

July 24, 1934.

C. MARISCHKA

1,967,582

COMBINED GAS AND STEAM PRODUCER

Filed March 28, 1929

2 Sheets-Sheet 1

Fig. 1

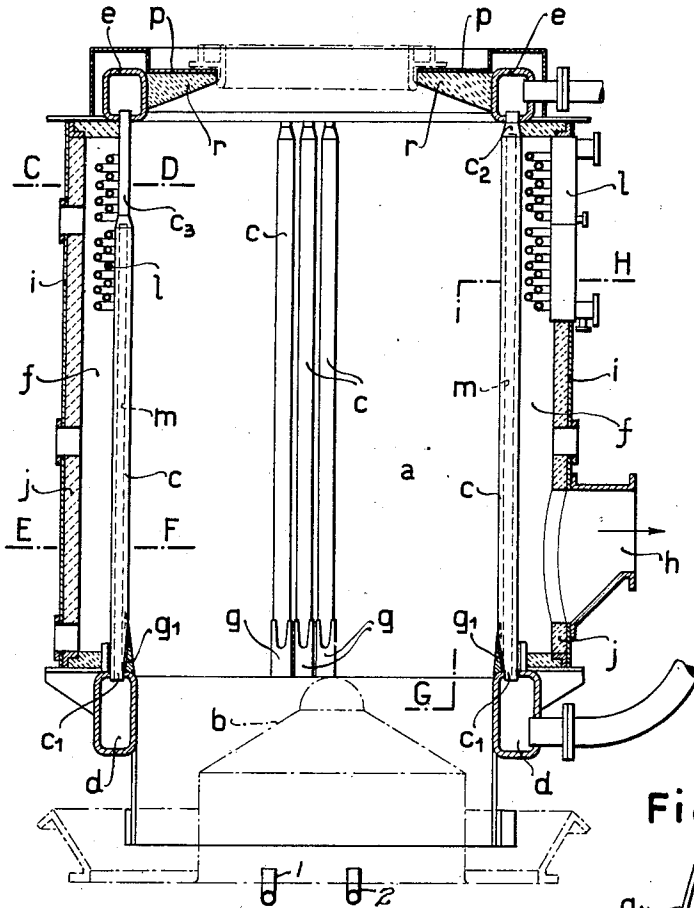


Fig. 2

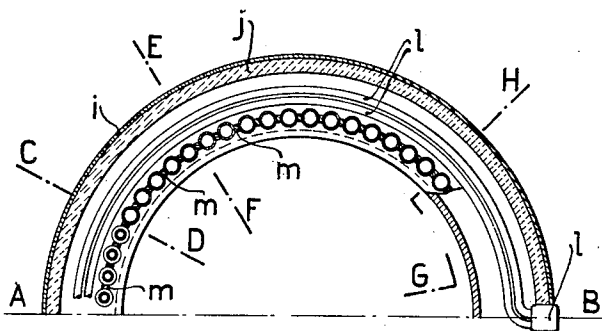


Fig. 3

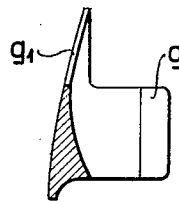


Fig. 4

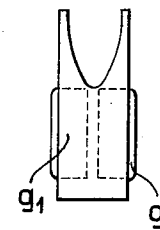
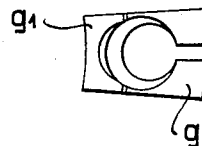


Fig. 5



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2 Sheets-Sheet 2

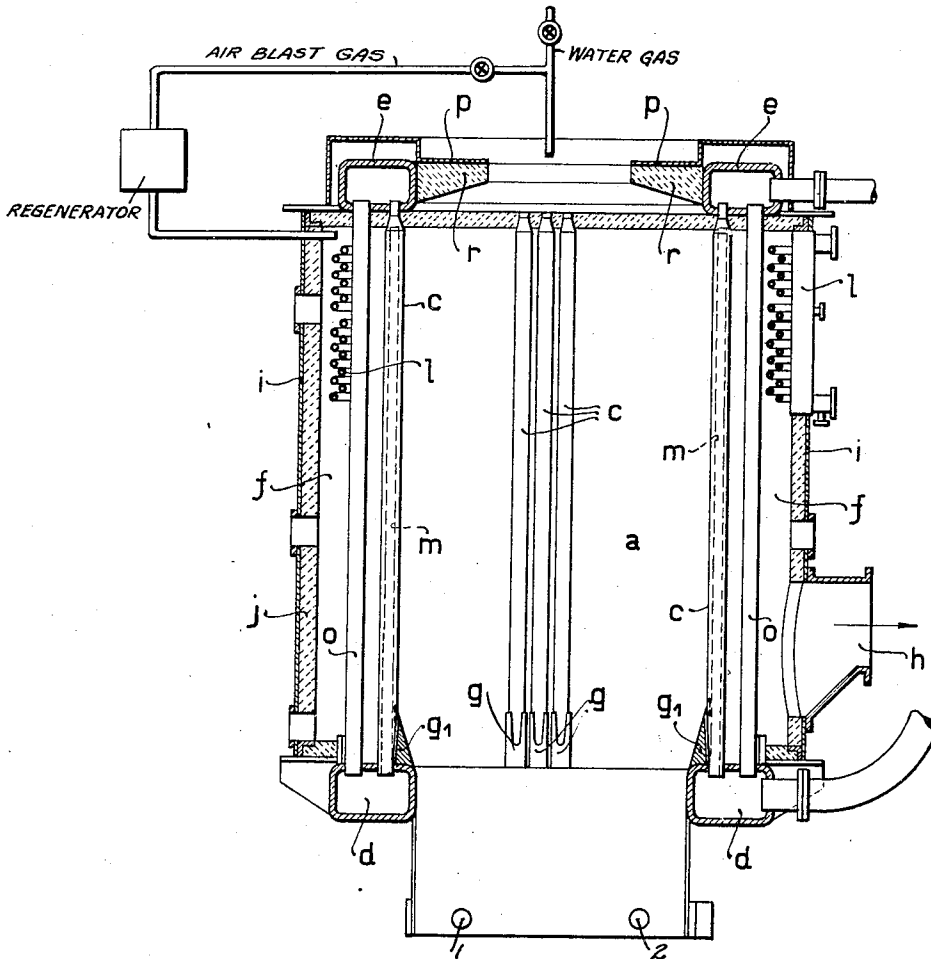
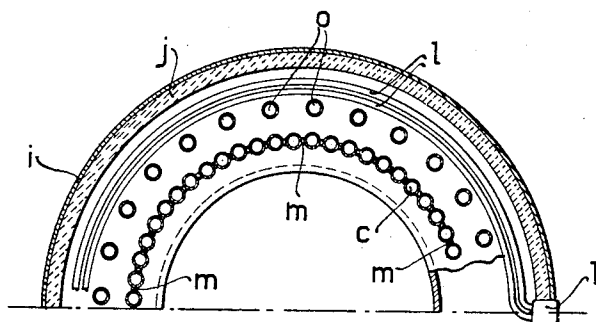


Fig. 6.

Fig. 7



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UNITED STATES PATENT OFFICE

1,967,582

COMBINED GAS AND STEAM PRODUCER

Carl Marischka, Vienna, Austria

Application March 28, 1929, Serial No. 350,790
In Austria April 3, 1928

4 Claims. (Cl. 122—5)

My invention relates to combined gas and steam producers having a gasifier shaft formed by tubes in which steam is produced by radiating heat from the fuel and by the hot gases developed during incomplete combustion.

The present invention relates to new arrangements and to essential improvements in combined gas and steam producers of the kind mentioned, in which, however, the gasifier shaft is constructed in the way of a water tube boiler.

The invention has for its object to simplify the construction and to guide the hot gases in a suitable manner, these gases coming either directly from the gasifier shaft or by a by-pass through a combustion chamber. The hot gases deliver their heat into an outer casing for assembling the gases and consequently also to the outer side faces of the tubes which encircle the gasifier shaft. This arrangement therefore distinguishes itself from the known combined gas and steam producers constructed in the way of tube boilers.

By this arrangement it is possible to increase the diameter of the gasifier shaft for more than 2 meters and to produce a steam pressure higher than 10 atmospheres without the necessity of employing very strong plates for the boiler, because the latter is composed of a plurality of elements—the tubes—which may be of relatively small thickness especially when the tubes are of round section.

The principal features of the invention are the following:

(1) The tapered shape of the ends of the tubes of the tube boiler forming the gasifier shaft. By means of this feature it is possible to insert the tubes into the upper and lower water chamber of the boiler without deflection of these tubes; the distance between the tapered parts in each chamber wall will therefore not be diminished and the solidity of the connection is maintained.

(2) Metallic shoes, into which the tapered ends of the tube are to be inserted. By these shoes it is possible to close tightly the room where the taperings are arranged against the room encircled by the casing assembling the gases. Each end of a tube may be provided with an upper and lower shoe, if desired, and all the shoes are arranged in close proximity to each other for the purpose of forming a tight wall out of said tubes. The upper shoes are not illustrated in the drawings as they are similar to the lower shoes. Instead of separate shoes a hollow ring in one piece or in several pieces may be provided upon the upper and lower ends of the tubes, these rings containing the openings for the inser-

tion of the tube ends. The shoes upon the upper tube ends may be eliminated, when the gaps between the tubes are rendered tight by any other means, for instance by filling them with fireproof clay or by laying out the gaps with fireproof stones, so that the gasifier shaft is separated from the outer casing in a gas tight manner.

The shoes or the ring provided for the lower ends of the tubes will be provided with inclined faces directed towards the middle axis of the gasifier shaft to obtain a smooth surface on the parts projecting into the gasifier shaft especially at the level of the grate notwithstanding the employment of tubes having a circular section. By these means the retaining of the slag in the intervening spaces between the tubes and on the step, formed in the inner face of the gasifier shaft at that line where the lower water chamber begins, is avoided.

(3) Metallic strips arranged between any of two adjacent tubes for procuring a complete tightness of the wall of tubes separating the gasifier shaft from the outer casing into which the gases enter. The metal of these strips has a greater expansion coefficient than the metal forming the tubes and may be for instance copper. The strips will be stemmed into the gaps on both sides of the wall and extend into the metallic shoes. The adjacent tubes may also be connected with each other by welding.

(4) The tapered shape of a certain number of tubes only on their upper end but at a greater length than the other tubes for the purpose of allowing the gases developed in the gasifier shaft to reach the gas room enclosed by the outer casing. The gaps between the said tubes having tapering ends on a greater length serve for allowing the passage into the casing. At that point where the hot combustion gases enter into the casing a steam superheater may be arranged with advantage. This passage is provided in cases when one and the same kind of gas is existing in the gasifier shaft as well as in the outer casing. If, however, gases of different kind are in these two rooms, the separating wall formed by the tubes is entirely and completely closed. This case occurs for instance when watergas is produced and the arrangement serves the purpose of preventing any mixture of the two different gases.

In producing watergas the sensible heat of the hot blow gases is used in the casing, which gases will be burned in a combustion room located sideways from the combined gas and steam producer. For this purpose it is necessary to provide a larger

heating surface than that which the tubes forming the separating wall can possibly have. For obtaining this enlargement one or more rows of additional tubes will be arranged between both

5 water chambers and the tubes in each row are not arranged closely adjacent each other, so that no tapering at their ends is necessary. These additional tubes may be arranged either in vertical or inclined direction.

10 In the outer casing of the arrangement adapted for the production of watergas, a steam superheater may be arranged, which is located at that part of the plant, where the hot gases are already partly cooled down and can no more have a temperature causing an undue heating of the tubes

15 of the superheater. This point is located ahead of the discharge of the gases from the casing. In the drawings are represented several modifications of a combined gas and steam producer

20 which are constructed in the same way as a water tube boiler and which are showing the features of this invention. Fig. 1 shows a vertical section through the producer along line A—B in Fig. 2. Fig. 2 shows a

25 plan view of Fig. 1, partly in section along lines C—D and E—F respectively. The Figs. 3, 4 and 5 show in vertical section, inner elevation and plan view one of the metallic shoes. The Figs. 6 and 7 represent a vertical section and a plan view partly in horizontal section of another modified form of the gas and steam producer especially for the production of water gas and steam.

30 *a* (Fig. 1) designates the shaft of the combined gas and steam producer and *b* is the grate upon which the fuel to be gasified is supported. The transmission of heat to the boiler takes place at first immediately by radiation from hot combustion material. The grate may be a fixed or a movable grate, for instance a rotating grate.

40 The tubes *c* forming the boiler are tapered on their lower ends *c*₁ and the upper ends *c*₂ for the purpose to insert these ends into the water chambers *d* and *e* respectively of the boiler. These tubes *c* are standing closely to each other and

45 the gaps between the adjacent tubes are made gas tight so as to form a gas tight wall separating the gasifier shaft *a* from an outer casing *i* encircling this wall and enclosing a gas chamber *f*.

This tightening means may consist of metallic

50 strips (*m*, Fig. 2), inserted between the adjacent tubes and stemmed into the gaps between the tubes. Another way to tighten the gaps is to weld the tubes together or to design the profiles for the tubes in such a way that two adjacent

55 tubes may be screwed or riveted together.

For the purpose of making gas tight the tapered

ends of the tubes also, these ends are inserted into

openings or cavities of metallic shoes *g* (Figs. 3,

60 4 and 5) or into openings of rings each made in one part or in several parts. The ends of the tubes inserted in these openings may be easily

tightened. For procuring a continuous smooth

inner surface of the gasifier wall the shoes or

65 rings will be provided with faces or plates *g*₁ inclined with respect to the middle axis of the combined gas and steam producer. This is diagram-

atically shown in Fig. 6 where the combustion

room is marked regenerator and where the path

70 of the gases is indicated by straight lines and valves are indicated by crossed lines.

The tapering end of the tubes *c* can be extended

on a greater number of adjacent tubes, as at *c*₃

(Fig. 1, left side) when the gaps between these

75 tubes should have a greater length, as is the case when free sections of sufficient area must be pro-

vided for allowing passage of the gas from the gasifier shaft *a* to the gas-room. These passages are arranged on the highest place and opposite to that part of the wall of tubes, in which the outlet of the gas *h* is provided, which is located in the lowest part of this wall, so that the hot gases coming from the gasifier shaft must sweep practically all tubes of the wall before being discharged from the gas room *f* enclosed by the casing *i*, so that said hot gases can deliver their sensible heat. To prevent losses of heat by radiation, the cover *p* of the gasifier shaft *a* is provided with an insulating layer *r* of refractory material 1 and 2 conventionally represent the usual air and steam inlets.

When the plant is to be used for the production of watergas the separating wall *c* is to be tightened at its whole length between the lower and upper water chamber (*d* and *e*). This modified arrangement is illustrated in Figs. 6 and 7.

The gaps between the tubes *c* then will be closed tightly around the whole circumference of the shaft and at the entire length of the tubes in one of the aforesaid manners. The combustion gases, escaping during the watergas production, arriving from the shaft of the gasifier are flowing by a discharge tube into the gas room *f* and sweep past or touch the tubes *c* and also a steam superheater *l* which may be arranged within the gas room *f* and may be formed by spiral tubes situated on the discharge side of the gases.

When the combined gas and steam producer is to be employed for the production of water gas further tubes *o* are arranged outside the tubes *c* forming the tightened separating wall. These tubes *o* are also inserted into the upper and lower water chamber (*d* and *e*), but do not stand closely one near the other; therefore it is not necessary to provide them with tapering ends. The tubes *o* serve to enlarge the heating surface.

The gas room *f* encircled by the casing *i* is limited on the inner side by the wall formed by the tubes *c* and on the outer side by an insulating layer *j* lining the inside of the casing *i* (Figs. 1, 2 and 6, 7 respectively).

The steam boiler constructed in this manner may be combined with one or more upper boilers for the purpose of ensuring a better circulation of the water, to obtain a larger water volume and a greater water surface.

The combined gas and steam producer constructed as a tube boiler may also be applied in such a manner as to work as a steam boiler per se, in which case a perfect combustion takes place in the gasifier shaft and the combustion gases emanating during this combustion deliver their heat to the tubes *c* surrounding the gasifier shaft *a* and in some cases to the tubes *o* provided for the purpose of enlarging the heating surface.

What I claim is:—

1. A combined gas and steam producer comprising upper and lower water chambers, an annular series of tubes connecting said chambers and cooperating with one another to provide a wall defining a gasifier shaft, and shoes on the lower ends of said tubes arranged in side to side engagement and against the top of the lower water chamber, said shoes having upwardly and outwardly inclined inner faces cooperating to form a smooth surface of suitable height extending upwardly from the lower water chamber and inwardly with respect to the lower end portions of said tubes.

2. A combined gas and steam producer comprising upper and lower water chambers, an

5	annular series of tubes connecting said chambers and cooperating with one another to provide a wall defining a gasifier shaft, a casing surrounding said series of tubes in spaced relation thereto to provide a gas chamber, said casing having an outlet opening therein, a plurality of said tubes at the side of the producer opposite to the outlet opening in said casing being of reduced diameter at their upper ends to provide spaces therebetween for the escape of gas from said gasifier shaft to said gas chamber, and means closing the spaces between all other portions of all of the tubes.	lower water chamber and inclined to meet the sides of the tubes above the lower water chamber and cooperating with one another to impart a smooth surface to the inner face of said wall directly above the lower water chamber.	80
10		4. A combined gas and steam producer comprising upper and lower water chambers, an annular series of tubes connecting said chambers and cooperating with one another to provide a wall defining a gasifier shaft, and shoes on the lower ends of said tubes cooperating with one another to impart a smooth surface to the inner face of said wall directly above the lower water chamber; said shoes being disposed in side to side abutting relation and their lower faces being shaped to the contour of the upper face of the lower water chamber and engaging the latter.	85
15	3. A combined gas and steam producer comprising upper and lower water chambers, an annular series of tubes connecting said chambers and cooperating with one another to provide a wall defining a gasifier shaft, and shoes on the lower ends of said tubes and on the top of the		90
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