

BOILER FOR BURNING BIOMASS PELLETS IN A SEMI - FLUIDIZED FUEL BED

This boilers may be used in municipal and industrial power systems, where a
5 slag-free burning of finely dispersed solid fuel (biopellets, or mixture of coal and
biopellets) is required.

A boiler comprises a cylindrical body (1) comprising a fire tube (2)
connected via long and short smoke tubes (3, 4) to a heating flue (5) adapted for
carrying-out smoke gases from the boiler into a funnel (not shown). A semi-
10 fluidized fuel bed is arranged in a lower portion of the fire tube (2). The semi-
fluidized bed is laterally defined in its lower portion by an air distribution grill
comprising a lower laterally perforated profile (6) and an upper laterally perforated
and curved profile (7). The lower profiles (6) are connected to a blow fan (not
shown) via a first tube system (8) through a first header (9). The upper profiles (7)
15 are connected to a secondary fan (not shown) via a second tube system (10)
through a second header (11). A fuel-supply pipe (12) is arranged at an upper
portion of the boiler for supply of granulated material into a furnace of the boiler
associated with the system for supply of the granulated material. A system for fuel
supply is provided as a flexible screw (13) enclosed in a tube (14), wherein the
20 system is connected to a fuel storage bin (15). The fuel-supply pipe comprises in
its upper portion a cover (16), wherein a fan (17) for tertiary air supply is mounted
on the cover (16). The fuel-supply pipe (12) is provided at an obtuse angle with the
longitudinal axis of the boiler towards smoke tubes (3). The front wall and the
back wall of the boiler are provided with a front and back rotary smoke boxes (18)
25 and (19) respectively. In an upper portion of the cylindrical body of the boiler 1, it
is provided a connecting pipe (20) for letting out the water heated in the boiler, and
in a lower portion of the cylindrical body of the boiler, it is provided a conduit (21)
for supplying the water to circulate through the boiler.

The boiler operates as follows. The boiler space is filled with water through
30 the conduit (21), wherein said water is heated and flows out through the connecting

pipe (20). Finely dispersed fuel is supplied through the fuel-supply pipe (12) from the fuel storage bin (15) via a flexible screw (13) enclosed in the tube (14). The fuel enters the fire tube (2) between the profiles (6), where it is transformed into a semi-fluidizing state by using force draft blowing air supplied under the fuel bed through perforated profiles (6). Smoke gases enter the heating flue (5) and the funnel (2) via the short and long smoke tubes (3) and (4) respectively. At the same time, the water in the boiler (1) body is heated. To completely use heat of the smoke gases, the smoke gases are rotated by 180° during their motion in the back smoke box (19). The first front smoke box (18) is adapted for collection of these gases in front of the heating flue inlet (5).

Air supplied for fuel burning is separated into three flows. Primary flow is supplied through the first header (9) and the first tube system (8) under profiles (6), and then this air is supplied under the fuel bed through openings in the profiles (6) and it promotes a fuel state transformation to a quasi-liquid state. Secondary air flow is supplied through the second header (11) and second tube system (10) under the profiles (7), and then it enters the furnace through openings in the profiles (7) caps, and the flow is involved in a further burning of volatile substances.

By means of primary air, a semi-fluidized bed of burning fuel and ash, wherein the bed is sufficiently thick in vertical direction for providing effective burning of all the particles in the finely dispersed coal and volatile substances is formed in the space between the profiles (6) and (7) and between the front and the back walls of the fire tube (2). Rounded form of profiles (7) prevents ash and fuel deposition thereon, wherein the secondary air flowing out of the openings of said profiles allows for effective burning of volatile substances. Tertiary air is supplied by the fan (17). It prevents hot gases from entering the fuel supply system and fuel ignition in the system. In addition, this tertiary air allows for creating a strong gas flow circulation from the back wall of the fire tube to the front wall thereof above the fluidized bed of the furnace. This allows separating fine fuel particles carried out from the bed of the smoke tubes (3) inlets and bringing them back to the burning area to decrease the carry-over of the fine fuel particles and to increase

efficiency of the boiler. In addition, an enhanced whirling of a gas created by tertiary air supply in the furnace provides a complete burnup of volatile substances therein and reduces fuel loss which would occur due to incomplete burning, thus increasing efficiency of the boiler.

5 Technical characteristics of the boiler

Capacity, kW – 500,

The water temperature at the outlet of the boiler, no more, °C - 95,

The water pressure in the boiler, MPa - not more than 0.4,

10 Boiler efficiency,%, not less than - 85,

The total capacity of electrical equipment installed on the boiler, kW, not more than - 5.5.

Scope of supply: the boiler, the fan of the primary blast, secondary blast fan, third blast fan, economizer, fuel system, fuel tank, exhaust fans, control.

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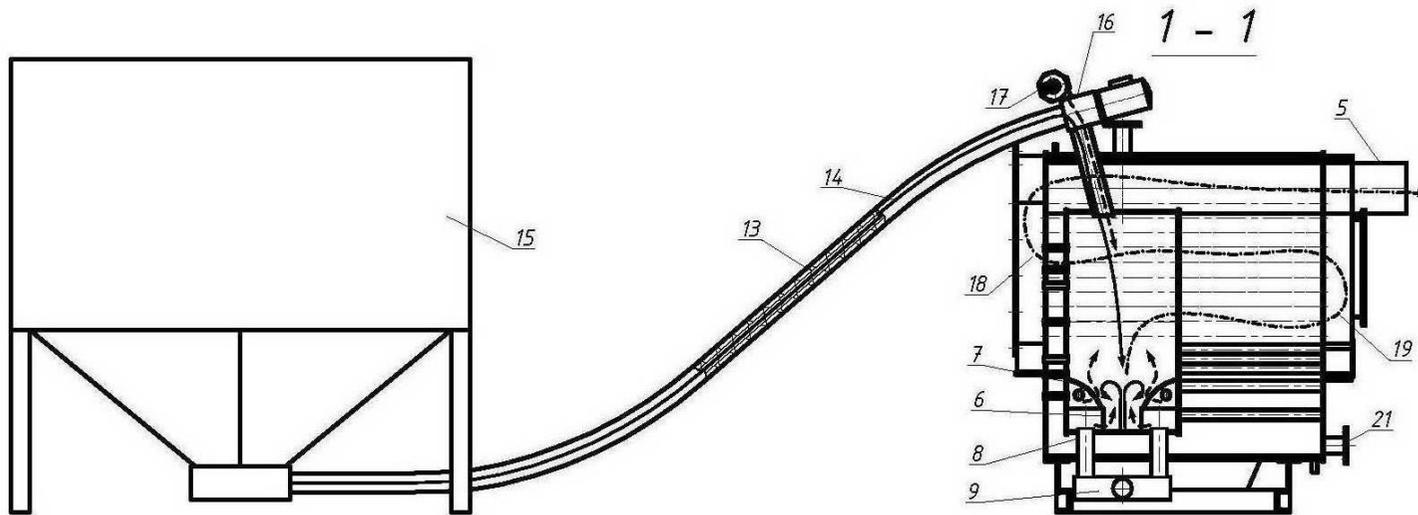


FIGURE 1

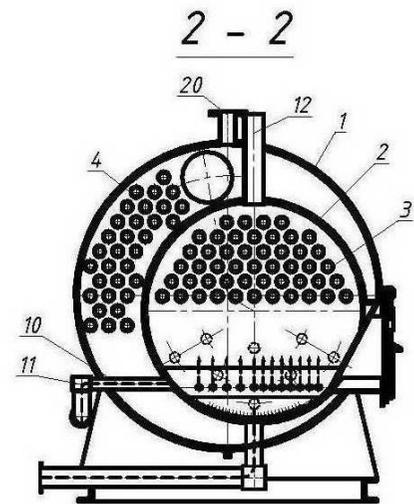
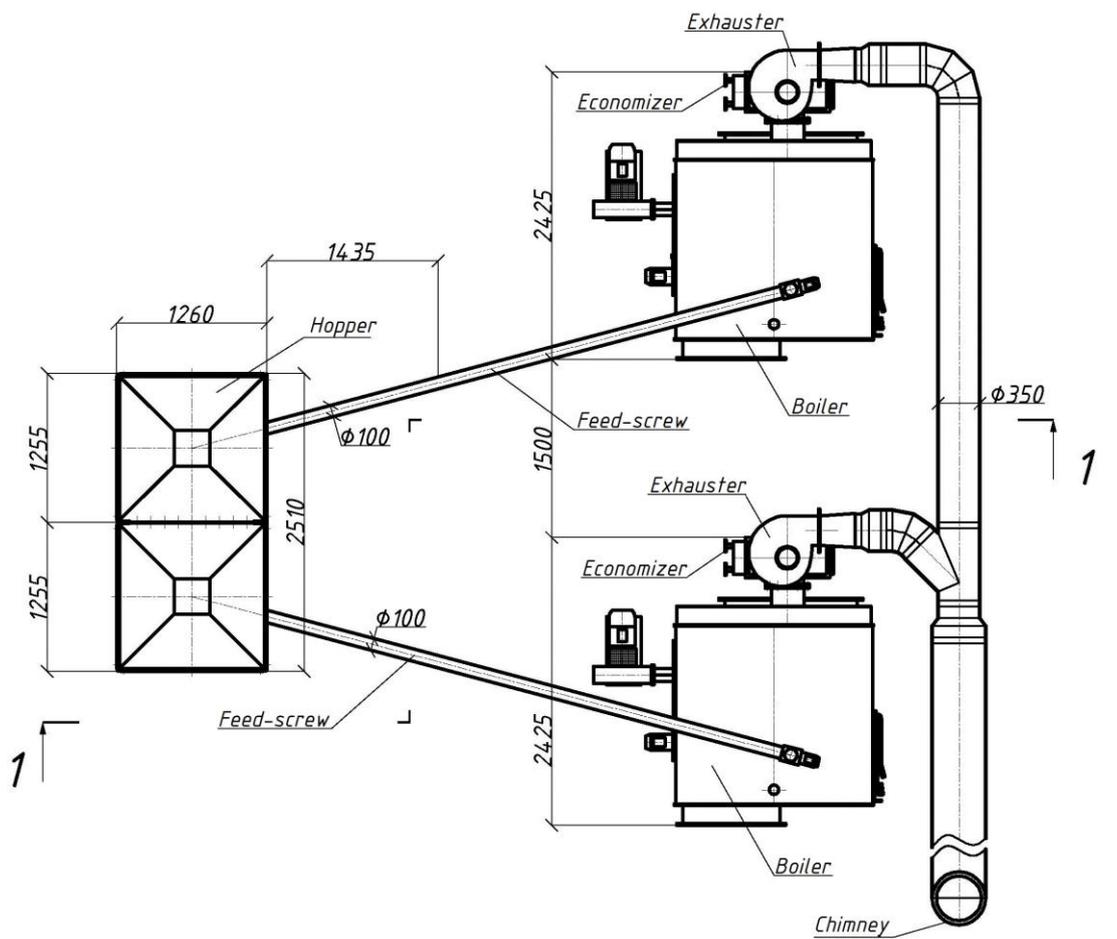


FIGURE 2



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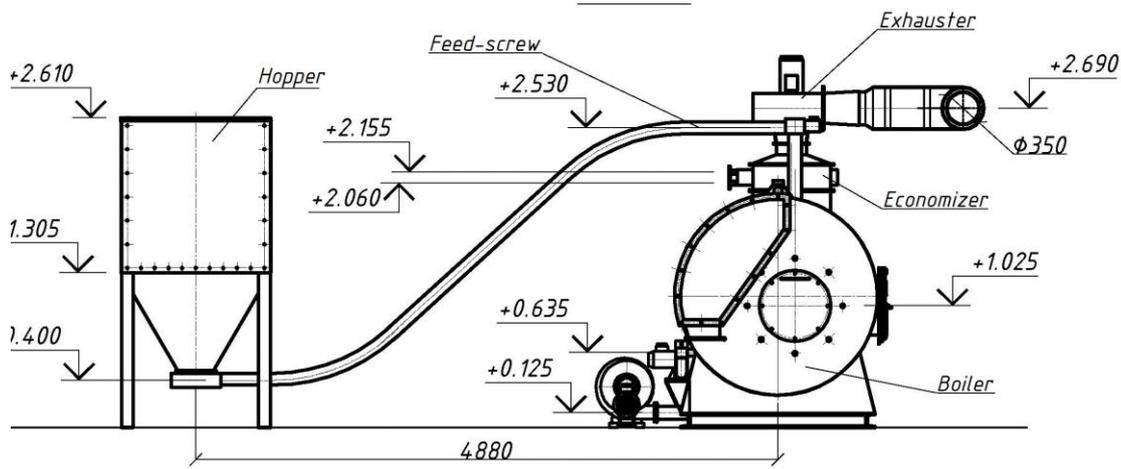


FIGURE 3 Example of two boilers in the boiler room



FIGURE 4. Boilers in the boiler room (general view)



FIGURE 5. Burning straw pellets in the boiler furnace