

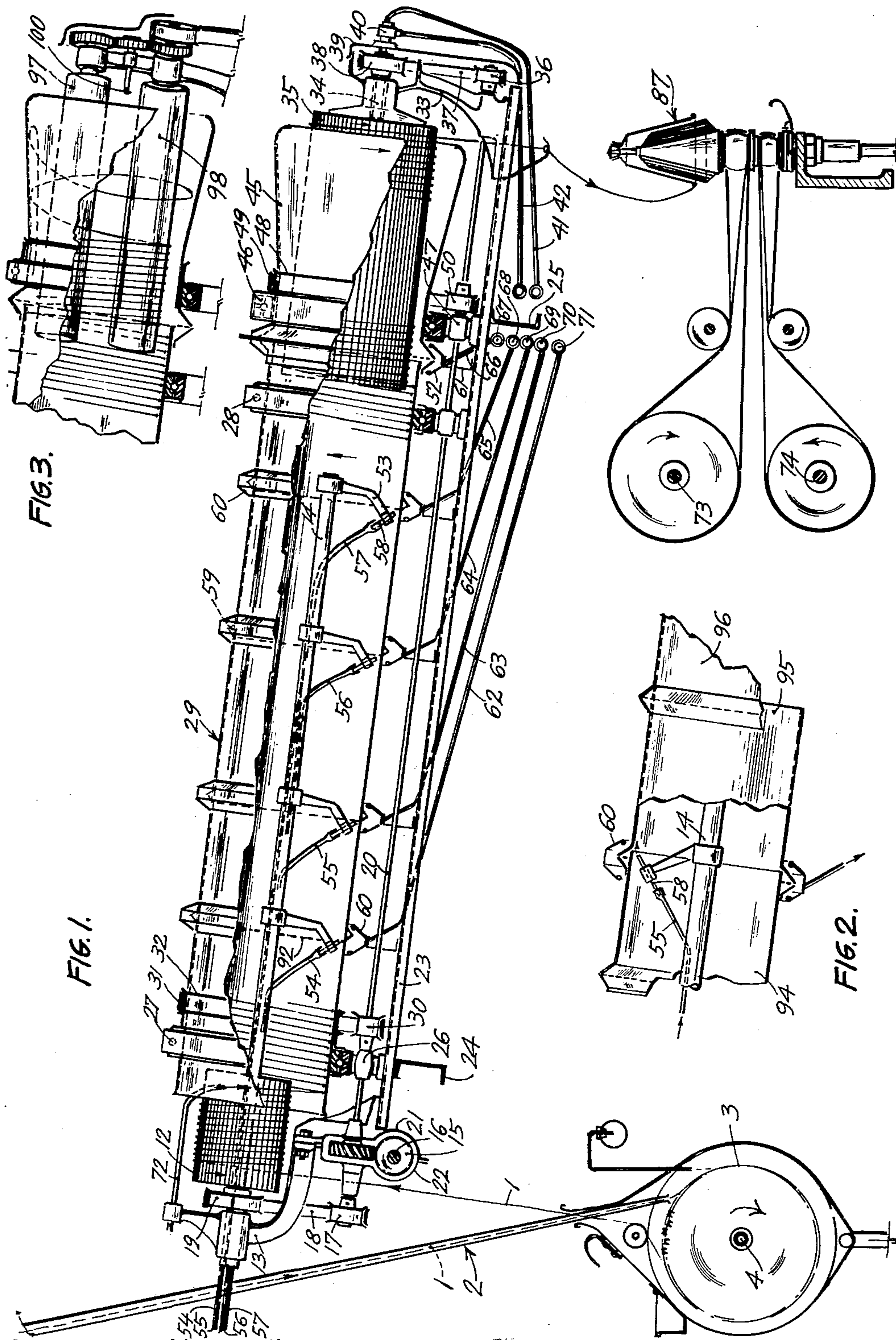
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YARN PROCESSING APPARATUS

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## YARN PROCESSING APPARATUS

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6 Claims. (Cl. 68—19)

This invention relates to new methods of continuous aftertreatment and to means for rapid continuous processing of freshly spun yarn such as rayon.

By the terms "processing and aftertreatment" I mean the usual wet treatment such as desulphurization, washing, bleaching, resin-pigment dyeing, plasticizing and drying.

It is a well known fact that most of the present continuously working spinning machines have one common disadvantage, i.e. slow speed of operation due to centrifugal force acting upon the yarn and liquids on surfaces of rapidly rotating reels or cylinders; the liquids fly off the circumference at more rapid speeds, resulting in poor and inefficient operation. Most of known continuous units work between 60 and 120 yards/min. and that is the prior art limit.

It might be mentioned, that already known are rapid means for conveying and processing yarns but not for what I term "continuous processing." Attention is called to United States Patent 2,680,084 describing hydraulic conveying for rubber threads and the like, permitting only one treatment, or two together at most, and no dyeing. This does not solve the complicated problem of chemical treatment of synthetic fibers like rayon with several chemical operations to be performed in succession, to provide a product ready-for-sale.

In case of processing synthetic textile fibers like viscose rayons, requiring as much as nine successive operations, a new conception is needed.

An object of the present invention is to provide means enabling any number of multiple chemical treatments of freshly spun yarn to be performed rapidly in succession.

Other objects and advantages will become apparent and the invention may be better understood from consideration of the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevation of apparatus according to the invention and comprising an inclined cylinder and a feed reel and a drying reel; Fig. 2 illustrates a modification in which the cylinder is made up of coaxial separate sections; and Fig. 3 illustrates a modified type of drying reel, in this case comprising two rollers with their axes inclined.

No effort is made herein to describe the stretch-spin equipment indicated generally at 2 in Fig. 1, for spinning and coagulating yarn 1, as it is described in my copending application Serial No. 603,707 filed August 13, 1956.

Also omitted is a detailed description of a lower stretching reel 3, which is covered separately in the above mentioned copending application.

Furthermore I do not bother herein to describe in detail the drive of the whole machine through shafting 4, 16, 73 and 74 and also a shaft for driving spinning pumps. All this is fully described in separate patent application now copending as continuation-in-part application Serial No. 662,543, filed May 29, 1957, and for a complete description of final twisting and coning spindle indicated generally at 87, reference may be had to my copending

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continuation-in-part application Serial No. 624,249, filed November 27, 1956.

Referring further to Fig. 1, a yarn processing device according to the present invention comprises an inclined rotating cylinder 29, of which the inner part is used for hydraulic conveyance and processing of yarn. This rotating cylinder is supported by bearings 27 and 28, held in housings 26.

The whole assembly is shown arranged on a channel 23, resting on two beams 24 and 25.

Power is transmitted to each cylinder from shaft 16, over worm gearing 15, arranged in a split-housing 21, 22. As shown, a part of 21 is bolted to cross-member 23, and a shaft 20 extends along the whole length of 23, and the shaft is used to drive various parts of the processing device at different speeds.

The cylinder is driven by a timing belt 31, running over sheave 30, arranged on shaft 20, and over sheave 32, on cylinder 29. On the outer side of worm gearing 15, to the left as viewed in Fig. 1, there is arranged a timing belt drive 18, over sheaves 17 and 19; the latter sheave is fastened with respect to a feed-reel 12, rotating on a stationary tube 14, fastened in a bracket 13, which is bolted to housing 21 for easy removal of the tube assembly 14.

The feed reel 12 extends partly into the cylinder 29 and it takes yarn from reel 3 and conveys this freshly spun yarn into the normally rotating processing cylinder 29 where, in order to ensure automatic threading, there is provided a nozzle 72, for introducing a first liquid directly to yarn advancing feed-reel 12, to force the yarn off the reel and thus onto the inner circumference of cylinder 29 where it is caught and held by centrifugal force while advanced in spirals as later mentioned.

To prevent liquid intermixture the main processing cylinder 29 is divided into several individual processing divisions separated by pluralities of tiny outlet holes 92 around the circumference. Next to those holes and placed on the outer part of the cylinder are rubber rings 59 of triangular section, enabling the liquids to flow into stationary circular channels 60, properly shaped to prevent loss of liquids except by way of pipes 62 and 66 by gravity and into collecting piping 67—71. Adjacent each group of outlet holes 92, there is located an inclined nozzle 58, held by a holder 53, delivering treating liquid slightly downhill, and thus processwise after, the respective ring or set of openings.

A drying and thread advancing reel 35 is arranged partly inside of cylinder 29. As shown it may have its own separate shaft 34, rotating in a housing 33 and driven from shaft 20 by a timing belt drive 36, 37 and 38. The housing is secured on channel 23, and drive 36—38 is covered with cover 39. The drying reel may be heated through coil, arranged inside in regular way. Inlet of steam may be arranged through a pipe 41; with condensate led out by a pipe 42; with each fluid passing through a rotary seal 40 on outer end of rotating shaft 34.

In order to enable selfthreading of yarn 1 onto the drying reel 35, as the yarn leaves the processing cylinder 29 there is arranged a funnel-like member 45, rotating in a bearing 46 which is held in a bracket 47, secured as by bolts (not shown) on channel 23. This member has its own timing belt drive 48, 49 and 50, derived from shaft 20.

In order to use the extracted plasticizing liquid from the yarn again, there is arranged an outer stationary ring 52, secured through a holding member 61 on channel 23, while piping 66, from the lowest point of the ring 52, conducts said plasticizer into a pipe-line 67.

Thus all liquids, including the wash-waters, are recirculated and may be taken back to inlet tubes for various liquids such as those shown at 54, 55, 56, 57 and 72.



Finally, and, for example, under the cylinder 29 and associate reel 35 as viewed in Fig. 1, there is arranged a twisting and coning device indicated generally at 87, as already mentioned.

There is thus provided a device of the character described. Instead of the inclined tube 29 being unitary, though provided in places for exhaust of each respective liquid through orifices 92 around the circumference, as shown by Fig. 1, the arrangement of Fig. 2 may be used with the yarn advancing cylinder comprising a number of coaxial sections 94, 95, 96 firmly joined end to end but permitting liquid leakage through the joints so that any former liquid can escape and new liquid introduced at an angle will push the yarn coils forward and downwardly into another section.

While Fig. 1 shows a drying advancing reel based on one known principle, there are other thread advancing means usable for drying, such as a pair of heated rollers 97 and 98, set slightly at an angle, as shown in Fig. 3.

How it works: Spun and coagulated yarn 1 is regenerated and stretched in stretch-spinning funnel 2, and elutriated by wash-water from a source 9 acting on advancing reel 3. From there the yarn goes over the thread advancing reel 12, arranged partly inside of main processing cylinder 29. This reel 12 preferably has a larger circumferential speed than reel 3 to perform the desired amount of additional stretch.

At a predetermined point on the reel 12, there is introduced a first desulphurization liquid treatment through tube 72 in such an amount, to wash the yarn off the reel 12 and to ensure proper hydraulic advancing in the inclined cylinder 29. Speed of cylinder 29 is slightly less than the circumferential speed of the reel 12, to enable recovery after the stretch and proper formation of yarn spirals.

When the liquid and yarn reach the first row of orifices in cylinder, the advancing liquid flows out through them, leaving the yarn inside, causing its spirals to compress closely together. Immediately after the orifices, wash water is introduced through conduit 54 and its inclined nozzle 58, causing the pushing of spirals ahead and further liquid-conveyance to next exchange, which may be bleaching, then washing, and finally plasticizing. Each liquid, even the wash-waters are collected and recirculated after proper regeneration.

It was formerly a customary practice, to let only drops of emulsion fall on continuously moving yarn. According to the present invention a far superior method is used, i.e. dispersion of emulsion in water and yarn soaked thoroughly in this bath, resulting in even plasticizing effect. After the plasticizer treatment, the yarn with some liquid leaves the rotating cylinder and by centrifugal force enters a rotating circular groove of funnel 45, which preferably rotates with an inner peripheral speed greater than the normal speed of the yarn at this point, so the end of yarn is positively wrapped around the drying reel 35. Excess of plasticizing liquid is extracted into stationary collecting ring 52, through orifices 51 in groove of part 45.

When desired, there can be arranged freely rotating squeezing soft rubber roll not shown at the end of main processing body, so yarn will enter the drying reel with least amount of liquid; furthermore said squeezer roll acts as means for proper feed of yarn onto the drying reel at rate as being advanced.

Preferably the drying reel has same or slightly larger circumferential speed, than the inner periphery speed of member 29, to ensure steady yarn-advancing without interruption.

The yarn after being dried, has tendency from centrifugal force acting upon it, to leave the periphery of said reel. But the free end of yarn, when touching the inner part of faster rotating funnel 45 is kept under light tension, keeping the yarn on the circumference of reel 35, to the end of 45.

The rollers 97 and 98 of Fig. 3 occupy approximately

the same space as, and can be easily interchanged for, the reel 35 shown on Fig. 1. Said rollers, set somewhat under angle, should have about the same or a slightly higher yarn touching periphery speed than cylinder 29. Selfthreading is performed in similar way, as before and free end of yarn, being dragged by cone 45 always little ahead of speed of yarn, assures the overwrapping for example up to a stop-pin 100, limiting further advance of yarn. From there the yarn is picked and threaded manually through pigtail 91 onto the cone 87, on which the proper traversing is done by rotating and traversing cap, so proper shape of cone is formed at very high constant linear speeds safely and without regard if the cone is empty or full.

With operation of apparatus according to the present invention yarn speeds of 250 to 500 yards per minute can be achieved.

The device herein shown and described does not limit the full scope of the invention and various modifications are possible without departing from the general idea. For instance, instead of one cylinder comprising all the needed chemical treatments, various processing can be separated on individual cylinders with inner conveying and instead of feed-reel, other type or godet wheel might be used. Also the drying, thread-advancing reel can be substituted for, as with a pair of heated rollers 97 and 98 set under slight angle, to enable thread advancing.

I claim:

1. Yarn advancing and treating apparatus comprising at least one hollow cylinder arranged to be rotatable about an inclined axis, a thread-advancing reel arranged to advance yarn into the cylinder adjacent its uppermost end, means for driving said reel and said cylinder at predetermined rates of speed such that the inner peripheral speed of the cylinder is slower than the peripheral speed of the reel, first liquid-introducing means pointed toward yarn upon the reel for introducing a first treating liquid and to cause the yarn to leave the reel and form helically upon the slower moving inner periphery of the cylinder, means including openings through the cylinder for allowing said first liquid to escape from the yarn and from the interior of the cylinder due to centrifugal force, second liquid-introducing means pointed toward the yarn within the cylinder downwardly of said means including openings and for introducing a second treating liquid to the yarn, and means for allowing said second liquid to escape from the yarn and from the cylinder due to centrifugal force.

2. Yarn treating apparatus comprising an inclined rotatable cylinder, means located adjacent the uppermost end of said cylinder and for introducing yarn so as to lay helically upon the inner surface thereof, plural means spaced axially along the cylinder and for introducing different treating liquids sequentially and separately to different portions of the yarn helix as it advances, axially spaced leakage paths through the cylinder to permit each liquid to escape without intermixture with any other liquid, axially spaced rotatable deflecting rings on the exterior of the cylinder and cooperating stationary collecting channels to further prevent liquid intermixture and permit re-use thereof, and drying means for collecting, drying, and advancing the yarn adjacent the lowermost end of said cylinder.

3. Yarn treating apparatus as in claim 2, further characterized by the cylinder comprising axially separate sections assembled as one rigid unit but with openings between sections to provide for the leakage paths for the successive liquids.

4. Yarn treating apparatus as in claim 2, further characterized by the cylinder comprising axially spaced rings of outlet holes passing radially through the hollow cylinder body to provide the leakage paths for successive liquids.

5. Yarn treating apparatus as in claim 2, further characterized by the drying means at the lowermost end of



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the cylinder comprising a reel arranged coaxially with the cylinder and having one end extending therein, a coaxial funnel surrounding a central portion of the reel between the lowermost end of the cylinder and the opposite end of the reel, and drive means for driving the reel to have a peripheral speed substantially the same as the speed of the inner periphery of the cylinder while driving the funnel to have an inner peripheral speed greater than the peripheral speed of cylinder and reel, whereby to assure proper advance of yarn adjacent said cylinder lowermost end.

6. Yarn treating apparatus as in claim 2, further characterized by the drying means at the lowermost end of

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the cylinder comprising a pair of heated rollers having non-meeting axes inclined, each with respect to the other, and each with respect to the axis of the cylinder, and a funnel-like rotating member arranged around a portion of said rollers for carrying the yarn from the main processing cylinder and acting as a self-threading device for the rollers.

## References Cited in the file of this patent

## UNITED STATES PATENTS

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