Feb. 15, 1955 P. L. SCHOONOVER 2,702,218

MEANS FOR MOUNTING CIRCULAR RAILS ON ROTARY MILLS

Filed Oct. 17, 1952 2 Sheets-Sheet 1

Fig. 1

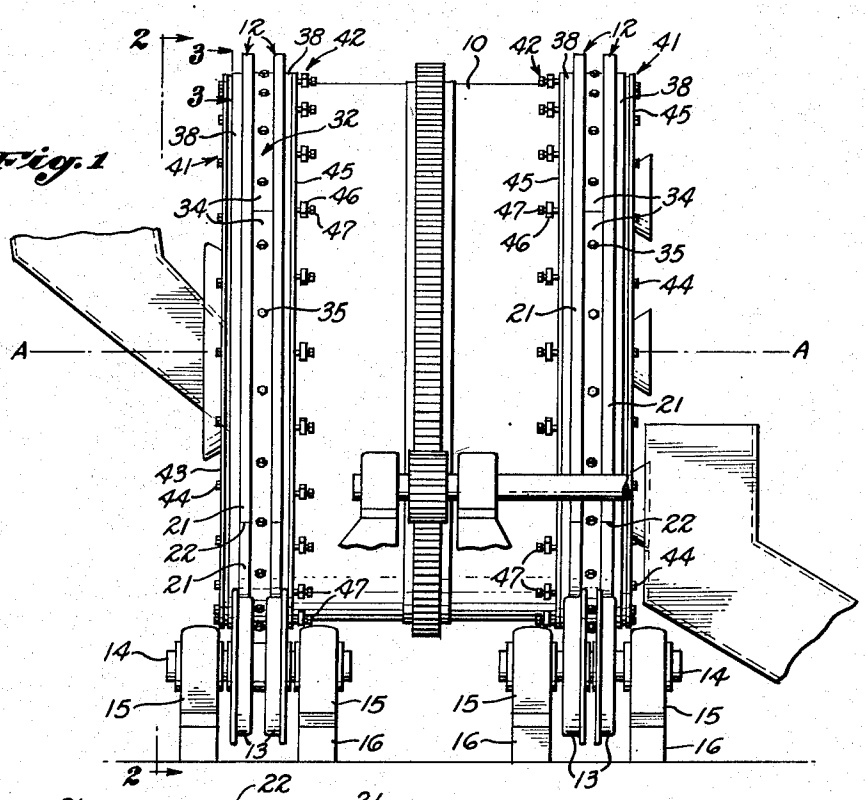


Fig. 2

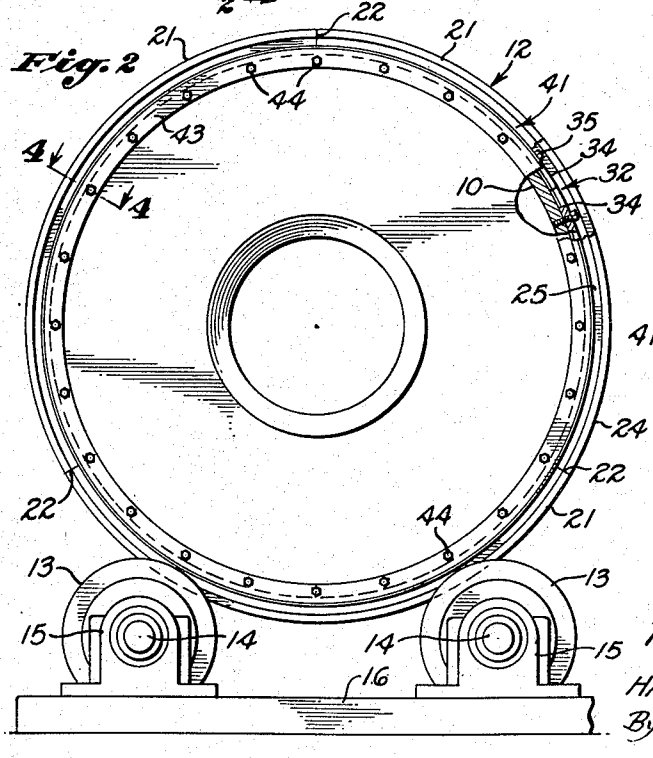
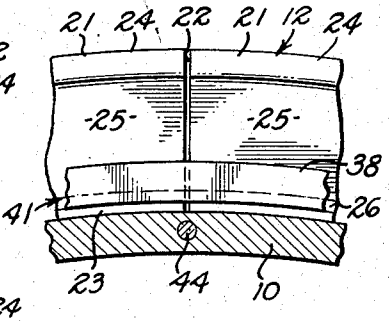


Fig. 3



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Filed Oct. 17, 1952 2 Sheets-Sheet 2

Fig. 4

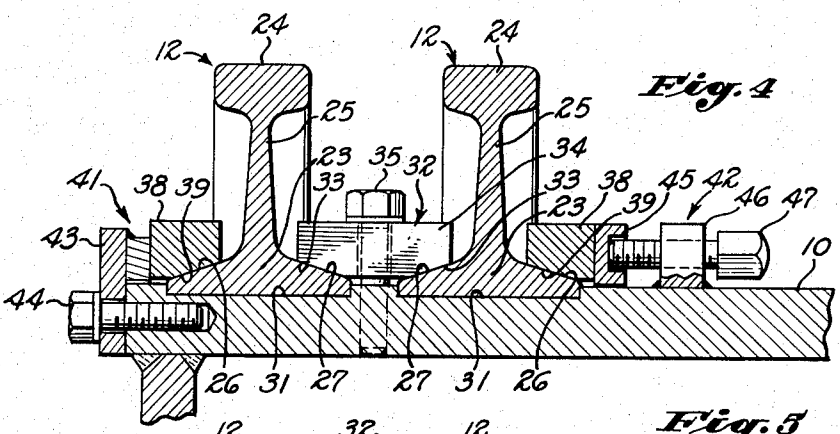


Fig. 5

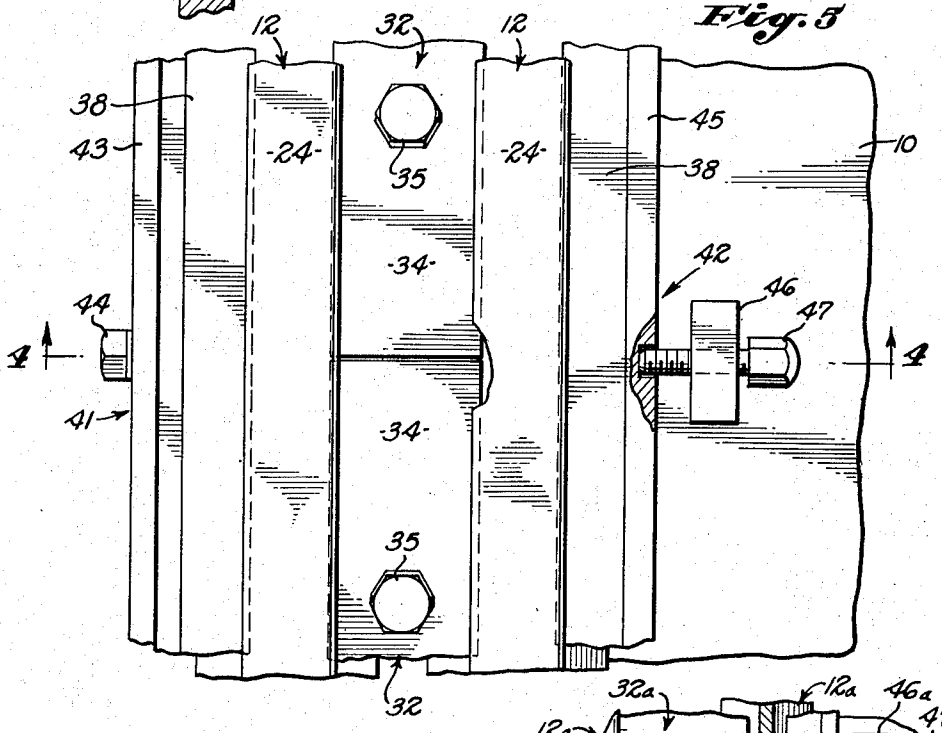


Fig. 6

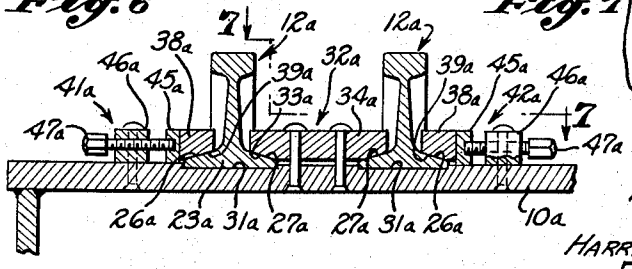
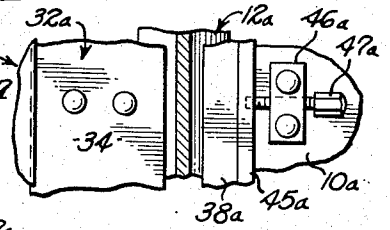


Fig. 7



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United States Patent Office 2,702,218 Patented Feb. 15, 1955

2,702,218

MEANS FOR MOUNTING CIRCULAR RAILS ON ROTARY MILLS

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Application October 17, 1952, Serial No. 315,288

13 Claims. (Cl. 308—204)

The present invention relates in general to rotary mills and, more particularly, to a rail mounting for such structures, the term "rotary mill", as used herein, being intended to include any rotary, shell-like structure operating about a generally horizontal axis, such as ball mills, rod mills, tumblers, driers, kilns, and the like.

As is well known in the art, a rotary mill includes a shell of circular cross section rotating about a generally horizontal axis in which materials are crushed, tumbled, dried, fired, or the like. Encircling the shell are annular rails which rest on rollers, the latter supporting the shell and rendering it rotatable about its axis.

A primary object of the present invention is to provide an improved mounting means for connecting the rails to the shell.

More particularly, an important object of the invention is to provide cam means carried by the shell and engaging the rails for biasing the rails radially inwardly into intimate engagement with the shell. In effect, the cam means shrink the annular rails onto the shell so as to secure them to the shell in a positive manner.

Another object is to provide a cam means for shrinking the annular rails onto the shell which permits ready removal of the rails for replacement, if this should ever become necessary.

Another important object of the invention is to provide each rail with a base having thereon an annular cam surface which converges toward one end of the shell, and to provide a cam ring encircling the shell and having an annular cam surface thereon which is complementary to and in engagement with the cam surface on the rail, the invention including cam actuating means carried by the shell and engaging the cam ring for biasing the cam ring axially of the shell in a direction such that the cam surface on the cam ring tends to ride up the complementary cam surface on the rail base so as to bias the rail base radially inwardly into intimate engagement with the shell.

Another object is to provide a rotary mill wherein the rails are arranged in pairs and in which the cam rings associated with the rails of each pair are biased axially of the shell in opposite directions by the corresponding cam actuating means. A related object is to provide a rotary mill wherein the annular cam surfaces on the rails of each pair face away from each other and wherein the annular cam surfaces on the cam rings of each pair face toward each other, the cam rings being biased toward each other by the respective cam actuating means.

Another object is to provide clamping means between and engageable with the bases of the rails of each pair for additionally securing the rails to the shell. A related object is to provide the clamping means with annular cam surfaces respectively engageable with other annular cam surfaces on the rail bases of each pair of rails.

A further object is to provide the shell with annular grooves therein receiving the rail bases so as to key the rails against movement axially of the shell.

A further object is to provide annular rails of sectional construction, the clamping means and the cam means forming the sole means of connecting the rail sections together and to the shell.

Another object is to provide in association with each pair of rails two or more pairs of oppositely flanged rollers, the flanges on the rollers of each pair engaging the respective rails of the corresponding pair on opposite sides thereof to prevent axial shifting of the shell relative to the supporting rollers.

A further object is to provide a rotary mill wherein the rails are ordinary railroad rails and wherein the rollers are ordinary railroad wheels. This provides a rotary mill mount which is unusually durable and yet much less expensive than prior rotary mill mounts.

The foregoing objects and advantages of the present invention, together with various other objects and advantages thereof which will become apparent, may be attained with the exemplary embodiments of the invention which are illustrated in the accompanying drawings and which are described in detail hereinafter. Referring to the drawings:

Fig. 1 is a side elevational view of a rotary mill which embodies the invention;

Fig. 2 is an end elevational view of the rotary mill and is taken along the arrowed line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view on an enlarged scale which is taken along the arrowed line 3—3 of Fig. 1;

Fig. 4 is a fragmentary sectional view on an enlarged scale which is taken along the arrowed line 4—4 of Fig. 2;

Fig. 5 is an enlarged, fragmentary side elevational view of the rotary mill of the invention, the plane of the sectional view of Fig. 4 also being indicated on Fig. 5;

Fig. 6 is a view on a reduced scale which is similar to Fig. 4, but which illustrates another embodiment of the invention; and

Fig. 7 is a fragmentary sectional view taken along the arrowed line 7—7 of Fig. 6.

Referring particularly to Figs. 1 and 2 of the drawings, the rotary mill illustrated therein includes a cylindrical shell 10 which is rotatable about an axis A—A that is at least generally horizontal. Mounted on the shell 10 are two pairs of annular rails 12. Each pair of rails 12 engages two horizontally spaced pairs of rollers or wheels 13, which support the shell 10 and provide for its rotation about the axis A—A. One wheel 13 of each pair engages one of the rails 12 of the corresponding pair of rails, and the other wheel of each pair engages the other rail of the corresponding pair of rails. The wheels of each pair are oppositely flanged, the flanges engaging the sides of the rails to prevent axial movement of the shell 10. In the particular construction illustrated, the wheels 13 on the left in Fig. 1 have their flanges engaging the outer sides of the rails of the corresponding pair, while the wheels on the right in Fig. 1 have their flanges engaging the inner sides of the rails of the corresponding pair. Each pair of wheels 13 is mounted on a shaft 14 carried by bearings 15 mounted on suitable bases 16.

As previously pointed out, the rails 12 are preferably ordinary railroad rails curved to fit the shell 10 in any suitable manner. Similarly, the wheels 13 are preferably ordinary railroad wheels, the result of using railroad rails for the rails 12 and railroad wheels for the wheels 13 being an inexpensive yet very durable mounting for the shell 10.

As best shown in Figs. 2 and 3 of the drawings, each rail 12 preferably comprises two or more rail sections 21 to facilitate shaping the rails and to facilitate applying them to the shell 10, the junctions between the rail sections being indicated by the numeral 22. Preferably, slight gaps between the rail sections 21 are provided at the junctions 22. As will become apparent, the rails 12 are secured to the shell 10 in such a manner that no splices, or other connections, between the sections 21 of each rail are necessary.

Referring particularly to Figs. 4 and 5 of the drawings, each rail 12 is provided with a relatively wide base 23, a head 24 which is engaged by the rims and flanges of the corresponding supporting wheels 13, and an interconnecting web 25. As best shown in Fig. 4 of the drawings, the rails 12 of each pair are provided, on their bases 23, with annular cam surfaces 26 which converge toward opposite ends of the shell 10 and which, in the particular construction illustrated, face away from each other. The rail bases 23 of each pair of rails 12 are also provided with other annular cam surfaces 27 which also converge toward opposite ends of the shell 10 and which, in the particular construction illustrated, are located adjacent each other and face toward each other. If ordinary railroad rails are employed for the rails 12, which is

preferable, the rail bases of such ordinary railroad rails are already shaped to provide the aforementioned annular cam surfaces 26 and 27 once the rails have been formed in circular configurations, which is an important advantage of utilizing ordinary railroad rails since no machining is necessary to provide the annular cam surface 26 and 27.

The external surface of the shell 10 is provided with axially-spaced pairs of axially-spaced, annular grooves 331 therein, the rails' bases 23 being disposed in the annular grooves 31, respectively. With this construction, the rails 12 are keyed against movement axially of the shell 10.

Disposed between the rails 12 of each pair is a clamping means 32 having annular cam surfaces 33 thereon which are complementary to and in engagement with the respective cam surfaces 27 of the corresponding pair of rails. The clamping means 32 is of sectional construction and includes a plurality of arcuate clamps 34 which, collectively, encircle the shell 10 and which are secured to the shell, as by screws 35 extending therethrough and threaded into the shell.

The rails 12 of each pair are also secured to the shell 10 by a pair of continuous cam rings 38 which encircle the shell and which are provided with cam surfaces 39 complementary to and in engagement with the respective cam surfaces 26 of the corresponding pair of rails. As will be apparent, if the cam rings 38 of each pair are biased toward each other, as in the particular construction illustrated, the cam surfaces 39 thereof tend to ride up on the cam surfaces 26 of the corresponding rails 12 so as to bias the corresponding rail bases 23 into intimate engagment with the shell 10. In other words the effect of biasing the cam rings 38 toward each other, in the particular construction illustrated, is to shrink the corresponding pair of rails 12 onto the shell 10 in much the same manner as hoops are shrunk onto a barrel. This insures a positive connection between the rails 12 and the shell 10, but permits ready removal of the rails for replacement if this is ever necessary, which is an important feature of the invention.

The cam rings 38 are biased toward each other by a pair of actuating means 41 and 42, respectively. The actuating means 41 comprises an actuating ring 43 which encircles the shell 10 and engages one of the cam rings 38, the actuating ring 43 being formed in two pieces in the particular construction illustrated. Extending through the actuating ring 43 and threaded into one end of the shell 10 are actuating screws 44 which, when tightened, force the corresponding cam ring 38 toward the corresponding rail 12 to cause the corresponding cam surface 39 to cam up over the corresponding cam surface 26, thereby tending to shrink the corresponding rail 12 onto the shell 10. Similarly, the actuating means 42 comprises an actuating ring 45 which encircles the shell 10 adjacent the other rail 12 of the pair under consideration. Welded, or otherwise secured, to the shell 10 adjacent the actuating ring 45 are lugs 46 through which actuating screws 47 are threaded, the actuating screws bearing against the actuating ring 45 so that, when tightened, they cause the corresponding cam ring 38 to cam up over the cam surface 26 of the corresponding rail 12 to tend to shrink this rail onto the shell 10 also. Thus, by tightening the actuating screws 44 and 47 so as to bias the cam rings 38 toward each other, both rails 12 are biased radially inwardly and are, in effect, shrunk onto the shell 10 to provide a positive connection between the rails and the shell. However, it will be apparent that the rails 12 may be removed readily for replacement if this should ever be necessary, which is an important feature of the invention. Also, with this construction, no splices, or other direct connections, between the sections 21 of the rails 12 are necessary, which is an important feature.

The embodiment of Figs. 6 and 7 of the drawings is similar to that described previously and identical reference numerals are employed for corresponding components, except that the suffix *"a"* has been added thereto. The main difference between the two embodiments is that, in the embodiment of Figs. 6 and 7, the actuating means 41*a* is identical to the actuating means 42*a* and includes an actuating ring 45*a* which is operated upon by screws 47*a* threaded through lugs 46*a*, the latter being shown as riveted to the shell 10*a*. The only other difference is that the arcuate clamps 34*a* of the clamping means 32*a* are riveted to the shell 10*a*, instead of being bolted thereto.

Although exemplary embodiments of the invention have been disclosed herein for purposes of illustration, it will be understood that various minor changes, modifications and substitutions may be incorporated in the embodiments disclosed without necessarily departing from the spirit of the invention.

I claim as my invention:

1. In a rotary mill, the combination of: a rotary shell; a pair of rails on the exterior of and encompassing said shell; a pair of oppositely actuating cam means carried by said shell and engaging said rails, respectively, and biasing said rails radially inwardly into intimate engagement with said shell for securing said rails to said shell; clamping means between said rails for securing same to said rotary shell; and rollers engaging said rails for supporting said shell.

2. In a rotary mill, the combination of: a rotary shell of circular cross section; rails on the exterior of and encircling said shell, each of said rails having a base contacting said shell and provided with an annular cam surface thereon which converges toward one end of said shell; cam rings encircling said shell and having annular cam surfaces thereon complementary to and respectively engaging said cam surfaces on said rail bases; cam actuating means carried by said shell and respectively engaging said cam rings for biasing said cam rings axially of said shell and toward said cam surfaces on said rail bases, respectively, so as to bias said rail bases radially inwardly into intimate engagement with said shell; clamping means between and engaging said rails for securing same to said shell; and rollers engaging said rails for supporting said shell.

3. In a rotary mill, the combination of: a rotary shell of circular cross section; a pair of rails on the exterior of and encircling said shell, said rails having bases contacting said shell and provided with annular cam surfaces thereon which respectively converge toward opposite ends of said shell; a pair of cam rings encircling said shell and provided with annular cam surfaces thereon complementary to and respectively engaging said cam surfaces on said rail bases; a pair of cam actuating means carried by said shell and respectively engaging said cam rings for biasing said cam rings axially of said shell in opposite directions and toward said cam surfaces on said rail bases, respectively, so as to bias said rail bases radially inwardly into intimate engagement with said shell; means between said rails for spacing said rails apart to resist any tendency for said cam rings to displace said rails relative to said shell in axial directions; and pairs of rollers engaging said pair of rails for supporting said shell.

4. In a rotary mill, the combination of: a rotary shell of circular cross section; a pair of rails on the exterior of and encircling said shell, said rails having bases contacting said shell and provided with annular cam surfaces thereon which converge toward opposite ends of said shell and which face away from each other; a pair of cam rings encircling said shell and provided with annular cam surfaces thereon complementary to and respectively engaging said cam surfaces on said rail bases, said cam surfaces on said cam rings facing toward each other; a pair of cam actuating means carried by said shell and respectively engaging said cam rings for biasing said cam rings axially of said shell and toward each other so as to bias said rail bases radially inwardly into intimate engagement with said shell; means between said rails for spacing said rails apart to prevent axial displacement of said rails relative to said shell by said cam rings; and pairs of oppositely flanged rollers engaging said pair of rails for supporting said shell.

5. A rotary mill as defined in claim 4 wherein said rail bases are provided with other annular cam surfaces thereon which respectively converge toward opposite ends of said shell and which face toward each other, said spacing means including clamping means between said rails and having annular cam surfaces thereon which are complementary to and respectively engage said other cam surfaces on said rail bases, said clamping means being secured to said shell.

6. A rotary mill as defined in claim 5 wherein said shell is provided with a pair of axially spaced, circumferential grooves therein, said rail bases being seated in said grooves, respectively.

7. A rotary mill as defined in claim 4 wherein each of said cam actuating means comprises a plurality of screws threadedly connected to said shell and acting on the corresponding cam ring.

8. A rotary mill as defined in claim 4 including another pair of rails, another pair of cam rings, another pair of cam actuating means and other pairs of oppositely flanged rollers having the same relationships to said shell and to each other as the pair of rails, the pair of cam rings, the pair of cam actuating means and the pairs of oppositely flanged rollers defined in claim 4.

9. A rotary mill as defined in claim 4 wherein each of said actuating means includes an actuating ring engaging the corresponding cam ring and includes a plurality of screws threadedly connected to said shell and engaging the corresponding actuating ring.

10. A rotary mill as defined in claim 4 wherein said rail bases are provided with other annular cam surfaces thereon which respectively converge toward opposite ends of said shell and which face toward each other, said spacing means including clamping means between said rails and having annular cam surfaces thereon which are complementary to and respectively engage said other cam surfaces on said rail bases, said clamping means being secured to said shell, said clamping means including two or more arcuate clamps disposed between said rails and secured to said shell.

11. A rotary mill as defined in claim 4 wherein said rails are ordinary railroad rails and wherein said flanged rollers are ordinary railroad wheels.

12. In a rotary mill, the combination of: a rotary shell of circular cross section; a rail on the exterior of and encircling said shell, said rail having a base contacting said shell and provided on opposite sides thereof with annular cam surfaces which respectively converge toward opposite ends of said shell; clamping means secured to said shell on one side of said rail and having an annular cam surface thereon which is complementary to and in engagement with the annular cam surface on the corresponding side of said rail base; a cam ring encircling said shell and having an annular cam surface thereon which is complementary to and in engagement with the cam surface on the opposite side of said rail base; cam actuating means carried by said shell and engaging said cam ring for biasing said cam ring axially of said shell in a direction opposite to the direction of convergence of the cam surface on said rail base which said cam ring engages, whereby to bias said rail base radially inwardly into intimate engagement with said shell; and rollers engaging said rail for supporting said shell.

13. A rotary mill as defined in claim 12 wherein said clamping means comprises two or more arcuate clamps secured to said shell.

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