is formed in the other end of pipe 68 so as, in use, to emit a pulsating jet stream.

A different adaptation is depicted in FIG. 5 wherein a multiply-apertured showerhead 72 is secured on outlet conduit 54. As shown, showerhead 72 includes a plate 74 through which extend a plurality of apertures 76 from which the resultant pulsating streams are caused to diverge outwardly by a deflector 78 and thus form a generally conical pattern.

As one additional exemplification of adaptation, FIG. 6 depicts a housed version of the unit having a slipon connector 80 at its outlet end to which an elongated tube 82 is affixed. At the other end of tube 82 are a plurality of fluid-spraying apertures 84. In this case, housing 55a is formed in two parts. As so arranged, the unit of FIG. 6 constitutes a pulsating fluid-discharge device particularly suitable for feminine hygiene. Fastener 80 serves to permit ready disengagement of tube 82 for purposes of cleaning.

Whatever the utility, it will be seen that the fluid pulsator is capable of being constructed with but few parts and out of very ordinary and readily available materials. Because the rate of pulsation in use is easily adjustable either by means of external or internal valving adjustment, the elasticity characteristics of sleeve 40 tend to be comparatively non-critical in practice. Consequently, favorable production quality is obtainable without the need for sophisticated control of either materials or assembly. For those reasons as well as the general simplicity of the entire unit, the device is economical to manufacture.

Viable operation has been achieved at pulse rates variable from only five pulses per minute to as many as 5,000 pulses per minute. Yet, the pressure in each pulse is approximately constant throughout that range.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A fluid pulsator comprising:

an elongated stem having an inlet region and an outlet region individually at respective opposite ends of said stem;

a first-channel in said inlet region communicating between the corresponding end of said stem and a first port in the intermediate sidewall of said stem;

a second channel in said outlet region communicating between a second port in the intermediate sidewall of said stem and that corresponding end of said stem;

valve means, including a valve and valve seat, disposed on said stem at said outlet region with said valve and valve seat located effectively in the path of said second channel;

and a longitudinally-elastic sleeve encircling said stem with its opposing ends sealingly secured individually to respective ones of said valve means and

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said end of said stem at said inlet region, said sleeve repetitively responding to fluid under pressure admitted through said first channel to operate said valve means to an open condition and then responding to release of said fluid through said second channel to operate said valve means to a closed condition.

2. A fluid pulsator as defined in claim 1 which further includes means for adjusting the longitudinal tension in said sleeve.

3. A fluid pulsator as defined in claim 1 in which a collar is threaded upon said stem over a portion of said inlet region and one end of said sleeve is secured to said collar.

4. A fluid pulsator as defined in claim 1 in which said valve is secured around said stem between said inlet and outlet regions, said valve seat is defined in a barrel slidable on said stem over said outlet region, and an end of said sleeve is secured to said barrel.

5. A fluid pulsator as defined in claim 1 which further includes a rigid tube longitudinally encircling said sleeve and of a diameter limiting radial expansion of said sleeve.

6. A fluid pulsator as defined in claim 1 which further

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includes means in said first channel for selectively varying the volume of fluid flow therethrough.

7. A fluid pulsator as defined in claim 6 in which said varying means comprises a tube in said first channel and in which said first port is located and means for progressively opening said first port.

8. A fluid pulsator as defined in claim 1 which further includes a multiply-apertured showerhead nozzle secured to said stem at said outlet region and in fluid communication with said second channel.

9. A fluid pulsator as defined in claim 1 which further includes a first pipe secured at one end to said stem at said inlet region and in fluid communication with said first channel, a slip-on hose fitting formed on the other end of said first pipe, a second pipe secured at one end to said stem at said outlet region and in fluid communication with said second channel, and a fluid-constricting nozzle formed in the other end of said second pipe.

10. A fluid pulsator as defined in claim 1 which further includes an elongated tube secured at one end to said stem at said outlet region and having at its other end a plurality of fluid-spraying apertures.

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