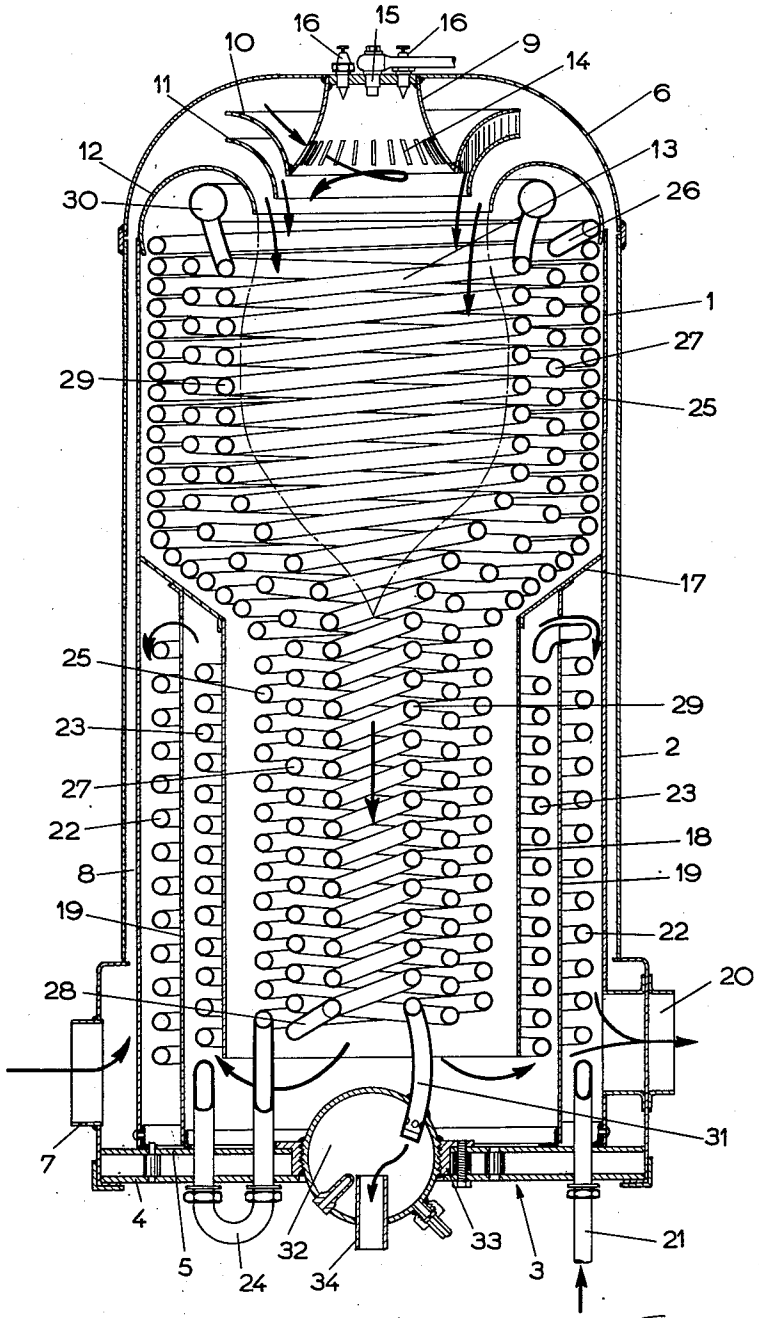
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STEAM GENERATOR

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STEAM GENERATOR

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My present invention relates to steam generators, and more particularly to a quick operating apparatus of this type.

Steam boilers are already known, of the type comprising within a body having a generally cylindrical shape; a combustion chamber extending along a portion of the length of said cylindrical body; a tubular arrangement for supplying the fuel-air mixture arranged at the opposite end of said combustion chamber and opening into said chamber a plurality of cylindrical, co-axially arranged partition members surrounding said arrangement and including an innermost partition member ending in a flared-out portion which merges to said combustion chamber, said partition member assembly being so disposed that the combustion gases flow through the successive annular chambers thus defined from the innermost to the outermost thereof in successively reverse directions through succeeding chambers and then escape through a suitable conduit passing through said boiler body; a nest of helical boiler tubes fed by water under pressure, said tubes being so arranged that the water therein successively flows through said annular chambers and along the inner surface of said combustion chamber; and a steam manifold or collector in the form of a sphere partially engaged within said combustion chamber.

In the generators of the above-described type a cylindrical envelope is provided which surrounds the furnace together with a cyiindrical partition member extending therefrom, in order to force cooling water to flow around the walls or partitions which are subjected to direct contact with the flames; furthermore, the body of the boiler is surrounded by a jacket which defines a circulation chamber for air which thus is pre-heated prior to be mixed with the fuel.

An object of my present invention is to provide an improved steam generator of the above-mentioned type.

Another object is to provide an improved steam generator of simple and economical construction.

A further object of my invention is to provide an improved steam generator which may be set under pressure quickly.

Yet another object of my invention is to provide an improved steam generator which may be set under pressure quickly even when cold.

Other and further objects and advantages of my invention will be apparent to those skilled in the art as the specification proceeds.

The steam generator in accordance with my

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invention is derived from the above-described-type. According to the invention, however, the tubular arrangement for feeding the air-fuel mixture is dispensed with; and the liquid fuel injector is mounted directly on that end wall of the boiler body which defines the combustion chamber; the spherically-shaped steam collector is attached to the oppositely arranged end wall. Furthermore, any protecting jacket for circulating cooling water is dispensed with and only an outer envelope or jacket is provided through which air flows towards suitable openings provided around the injector for feeding the liquid fuel. This arrangement is made possible due to the fact that the generator is made of refractory steel sheets and that the arrangement through which air passes into the combustion chamber prevents the flames directly to contact the walls of said chamber and of the cylindrical partition member which protects said chamber.

In a boiler arranged in accordance with my present invention, a more considerable surface area of the nest of boiler tubes is subjected to direct radiation from the flames.

According to another feature of my invention, spark-plugs are mounted in the end wall of the combustion chamber and are fed by the secondary circuit of a high voltage transformer, thus facilitating the initial ignition of the combustible mixture in the cases where the boiler is cold when starting running.

My invention will be best understood from the following description of an exemplary embodiment thereof, taken in an illustrative sense only without any limitative intention, in connection with the appended drawing, wherein the single figure diagrammatically shows an axial cross-section of a steam generator embodying my invention.

As may be seen from said drawing, the cylindrical body 1 of the boiler is surrounded by an envelope 2 also of cylindrical shape. The end wall 3 is made of a pair of walls 4 and 5, respectively, and closes the boiler at one end; the other end of the boiler is closed by a removable end wall 6 so arranged as to enable free expansion of the parts.

7 designates the inlet for the combustion air within the chamber 8 defined between the walls 1 and 2. The end wall 6 is provided with an inwardly directed, flared-out conduit 8 integral with annular flanges 10, 11, 12 which are securedly fixed apart and stiffened by members which may act as guide blades for the air flowing therethrough within the combustion chamber

13. The conduit 9 is provided with air inlet apertures along its periphery, said apertures being provided in turn with fins 14, thereby insuring a complete mixing of the fluid fuel atomised by an injector 15.

A pair of spark-plugs 16 are provided and the terminals thereof may be connected to a high voltage supply source, supplying for instance a potential amounting to 10,000 volts and comprising the secondary winding of a transformer. The spark-plugs may be arranged on a suitable sliding unit (not shown) enabling them to be slid off.

The combustion chamber 13 is defined by a frustro-conical wall 17 which extends in a cylindrical wall portion 18; a second cylindrical wall 19 acts as a baffle and forces the combusted gases to be deflected away from their original path of travel before they are allowed to escape through an outlet conduit 20.

Water under pressure is forced into a first coil 22 through a supply pipe 21; the coil 22 is connected to a second coil 23 mounted within the walls 18 and 19; through an outer connection 24 the coil 23 is connected in turn to a coil 25 which is extended along the walls 18, 17 and 1. A bent pipe 26 then connects the coil 25 with a further coil 27 which extends within the coil 25; the coil 27 opens in a bent pipe 28 which in turn is connected to a coil 29 which extends along a double helical path from the pipe 28 to a toric collar 30 on the one hand, and from said toric collar 30 to a connecting member 31 which opens into the manifold or collector 32 for the superheated steam. This spherically shaped collector 32 is threaded in a supporting block 33 which is secured itself to the end wall 3 of the unit. The superheated steam is taken off at 34.

Air is pre-heated by passing through the outer double wall of the boiler and is blended with the fuel by flowing through the stepped annular openings in the flanges 10, 11, 12; the fins associated therewith impart a rotational movement to said air while intimately mixing the combustible blend. The coils in the combustion chamber 13 and within the partition members 17 and 18 which extend therefrom are subjected to the direct radiation from the flame; consequently the boiler may be set under pressure very quickly. The burned gases flow away at a very high speed and at a high temperature and the remaining energy thereof may be used in any suitable manner, as in a gas turbine for instance.

The flows of water, fuel and air under pressure are controlled respectively by related valves arranged on a common control board which also comprises meters for controlling the firing and the steam outflow.

While I have described my invention in connection with a specific embodiment thereof, it is to be clearly understood that this embodiment has been given by way of an example only and that many changes and variations could be made thereto without departing from the scope of my invention which therefore I do not intend to limit more than comprised within the scope of the appended claims.

What I claim is:

1. Dry steam generator of the type set forth, comprising in combination: a generally cylindrical closed outer envelope having first and second oppositely positioned end walls, fuel injecting means and fuel igniting means, both located in said first end wall, an inwardly directed, flared out conduit surrounding said injecting means and said igniting means, primary air inlet apertures being provided at the periphery of said conduit, means for introducing primary air within said conduit including an air inlet in said outer envelope in the vicinity of said second end wall, and a second envelope within said outer envelope, laterally spaced therefrom and extending from the second outer end wall to the vicinity of the outer portion of said flared out conduit thus affording a passage between said conduit and said second envelope for air admitted between said outer and said second envelopes, outer flared elements provided at the said outer portion affording other air passages for directing secondary air provided by said admitted air toward a free axial region within said envelope, whereby forming a free heat radiating feather of burning gases progressing downstream along the axis of said envelopes, exhaust means for the burnt gases provided on said outer envelope, a plurality of substantially cylindrical serially interconnected partition members coaxially arranged within said second envelope and extending longitudinally only in the gas downstream region of said envelopes ending in the vicinity of said exhaust means and affording longitudinally disposed annular passages, the outermost partition member extending down to said second end wall, the innermost partition member delimiting in said second envelope an upstream region of largest diameter for heat transference by radiation and a downstream region of smaller diameter, a tapered partition member connecting said largest and smaller regions, at least one continuous boiler coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and respectively located between said cylindrical partition members affording inner and outer longitudinal gas passages, a water admission pipe entering said envelope and connected to the end of said outermost helical coil element located in the vicinity of said exhaust means, at least one primary continuous superheater coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and extending from said downstream region into said upstream region of exclusive radiation heat transference by substantially following internally the outer contour of said smaller and largest regions, successively, so as to afford a funnel-like disposition coaxial with said envelopes flaring inwardly in the gas downstream direction, an innermost final superheater coil internally following the said axial funnel-like disposition, a substantially toric steam superheater collector in the gas upstream region connecting the near-by end of said primary superheater coils to the near-by end of said final superheater coil, and a substantially spherical steam homogenizing manifold mounted in said second end wall of said outer envelope.

2. Dry steam generator of the type set forth, comprising in combination: a generally cylindrical closed outer envelope having first and second oppositely positioned end walls, fuel injecting means and outwardly retractable fuel igniting means, both located in said first end wall, an inwardly directed, flared out conduit surrounding said injecting means and said igniting means, primary air inlet apertures being provided at the periphery of said conduit means for introducing air within said conduit, including an air inlet in said outer envelope in the vicinity of said second end wall, and a second envelope within said outer envelope, laterally spaced there-

from and extending from the second outer end wall to the vicinity of the outer portion of said flared out conduit, thus affording a passage between said conduit and said second envelope for air admitted between said outer and said second envelopes, outer flared elements provided at the said outer portion affording other air passages for directing secondary air provided by said admitted air toward a free axial region within said envelope, whereby forming a free heat radiating feather of burning gases progressing downstream along the axis of said envelopes, exhaust means for the burnt gases provided on said outer envelope, a plurality of substantially cylindrical serially interconnected partition members coaxially arranged within said second envelope and extending longitudinally only in the gas downstream region of said envelopes ending in the vicinity of said exhaust means and affording longitudinally disposed annular passages, the outermost partition member extending down to said second end wall, the innermost partition member delimiting in said second envelope an upstream region of largest diameter for heat transference by radiation and a downstream region of smaller diameter, a tapered partition member connecting said largest and smaller regions, at least one continuous boiler coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and respectively located between said cylindrical partition members affording inner and outer longitudinal gas passages, a water admission pipe entering said envelope and connected to the end of said outermost helical coil element located in the vicinity of said exhaust means, at least one primary continuous superheater coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and extending from said downstream region into said upstream region of exclusive radiation heat transference by substantially following internally the outer contour of said smaller and largest regions, successively, so as to afford a funnel-like disposition coaxial with said envelopes flaring inwardly in the gas downstream direction, an innermost final superheater coil internally following the said axial funnel-like disposition, a substantially toric steam superheater collector in the gas upstream region connecting the near-by end of said primary superheater coils to the near-by end of said final superheater coil, and a substantially spherical steam homogenizing manifold mounted in said second end wall of said outer envelope.

3. Dry steam generator of the type set forth, comprising in combination: a generally cylindrical closed outer envelope having first and second oppositely positioned end walls, fuel injecting means and fuel igniting means, both located in said first end wall, an outside high voltage supply source operatively connected to the terminals of said fuel igniting means, an inwardly directed flared out conduit surrounding said injecting means and said igniting means, primary air inlet apertures being provided at the periphery of said conduit, means for introducing air within said conduit, including an air inlet in said outer envelope in the vicinity of said second end wall, and, a second envelope within said outer envelope, laterally spaced therefrom and extending from the second outer end wall to the vicinity of the outer portion of said flared out conduit, thus affording a passage between said conduit and said second envelope for air

admitted between said outer and said second envelopes, outer flared element provided at the said outer portion affording other air passages for directing secondary air provided by said admitted air toward a free axial region within said envelope whereby forming a free heating radiating feather of burning gases progressing downstream along the axis of said envelopes, exhaust means for the burnt gases provided on said outer envelope, a plurality of substantially cylindrical serially interconnected partition members coaxially arranged within said second envelope and extending longitudinally only in the gas downstream region of said envelopes ending in the vicinity of said exhaust means and affording longitudinally disposed annular passages, the outermost partition member extending down to said second end wall, the innermost partition member delimiting in said second envelope an upstream region of largest diameter for heat transference by radiation and a downstream region of smaller diameter, a tapered partition member connecting said largest and smaller regions, at least one continuous boiler coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and respectively located between said cylindrical partition members affording inner and outer longitudinal gas passages, a water admission pipe entering said envelope and connected to the end of said outermost helical coil element located in the vicinity of said exhaust means, at least one primary continuous superheater coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and extending from said downstream region into said upstream region of exclusive radiation heat transference by substantially following internally the outer contour of said smaller and largest regions, successively, so as to afford a funnel-like disposition coaxial with said envelopes flaring inwardly in the gas downstream direction, an innermost final superheater coil internally following the said axial funnel-like disposition, a substantially toric stream superheater collector in the gas upstream region connecting the near-by end of said primary superheater coils to the near-by end of said final superheater coil, and a substantially spherical steam homogenizing manifold mounted in said second end wall of said outer envelope.

4. Dry steam generator of the type set forth, comprising in combination: a generally cylindrical closed outer envelope having first and second oppositely positioned end walls, fuel injecting means and fuel igniting means, both located in said first end wall, an inwardly directed flared out conduit surrounding said injecting means and said igniting means, primary air inlet apertures being provided at the periphery of said conduit, means for introducing air within said circuit, including an air inlet in said outer envelope in the vicinity of said second end wall, and a second envelope within said outer envelope, laterally spaced therefrom and extending from the second outer end wall to the vicinity of the outer portion of said flared out conduit, thus affording a passage between said conduit and said second envelope for air admitted between said outer and said second envelopes, outer flared elements provided at the said outer portion affording other air passages for directing secondary air provided by said admitted air toward a free axial region within said envelope whereby forming a free heating radiating feather of burning gases progressing

downstream along the axis of said envelopes, exhaust means for the burnt gases provided on said outer envelope, a plurality of substantially cylindrical serially interconnected partition members coaxially arranged within said second envelope and extending longitudinally only in the gas downstream region of said envelopes ending in the vicinity of said exhaust means and affording longitudinally disposed annular passages, the outermost partition member extending down to said second end wall, the innermost partition member delimiting in said second envelope an upstream region of largest diameter for heat transference by radiation and a downstream region of smaller diameter, a tapered partition member connecting said largest and smaller regions, at least one continuous boiler coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and respectively located between said cylindrical partion members affording inner and outer longitudinal gas passages, a water admission pipe entering said envelope and connected to the end of said outermost helical coil element located in the vicinity of said exhaust means, at least one primary continuous superheater coil having a number of helical elements coaxially disposed with respect to each other and to the said envelopes and extending from said downstream region into said upstream region of exclusive radiation heat transference by substantially following internally the outer contour of said smaller and largest regions, successively, so as to afford a funnel-like disposition coaxial with said envelopes flaring inwardly in the gas downstream direction, an innermost final superheater coil internally following the said axial funnel-like disposition, a substantially toric steam superheater collector in the gas upstream region connecting the near-by end of said primary superheater coils to the near-by end of said final superheater coil, a liner for said second end wall and spaced therefrom, and a substantially spherical steam homogenizing manifold removably mounted on said second end wall and said liner.

5. Dry steam generator of the type set forth in claim 1, wherein all utilized fluids are admitted into the generator under a substantial pressure and all parts exposed to high temperatures are made of refractory material.

JEAN JOOSTEN.

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