(No Model.)

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G. H. TAYLOR.

FURNACE.

No. 424,377. Patented Mar. 25, 1890.

FIG. 1.

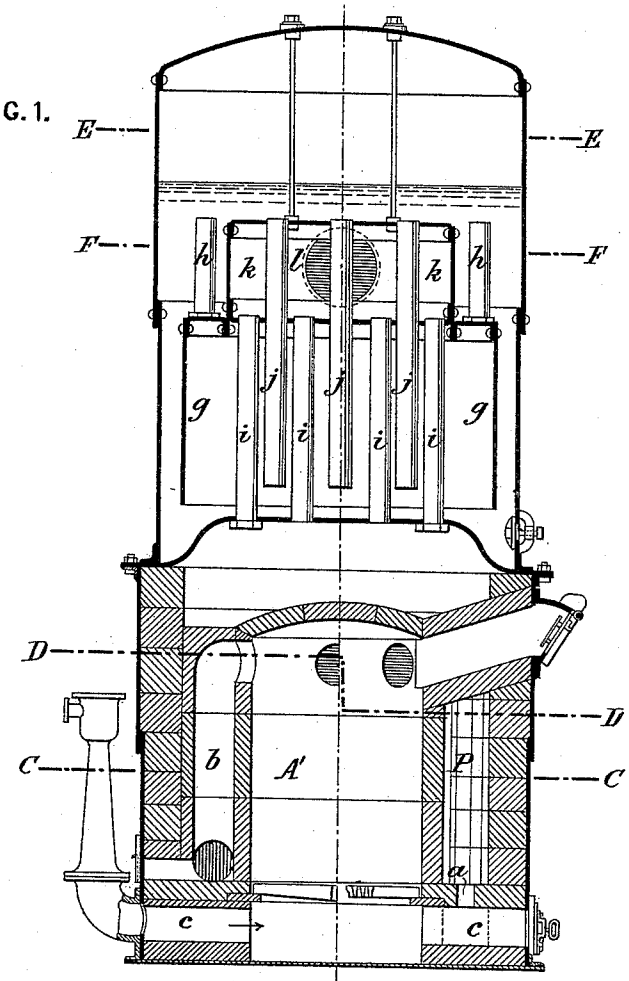
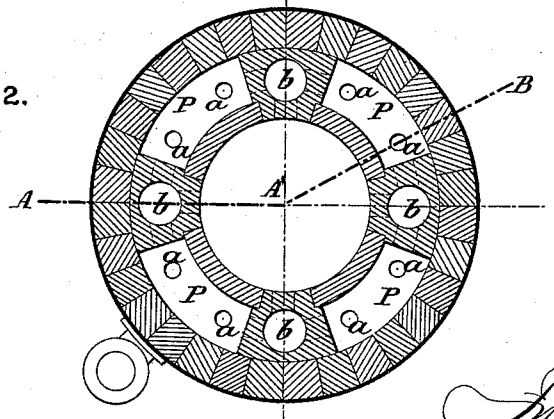


FIG. 2.



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FIG. 3.

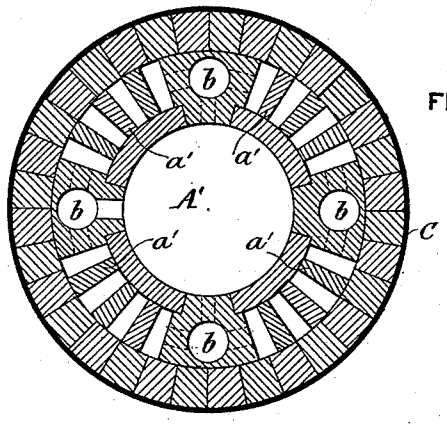


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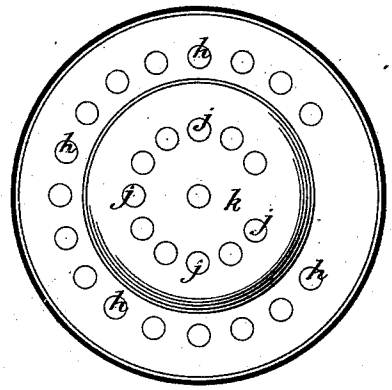
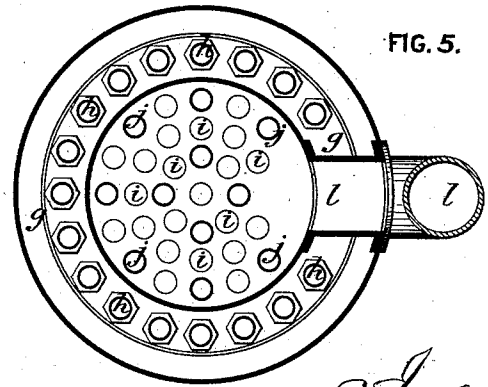


FIG. 5.



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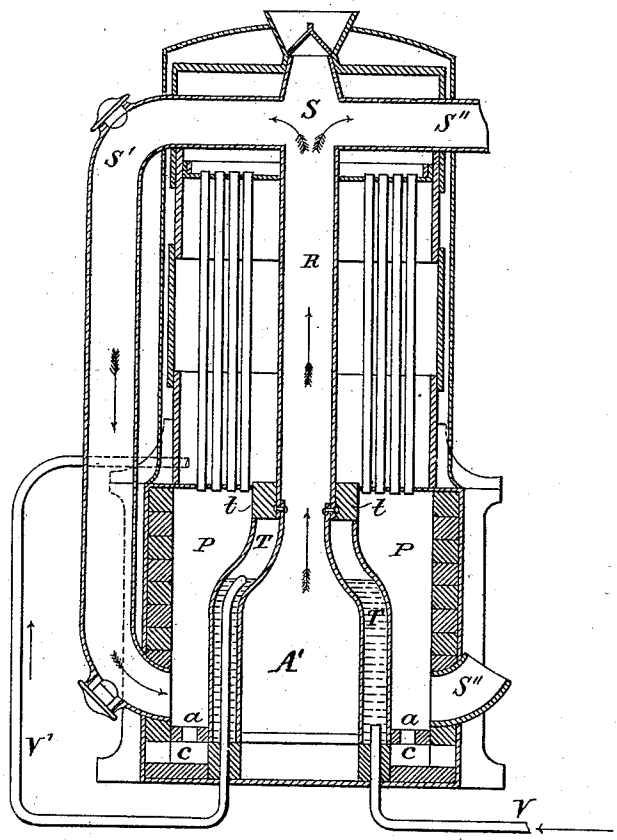
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FIG. 6.



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FURNACE.

No. 424,377. Patented Mar. 25, 1890

FIG. 7.

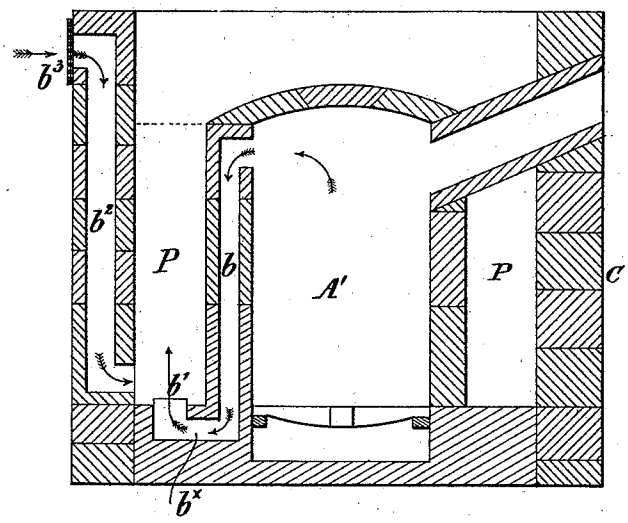
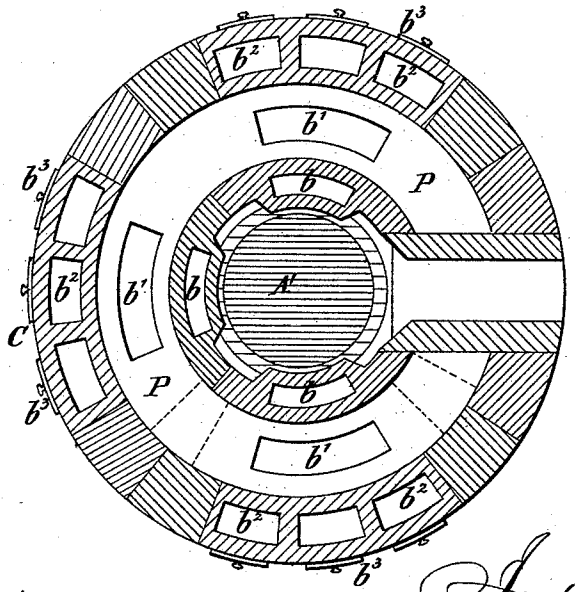


FIG. 8.



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FURNACE.

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FIG. 9.

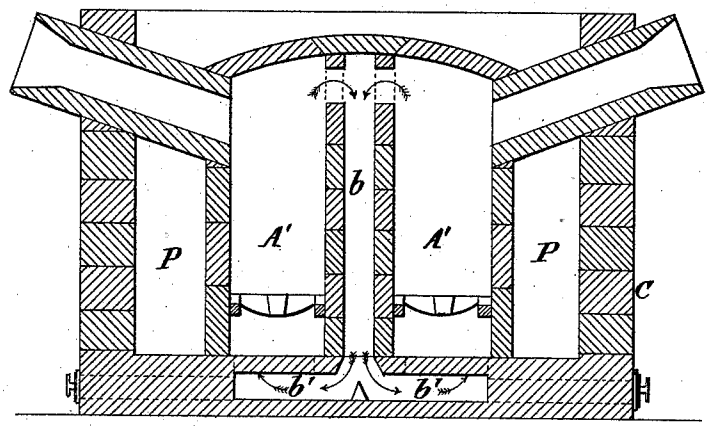
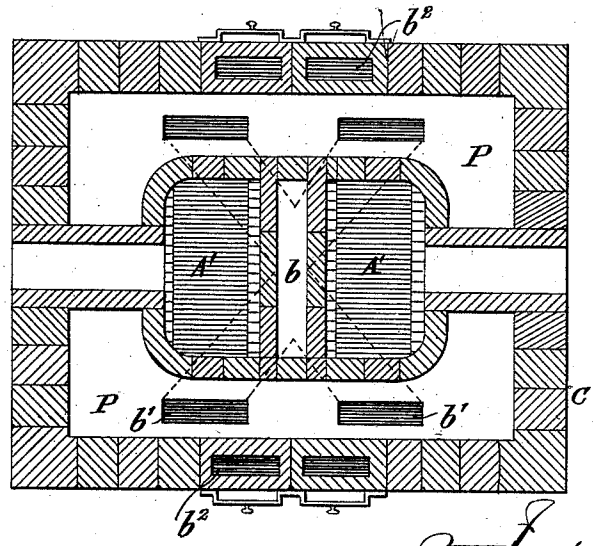


FIG. 10.



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UNITED STATES PATENT OFFICE.

GEORGE HENRY TAYLOR, OF LIVERPOOL, COUNTY OF LANCASTER, ENGLAND.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 424,377, dated March 25, 1890.

Application filed July 13, 1889. Serial No. 317,414. (No model.) Patented in France March 26, 1889, No. 198,216; in Switzerland April 3, 1889, No. 805; in Germany April 5, 1889, No. 49,337; in Belgium April 5, 1889, No. 85,696; in Spain April 24, 1889, No. 9,509; in Italy May 18, 1889, No. 25,462/9, and in Canada May 20, 1889, No. 32,579.

To all whom it may concern:

Be it known that I, GEORGE HENRY TAYLOR, a subject of the Queen of Great Britain and Ireland, residing at Liverpool, in the county of Lancaster, England, have invented new and useful Improvements in Furnaces, (for which I have obtained patents in France, dated March 26, 1889, No. 198,216; in Germany, dated April 5, 1889, No. 49,337; in Switzerland, dated April 3, 1889, No. 805; in Belgium, dated April 5, 1889, No. 85,696; in Spain, dated April 24, 1889, No. 9,509; in Italy, dated May 18, 1889, No. 25,462/9, and in Canada, dated May 20, 1889, No. 32,579,) of which the following is a specification.

My invention relates to improvements in that type of furnaces wherein the fuel is converted from the solid into the gaseous form in the central part of the fire-box, and the combustion-chamber is formed between the producer and the outer casing of the fire-box, said apparatus being employed for the generation of steam and other heating purposes.

My invention comprises several modifications. The gas-producer may be of various forms, as hereinafter set forth, as also may the steam-generator, and these may be combined together, those forms being chosen which are most convenient under the particular circumstances of the case.

The improvements will be hereinafter described in detail, and specifically set forth in the claims, reference being made to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of the furnace and boiler, taken on the line A B, Fig. 2. Fig. 2 is a transverse sectional view taken on the line C C, Fig. 1. Fig. 3 is a similar view taken on the line D D, Fig. 1. Fig. 4 is a similar view taken on the line E E, Fig. 1. Fig. 5 is a similar view taken on the line F F, Fig. 1. Fig. 6 is a vertical sectional view showing a modification of the furnace structure and boiler. Fig. 7 is a vertical sectional view showing another modification of the furnace structure. Fig. 8 is a transverse sectional view of the construction shown in Fig. 7. Fig. 9 is a vertical sectional view showing another modification of the furnace structure, and Fig. 10 is a transverse sectional view of the construction shown in Fig. 9.

The invention relates, among other things, to the construction of the brick-work comprising the furnace structure below the central gas-producer A′ with openings or passages for the admission of air, which is required to be mixed with the gas proceeding from the inlets situated at the bottom of the gas-conduits for the purpose of promoting combustion.

Now according to this improvement I form an air chamber or passage *c*, Fig. 1, by preference annular, in the brick-work of the furnace structure and adjacent to the fire-grate, as shown, for the purpose of conveying the necessary air into the combustion-chamber P to insure perfect combustion of the gases, and such chamber or passage may be provided with suitable blowers (steam or air) for the purpose of injecting such air. I further form openings *a* in the top of this annular chamber *c*, and I arrange them concentrically with the combustion-chamber at convenient distances in order to supply such combustion-chamber with heated air for the purpose of igniting the gases and supporting combustion in as thorough a manner as possible.

To effect a thorough intermixture or admixture of the ascending jets of gas and air proceeding, respectively, from ducts *b*, formed in the brick-work of the furnace or gas-producer, and from the annular chamber *c*, before mentioned, I divide these jets into thin streams or streamlets. For this purpose I provide radial sections of fire bricks or blocks *a*′, Fig. 3, and I arrange the same in and around the space between the gas-producer A′ and the outer brick-work of the furnace structure for about half-way down, whereby the desired object is attained.

In the modification shown in Fig. 6 the gases are led off by a central uptake or flue R from the producer portion A′ of the furnace through the steam-generator, from the

upper part of which they are conveyed by means of an air-tight jointed cross-tube S and diving-flues S′ S″, passing outside the generator and producer to the combustion-chamber P. The furnace in this case is in a measure rendered detachable from the generator, inasmuch as the neck of the furnace fits to the lower part of the uptake or central tube, and the joint between the same is covered and protected by a ring *t*, of suitable refractory material, thus enabling the boiler to be readily removed for any purpose required. In this arrangement I form around the gas-producer A′ a water-jacket or feed-water heater T, suitably stayed, which is supplied with water pumped or otherwise conveyed under pressure from a tank by a pipe V. From this jacket the hot water is discharged by other pipes V′ into the boiler. After the gases have reached the combustion-chamber they ascend through the tubes of the boiler, having met and mixed with the heated air introduced through the opening *a* from the annular flue *c*, or through ducts constructed in the outer brick wall of the furnace structure of the combustion-chamber, (see Figs. 7 and 8,) hereinafter fully referred to, and which admission of air through these ducts is regulated by means of suitable air-grids, thereby heating the air in its passage downward to the required temperature to promote combustion. The air supplied to the gases for combustion may likewise be heated preparatory to use by the waste heat of the products of combustion by any suitable arrangement of air-conduits, so as to economize heat.

Figs. 7 and 8, which are respectively a vertical section and horizontal section, refer to a somewhat modified arrangement of the gas-producer shown Figs. 1, 2, 3, and 6. In this modification the gases collected within the gas-producer A′ are conveyed therefrom by ducts *b* constructed in the refractory brick-work constituting the walls of the producer. Thence the gases pass underneath and upward through suitable passages or culverts *b′* into the combustion-chamber P, where they meet with the heated air from the passages b^2, constructed in the brick-work of the furnace structure, and which is admitted and regulated through air-grids b^3.

It will be obvious that by the arrangement described above the gases and air both become highly heated in their passage through the respective ducts in the refractory material, and an excellent system of combustion is obtained, which is capable of easy regulation, and which enables effective steam-generation to be obtained even from very low qualities of fuel, which in some places are regarded as waste. This furnace can also be adapted for the use of liquid fuel. This modification of gas-producer may likewise be arranged in double or twin form, as shown in vertical and horizontal sections, Figs. 9 and 10, respectively, and consists of two producers A′ A′ placed within one general annular combustion-chamber. Said producers each have separate charging and clinkering doors, fire-grates, and ash-pits, and are divided or separated by a double oblong party-wall extending across the area of the inner furnace and forming a gas-duct or downtake *b*, through which the gases pass on their way downward, and thence along the passage $b^\times$ and upward through the ducts *b′* into the general combustion-chamber P to meet the necessary heated air passing through the passages b^2 b^2 into the brick-work of the combustion-chamber, as hereinbefore described with reference to Figs. 7 and 8.

In Fig. 1 I exhibit a steam-generator, which is constructed to especially adapt it for use with my improved furnace structure. This generator, as shown, is provided with a set of tubes *i*, connected vertically with a flat cylindrical-shaped drum or waste-heat box *k*, to which is attached a cylindrical metallic hood *g*, enveloping the set of tubes *i*. This hood, where bolted to the waste-heat box *k*, which is below the water-level, is constructed with a flat rim at the top sufficiently wide to admit of a number of relief-tubes *h*. To the box *k* are fixed another set of tubes *j*, and these extend from the upper plate of the said box through the lower plate, their free ends coming down into the boiler, but not extending to the lower tube-plate thereof, as the ends are well within the said hood *g*. The waste gases are led from the tubes *i*, which are fire-tubes, to an exit-pipe *l* for further use for heating the feed-water, air-supply, &c., while the gases in each case are regulated and controlled by suitable valves. The water surrounding the fire-tubes *i* and the water-tubes *j* and enveloped by the hood *g* circulates in the following manner: It is first subjected to the action of the heat ascending against the tube-plate and upward through the fire-tubes *i* into the waste-heat box, causing a suitable and sufficient agitation of the water above the tube-plate, which tube-plate is thus subjected to the frictional action of the water and steam, chiefly owing to the latter rushing to the mouths of the water-tubes, while the contrary action of the two sets of tubes prevents any sediment forming on the lower tube-plate and foaming or priming taking place in the boiler. The object of this arrangement is to keep the tube-plates free from scaly or saline deposit and to allow of their being readily cleaned.

The herein-described improvements considerably enhance the practical utility of this system of self-contained steam-generator, while the herein-described forms of gas-producer and combustion-chamber can, with obvious modifications, be easily rendered adaptable to existing steam-generators of various types—such, for instance, as horizontal boilers constructed in self-contained horizontal form.

The herein-described forms of steam-generator may be readily combined with either of the modified constructions of gas-producer above set forth.

I do not herein broadly claim the steam-generator constructed as described with reference to Figs. 1, 4, and 5, as such *per se* constitutes the subject-matter of a separate application for Letters Patent filed February 25, 1890, No. 341,779.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A furnace for heating a steam-generator, comprising a brick-work structure adapted to support the generator, a central gas-producer A′, an annular combustion-chamber P, placed round the gas-producer between its wall and the brick-work of the furnace structure, and receiving the gases from said gas-producer, and air-heating passages for the admission of the external atmosphere into the base of the combustion-chamber for admixture with the gases received in the latter from the gas-producer, substantially as described.

2. The combination of a brick-work furnace structure having a central gas-producer A′, an annular combustion-chamber P, extending round the gas-producer and receiving the gases therefrom, and an air-heating passage for the admission of external atmosphere into the combustion-chamber with a steam-generator surmounting and supported by the furnace-chamber and having flue-tubes opening at their lower ends into the combustion-chamber above the gas-producer, substantially as described.

3. A furnace for heating a steam generator, comprising a brick-work structure adapted to support the generator, a central gas-producer A′, an annular combustion-chamber P, extending round the gas-producer and receiving the gases therefrom, an annular air-chamber *c* at the base of the gas-producer, receiving external atmosphere, and vertical orifices *a′* in the upper part of the annular air-chamber, connecting the latter to the base of the combustion-chamber, substantially as described.

4. The combination of a brick-work furnace structure having a central gas-producer A′, an annular combustion-chamber extending round the gas-producer and receiving the gases therefrom, an annular air-chamber *c*, formed in the brick-work at the base of the gas-producer and receiving external air, and vertical orifices *a′* in the upper part of the annular air-chamber, connecting the latter to the base of the combustion-chamber, with a steam-generator surmounting and supported by the furnace structure and having flue-tubes opening at their lower ends into the combustion-chamber above the gas-producer, substantially as described.

5. The combination, in a furnace, of a brick-work structure surmounted by a steam-generator and having a central gas-producer, a combustion-chamber extending round the gas-producer and receiving the gases therefrom, and an air-heating passage for the conduct of atmospheric air to the combustion-chamber with a central flue rising from the gas-producer through the steam-generator and descending flues connected with the upper portion of the central flue and with the combustion-chamber, substantially as described.

6. The combination, in a furnace, of a brick-work structure surmounted by a steam-generator and having a central gas-producer, an annular combustion-chamber round the latter, and an annular air-chamber arranged in the brick-work at the base of the gas-producer and having air-orifices in its upper part for conducting air into the base of the combustion-chamber with a central flue rising from the gas-producer through the generator and descending flues connected with the upper portion of the central flue and with the combustion-chamber, substantially as described.

7. The combination, in a furnace, of a brick-work structure having a central gas-producer, an annular combustion-chamber round the latter, an air-passage for heating and conveying air to the combustion-chamber, a feed-water heater surrounding the gas-producer, a steam-generator supported by the brick-work structure above the feed-water heater and having flues open to the combustion-chamber, and pipes for supplying water to the heater and the generator, substantially as described.

8. The combination, in a furnace, of a brick-work structure having a central gas-producer, an annular combustion-chamber round the latter, an air-passage for heating and conveying air to the combustion-chamber, a feed-water heater surrounding the gas-producer, a steam-generator supported by the brick-work structure above the feed-water heater, pipes for supplying water to the heater and the generator, a central flue rising from the gas-producer through the generator, and descending flues connecting the central flue with the combustion-chamber, substantially as described.

9. The combination, in a furnace, of a brick-work structure having a central gas-producer and a surrounding combustion-chamber to which heated atmospheric air is supplied from the exterior with a steam-generator supported by the brick-work over the combustion-chamber and having flue-tubes open to the latter, a feed-water heater surrounding the gas-producer in the combustion-chamber, and flues connecting the gas-producer with the combustion-chamber, substantially as described.

10. The combination, in a furnace, of a brick-work structure having a central gas-

producer and a combustion-chamber round the same to which atmospheric air is supplied from the exterior with a steam-generator, a feed-water heater surrounding the gas-producer in the combustion-chamber and connected with the generator, and flues connecting the gas-producer with the combustion-chamber, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORGE HENRY TAYLOR.

Witnesses:
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T. CREIGHTON,
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