Feb. 27, 1934. B. BAUER 1,948,691

STEEL SKELETON FOR REENFORCED CONCRETE STRUCTURES

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Fig.1

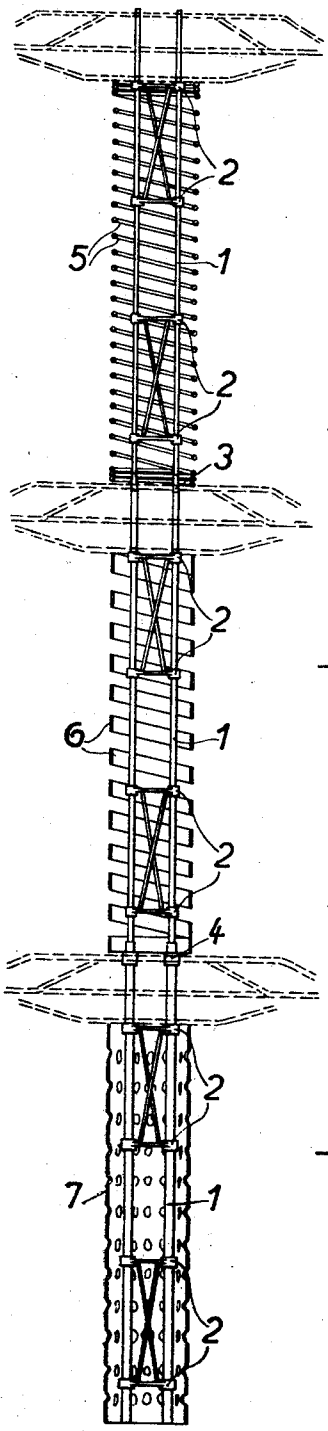


Fig.2

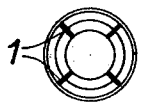


Fig.3

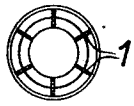


Fig.4

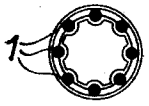


Fig.5

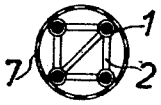


Fig.6

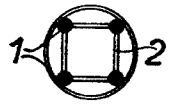


Fig.7

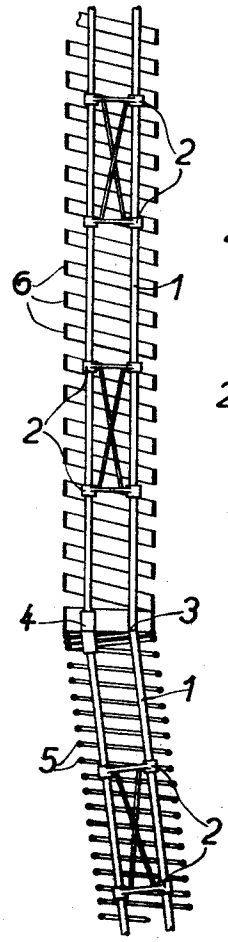
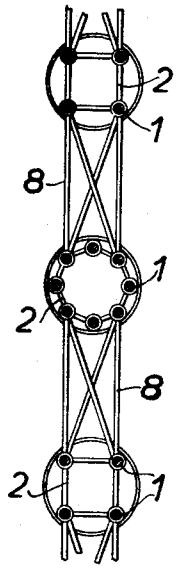


Fig.8



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Fig. 9

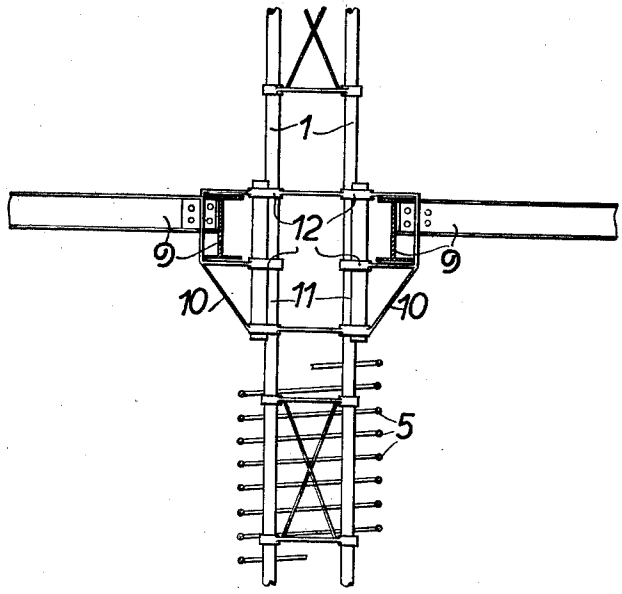
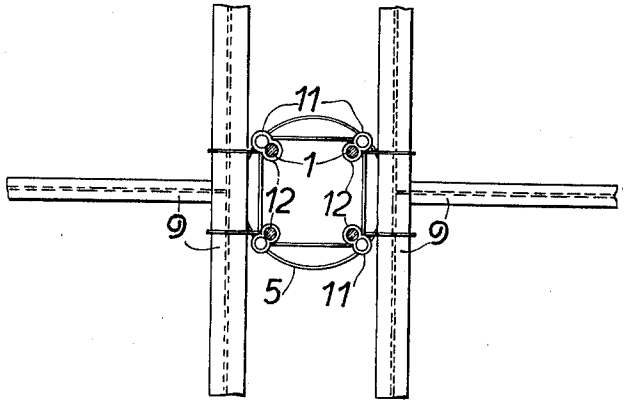


Fig. 10



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Fig. 11

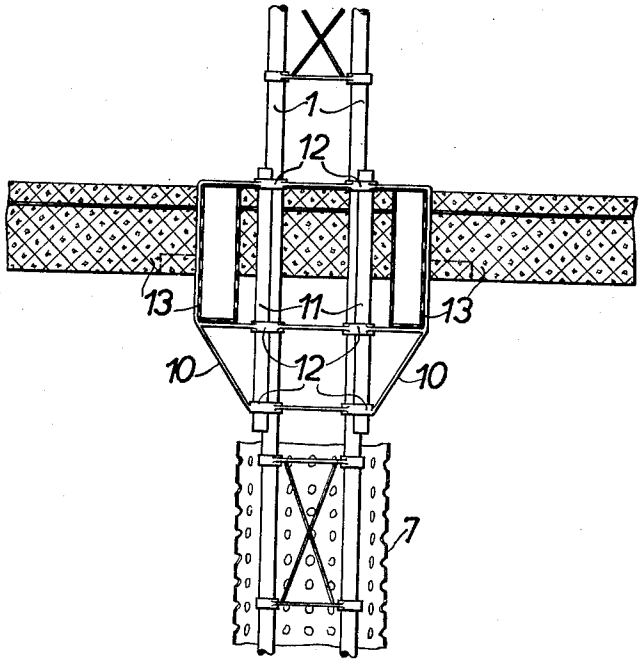
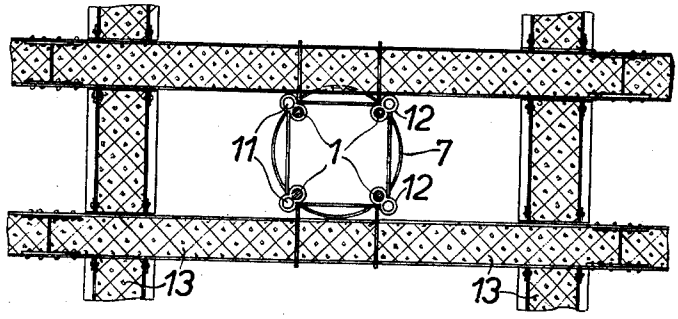


Fig. 12



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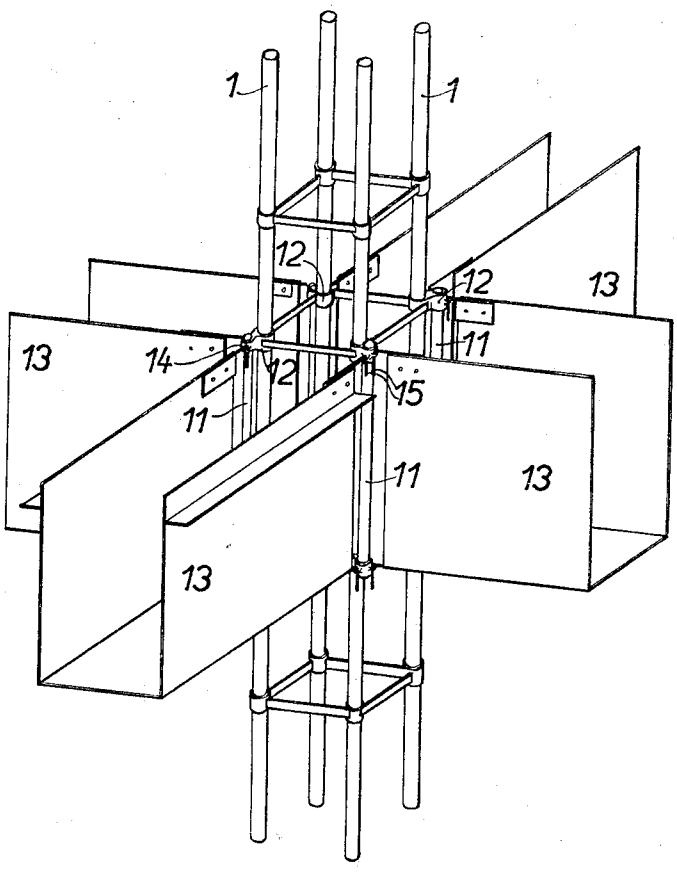
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Fig. 13



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STEEL SKELETON FOR REENFORCED CONCRETE STRUCTURES

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Fig. 14

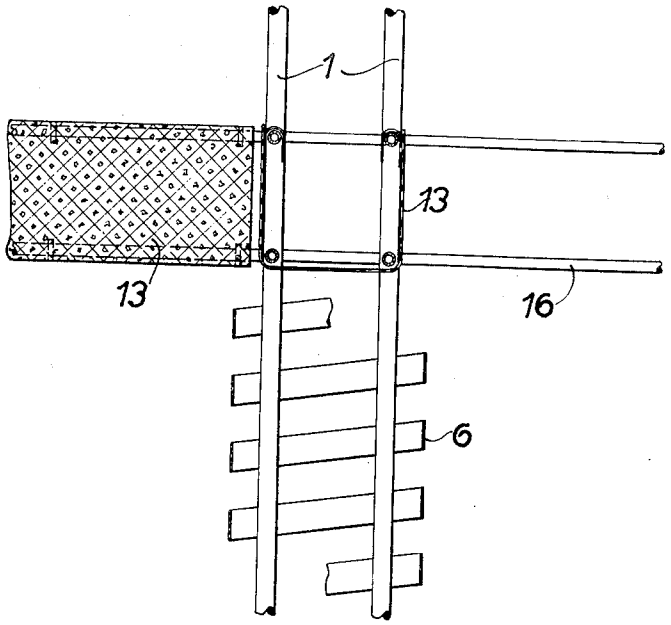
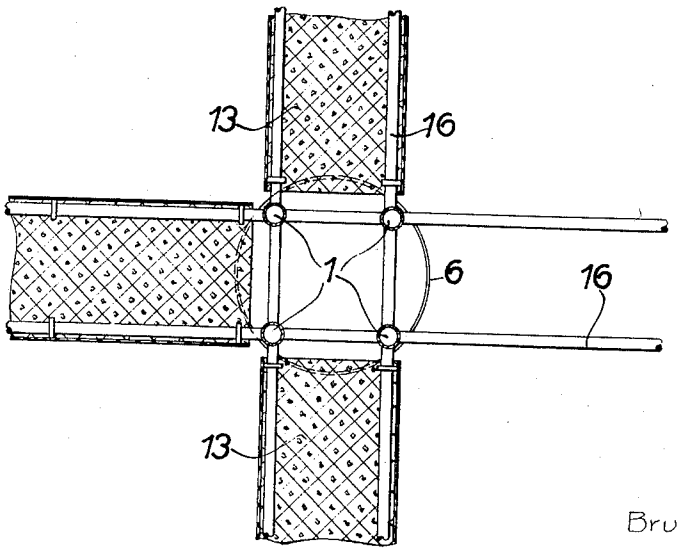


Fig. 15



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UNITED STATES PATENT OFFICE

1,948,691

STEEL SKELETON FOR REENFORCED CONCRETE STRUCTURES

Bruno Bauer, Vienna, Austria

Application August 23, 1929, Serial No. 387,858
In Austria December 29, 1928

9 Claims. (Cl. 72—76)

Although the reenforced concrete mode of construction possesses many advantages compared with the iron construction, the reenforced concrete could not compete in any way with the steel skeleton construction as far as high buildings (buildings with a large number of flats, skyscrapers) are concerned. By the term steel skeleton construction is not to be understood a construction in which the bearing character of walls and pillars is taken into consideration, in order to assign to these elements of construction a volumetric function only, but one in which all forces (load on flats, wind pressure and the like), acting on the finished structure, are received by a steel skeleton constructed and dimensioned for this load or stress and consisting of rolled sections (generally H-sections) riveted or welded together. Therefore a steel skeleton of this kind constitutes the complete supporting structure of the whole building and after erecting said skeleton, which is done in the manner of iron constructions, the same is provided with a fireproof lining and walled up. These fireproof supports are of the greatest importance for the security of a tall building, because in case of fire in one of the lower flats, the deformation of the supports owing to the heat may lead to the collapse of the building. However the steel skeleton constructions used at present in connection with high buildings possess the drawback, that the masonry, either of concrete or bricks, necessary for the fire-proof encasing of the skeletons and for making the ceilings, subject said steel skeletons to an undue load because they are not utilized for bearing or carrying objects. Compared with this, the building constructions of reenforced concrete represent a compound member, which serves the purpose of carrying or supporting the two materials, namely concrete and iron, of which it consists, so that in this kind of constructions, the concrete enclosing the iron mountings protects the iron against damage by rust or fire and also acts as a support or carrier. However this economic advantage can only be made use of in part because the rigidity and stiffness of the reenforced concrete constructions can only be utilized after the hardening of the concrete and therefore it is necessary to make a rigid boarding scaffold in order to shape the reenforced concrete structure. This rigid hollow mold, which usually consists of wood and has to be erected at the site of the building at comparatively high costs, uses up a large proportion of the savings gained by the reenforced concrete construction compared with the steel skeleton structure. The mode of working during the erection of the reenforced concrete buildings renders necessary the manufacture of a hollow mold for each flat and the subsequent alternate insertion and embedding of the reenforcing iron in the concrete, because the manufacture of a hollow mold of boardings uniformly for the whole building is very expensive in view of the necessary safety of the whole boarding scaffold.

The present invention has for its object to combine the advantages of the steel skeleton structure and the reenforced concrete structure and at the same time avoid the drawbacks of these two constructions. The reenforcing skeleton according to the present invention does not form per se the supporting scaffold of the entire building but possesses such a bearing power that it is not necessary to carry out the boarding and concreting by steps, because the reenforcing skeleton can be erected in a uniform manner by trained fitters and the erection can precede the concreting operation for two or three or even more flats.

The reenforcements of the reenforced concrete structure, which in view of the regulations at present in force can be employed for a certain percentage of reenforcement and in view of the tendency to use as small a quantity of iron as possible in such reenforcements, are not sufficiently strong to properly resist for instance the wind in case of high buildings or readily permit erection as in the case of bridges before the concreting operation takes place.

This object can however be attained according to my present invention by uniting bars or rods of considerably larger cross-sectional area, than correspond to the regulations at present in force, by means of straps and uniform connections over the entire structure, to new kinds of skeletons and use the same as reenforcements.

Thus stiff, rigid and firm bars or rods of materials of comparatively great resistance to contusions and other shocks, such as cast iron or transmission-shaft steel or the like, are used. These bars or rods directly are joined to each other by means of welding or by cups, grooves, notches, wedges, locks or adjustable sleeves and the like, in order to produce a uniform vertical reenforcement passing through the entire structure.

Particularly the horizontal parts of the reenforcing skeleton according to the present invention do not need to be of the whole cross-sectional area found by calculation, but only that part is of standard size, which after erection constitutes the whole reenforcement and provides a firm support for the boardings. The skeleton

can thus be produced in a considerably simpler and lighter manner, whereby the costs of the boardings are reduced very considerably. Preferably also boarding-supports can be employed for the erection of the reenforcing skeleton according to the present invention, the said supports satisfying five functions.

1. They impart a sufficient rigidity to the reenforcing skeleton advanced for three or four flats.

2. They constitute a part of the reenforcement of the reenforced concrete beams determined by calculation.

3. They replace brackets.

4. They serve as boarding of the reenforced concrete beam.

5. They form the bearing of the ceiling-boarding.

In the finished reenforced concrete structure either the stiff reenforcements forming the reenforcing skeleton or a combination of stiff and loose insertions are present, the stiff insertions being formed by the reenforcing skeleton, while the loose insertions are introduced in known manner before the concreting operation, in order to correspondingly complete the reenforcement formed by the skeleton.

Some modes of carrying out the present invention are illustrated by way of example on the accompanying sheets of drawings in which—

Fig. 1 is a diagrammatic view in longitudinal section of the vertical longitudinal reenforcement of a concrete pillar extending through three flats.

Figs. 2, 3, 4, 5 and 6 are cross-sectional views of the various forms of the reenforcement.

Fig. 7 is a diagrammatic view in longitudinal section of the reenforcement of two adjacent pressure members of a concrete bridge.

Fig. 8 shows in cross section the reenforcement of adjacent pressure members of a concrete bridge.

Figs. 9 to 15 illustrate different modes of connection between the vertical longitudinal reenforcements and the horizontal reenforcements.

In the construction shown in Fig. 1, the stable bars or rods 1 are united with one another by distance members 2 in such a manner, that the reenforcement of the entire building passes through all flats. As indicated at 3 the connection between the individual adjoining rods 1 is effected either by welding or by adjustable sleeves as shown at 4. The character 5 designates a strapping of rolled wire, 6 is a tube formed by spirally winding an endless strip and 7 indicates a tube of perforated sheet metal. The latter may be seamless or formed by welding. The arrangement may be such, that the tube is produced by rolling a suitable sheet metal and longitudinally welding the same along the strapping or in a separate operation and thereafter the tube is pushed over the longitudinal rods.

These longitudinal rods 1 are arranged radially placed on edge as shown in Fig. 2, whereby either four rods of this kind are provided or a larger number of these rods may be arranged as shown in Fig. 3.

In the construction shown in Fig. 4 eight round rods are provided, while Fig. 5 shows the application of four round rods held by adjustable distance members 2. In the construction shown in Fig. 6 the four round rods and the distance members consist of a casting.

The reenforcement according to the present invention is applicable to high buildings with any desired number of flats.

As shown in Figs. 7 and 8, the reenforcement according to the present invention can be used with particular advantage also for reenforced concrete bridges. Substantially the same longitudinal rods 1 with distance members 2 and straps 5 and 6 are used to form a bridge-arch by uniting the adjoining longitudinal rods by welding or the like.

In the construction shown in Figs. 9 and 10 in side view and plan view respectively, stiff horizontal reenforcements 9 are rigidly connected with the stiff vertical longitudinal reenforcements 1, consisting of rods, bars, tubes or the like, by means of cage-like bearings 10 secured to the longitudinal reenforcements 9 and carrying the said horizontal reenforcements. The bearings 10 are secured to rods or bars 11, which are pushed onto the longitudinal reenforcements 1 by means of sleeves 12. These rods 11 preferably overlap the abutting places of the longitudinal reenforcements, so that under certain circumstances it is not necessary to unite the individual members of these longitudinal reenforcements. The horizontal reenforcements 9 are connected with the cage-like bearings 10 preferably by screws, rivets, welding or the like. The vertical longitudinal reenforcements are strapped in the usual manner. In the illustrated construction, a stable spiral wire 5 forms the strapping.

In the construction shown in Figs. 11 and 12 in side view and in plan view respectively, horizontal reenforcements 13 are inserted in the cage-like bearings 10, the said reenforcements 13 being trough-shaped and preferably of rasp-shaped steel sheets. These horizontal reenforcements also serve as casings for the ceiling-beams. In the illustrated embodiment, a perforated tube 7 constitutes the enclosure of the vertical reenforcements 1.

In the perspective view shown in Fig. 13, the rods 11, pushed by means of sleeves 12 onto the longitudinal reenforcements, carry eyelets 14 from which the trough-shaped horizontal reenforcements 13 are suspended by means of hooks 15. In the construction shown in Figs. 14 and 15 in side view and in plan view respectively, the vertical longitudinal reenforcements 1 and the horizontal reenforcements 16 consist of tubes which are welded together at the abutting place. The trough-shaped horizontal reenforcements 13 are suspended from the steel skeleton thus formed. A spiral wound band 6 forms the strapping of the vertical horizontal reenforcements.

The use of the trough-shaped horizontal reenforcements of rasp-like steel sheet calls for certain provisions in order to firmly connect the poured-in concrete with these encasing troughs. Before pouring in the concrete the metal walls are covered with beton milk either inwardly or outwardly or on both sides. If desired the steel-troughs may be previously faced with cement or covered with concrete. In view of this preliminary treatment, the rasp-like openings are closed and the concrete subsequently poured adheres firmly to the casing.

I claim—

1. A self supporting steel skeleton for a reenforced concrete structure for tall buildings comprising a plurality of spaced bars extending vertically through the entire building, spacing means for joining the bars together outside of the area enclosed by said bars and leaving the cross section of concrete between said bars sub-

stantially undivided throughout the length of the column, each bar consisting of a plurality of short units joined at their abutting ends and reenforcing elements to connect the ends of such units.

2. A self supporting steel skeleton for a reenforced concrete structure for tall buildings comprising a plurality of spaced bars extending vertically through the entire building, spacing means for joining the bars together outside of the area enclosed by said bars and leaving the cross section of concrete between said bars substantially undivided throughout the length of the column, each bar consisting of a plurality of short units joined at their abutting ends and reenforcing means encircling said bars.

3. A self supporting steel skeleton for a reenforced concrete structure for tall buildings comprising a plurality of spaced, rigid bars extending vertically through the entire building, spacing means for joining the bars together outside of the area enclosed by said bars and leaving the cross section of concrete between said bars substantially undivided throughout the length of the column, each bar consisting of a plurality of short units welded together at their abutting ends, and a plurality of spirally wound strips encircling said bars and rigidly secured thereto.

4. A self supporting steel skeleton for a reenforced concrete structure for tall buildings comprising a plurality of spaced bars extending vertically through the entire building, horizontal distance pieces for securing said bars together at different elevations outside of the area enclosed by said bars and leaving the cross section of concrete between said bars substantially undivided throughout the length of the column, and perforated tubes surrounding said bars and rigidly secured thereto.

5. A self supporting steel skeleton for a reenforced concrete structure for tall buildings, comprising a plurality of spaced bars extending vertically through the entire building, each bar consisting of a plurality of shorter units joined at their abutting ends, horizontal distance pieces for securing said spaced bars together outside of the area enclosed by said bars and leaving the cross section of concrete between said bars substantially undivided throughout the length of the column, said pieces having sleeves which fit over the joints between the various units of each vertical bar, and secure said units together, and means surrounding and rigidly secured to said bars.

6. A self supporting steel skeleton for a reenforced concrete structure for tall buildings, comprising a plurality of spaced rigid bars extending vertically through the entire building, spacing means for joining said bars together, bearing cages secured at various heights to said vertical bars, and horizontal reenforcing members secured in said cages.

7. A structure as recited in claim 6 wherein the horizontal reenforcing members comprise perforated metallic troughs.

8. A self supporting steel skeleton for a reenforced concrete structure for tall buildings of a nature to withstand the forces acting on the building prior to concreting, comprising a plurality of rigid spaced bars extending vertically through the entire building, spacing means for joining said bars together, perforated tubes surrounding and secured to said bars at various elevations, bearing cages secured to said vertical bars between the ends of said tubes and horizontal reenforcing members secured in said cages.

9. A structure as defined in claim 6, wherein the bearing cages have rods secured thereto and sleeves on said rods for fastening said cages to said spaced bars.

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