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(54) **Turbogenerator assembly for a water heater**

(57) The dynamo-electrical turbo generator assembly is incorporated in a domestic water heater provided with a water flow (19), the turbo generator assembly (1,2) includes a longitudinal portion of conduit pipe (7) fitted with a discharge valve (8), and having an internal flat wall (7c) dividing the water flow (19) and forming a branch conduit (18) for impelling the turbine wheel (5). The drive shaft (4) common with the magnet rotor (3) of

the alternator (2) is positioned offset to a central plane (E) for the formation of a tangential outlet (20) for the water flow (18') towards the wheel vanes (5). A moulded plastic alternator body (6) provided with a chamber (14) housing the rotor, is mounted on said portion of conduit pipe (7) and crossed by the common drive shaft (4). A coupling means (6b,7b) of the alternator body (6) is provided to the portion of conduit pipe (7).

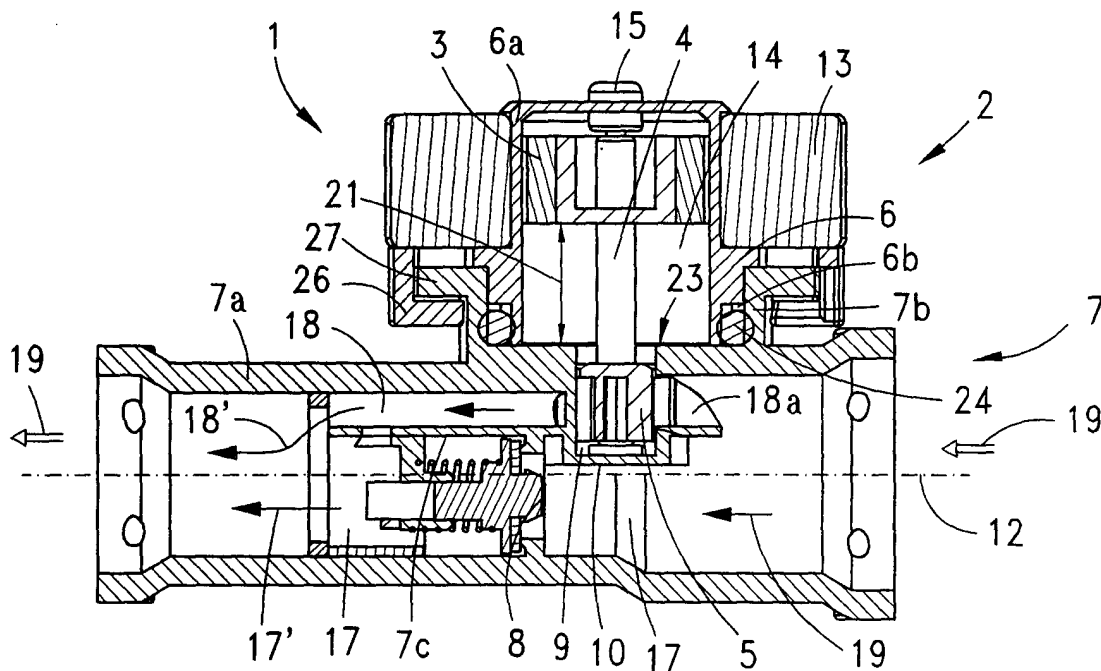


FIG. 2

Description

[0001] The present invention relates to an electric power generating unit actuated by a hydraulic turbine for mounting in a domestic water heater, wherein the turbine is associated with the generator dynamo-electric alternator and interposed in the water heater conduit.

Prior art

[0002] On a water heater a source of electric current is required to supply the circuits for ignition and flame detection and for one or two heater fuel gas flow regulating electromagnetic valves. Miniature-sized turbine power generating assemblies for water heaters that produce a peak electric current of around 100 mA are already known. They are made up of a dynamo-electric alternator and a longitudinal portion of water conduit pipe, which is interposed in the sanitary cold water circuit. The portion of pipe has a built-in minimum water pressure discharge valve and the turbine is driven by a flow of water shunted from the heater sanitary water circuit, parallel to the valve and bypassing it. The alternator body is mounted on the turbo generator conduit pipe and coupled to it with a watertight joint. The alternator rotor is the permanent magnet type and its shaft is shared by the turbine, so that the rotor is housed in a chamber in contact with the current of water that impels the turbine.

[0003] In the turbo generator disclosed in WO-8607503 the turbine is partly immersed in the same flow of heater sanitary water, the shaft of the turbine being parallel to this flow, and the water conduit pipe narrows in its passage through the turbine for its discharge outlet towards the vane wheel.

[0004] In the turbo generator assembly disclosed in WO-860136876 the turbine is wholly immersed in a flow of actuating water shunted from the heater water flow and parallel to it. The bypass conduit for the actuating flow is formed by moulding outside the heater flow conduit pipe, below a base of the alternator body, and it is screwed to the conduit pipe.

[0005] The problems affecting the known solutions for water heater' turbo generator assemblies stem from the construction of the longitudinal portion of conduit pipe that is interposed in the heater circuit, which is provided with a turbine and a discharge valve, and on which an alternator body is mounted by means of a watertight coupling to the section of conduit pipe, although they also stem from the loss of pressure in the turbine actuating water flow.

Disclosure of the invention

[0006] The object of the present invention is a miniature electrical turbo generator assembly for a domestic water heater which is inserted in the sanitary cold water conduit circuit, as defined in claim 1.

[0007] The main heater circuit conduit with a dis-

charge valve, the conduit for the turbine actuating flow, the turbine housing chamber, and the means for coupling the alternator to the turbine are constructed wholly inside a section of conduit pipe moulded with a substantially cylindrical external configuration. The alternator body housing the magnet rotor and supporting the drive shaft is of simple construction, as the preferably toroidal shaped stator is mounted on a rotor body, which is coupled directly to this portion of pipe, and in this way only one body is formed for the magnet rotor for recess coupling. The parallel conduit for actuating the turbine wheel is formed inside the portion of main conduit pipe. The parallel duct inlet and outlet and the arrangement of the vane wheel in it are adapted to reduce the pressure drop in the bypass conduit actuating flow.

Short description of the drawings

[0008]

FIG. 1 shows a transverse elevation view of a hydraulic turbo generator assembly arranged on a water heater conduit.

FIG. 2 is a longitudinal sectional view of the turbo generator assembly of FIG. 1 according to line II.

FIG. 3 is a longitudinal sectional view of the turbo generator assembly of FIG. 1, according to line III.

Detailed description of an embodiment of the invention

[0009] With reference to figures 1-3 an embodiment of turbo generator assembly 1 for a domestic water heater in accordance with the present invention comprises: an alternator 2 with a permanent magnet rotor 3, a turbine wheel 5 turning a drive shaft 4 common to the magnet rotor 3, and a preferably toroidal shaped stator 13 encircling a alternator body 6, a longitudinal portion of conduit pipe 7, which is inserted in the sanitary water circuit 19 of a heater, and it has a flat inner wall 7c extended in the axial direction of the pipe 7 for its division into a main conduit 17, provided with a discharge valve 8, and a bypass conduit in which the turbine wheel 5 is interposed. The dividing wall 7c thereby establishes two water flows, a main flow 17', which is controlled by the discharge valve 8, and an actuating flow 18' for the wheel 5, which bypasses the discharge valve 8.

[0010] The alternator body 6 houses a rotor chamber 14, and the pipe 7 also comprises a turbine chamber 9 formed integral with the pipe 7 and isolated from the rotor chamber 14. For connecting the alternator body 6 to the conduit pipe 7, both are provided with direct recess coupling means 6b, 7b and means 6b,23,24 for the watertight sealing of the rotor chamber 14.

[0011] According to one embodiment of the turbo generator assembly, the conduit pipe 7 has an approximate length of 77 mm, an outside diameter of 24 mm, inside diameter of around 17 mm, the magnet rotor 3 has a

diameter of 20 mm, and the turbine wheel has a diameter of 12 mm.

[0012] In an example of embodiment of the alternator 2, the alternator body 6 is made of tubular-shaped moulded plastic with a dome 6a on the body which forms the magnet rotor chamber, and a tubular part 6b for mounting on the tube 7. The stator 13 is mounted around the dome 6a and the drive shaft 4 is supported with one end on a support 15 on this dome 6a and with the opposite end at the bottom of a housing 10 in the wheel 5, whose vanes are thereby completely exposed to an impelling water flow.

[0013] The conduit pipe 7 is of uniform cylindrical cross section with a ducting centre line 12, and by means of a flat wall 7c, which divides the round section of the pipe 7, it forms the main conduit 17 and the parallel bypass conduit 18. The dividing wall 7c extends in the direction of the heater flow 19, from upstream of the turbine chamber 9 to downstream of the valve 8. The turbine chamber 9 is formed by means of a housing 10 in the wheel 5 integral with the partition wall 7c and it extends from a cylindrical wall 7a of the portion of tube 7 below the plane of the dividing wall 7c.

[0014] In the main conduit 17 a main flow 17' is established when the pressure in the heater circuit 19 exceeds a value, for instance, of 0.2 bar. The bypass conduit 18 maintains a flow 18' towards the turbine chamber 9, irrespective of whether the discharge valve 8 is closed. Initially, while the main flow 17' circulates, the shunted flow 18' is greater, so that the alternator 2 generates more electric power for supplying the heater ignition circuit.

[0015] The bypass conduit 18, as per the plan view (FIG. 3), has a funnel-shaped input section 18a, while the turbine chamber 9 discharges onto a width 20 equivalent to the space between two vanes on wheel 5, and an output section 18b which widens downstream. The input 18a and output sections 18b of the actuating conduit are formed between the flat dividing wall 7c below (FIG. 1) and the conduit pipe cylindrical wall 7a above. The mouth 20 of the input section 18a is located centrally on the ducting centre line 12. Thus, the height 22 of the mouth 20 will be maximum coinciding with a diameter of the cylindrical wall 7a, and the shunted actuating current 18' will therefore be greater through the conduit 18 on the dividing wall 7c. For the impelling current 18' in the input section 18a to urge tangentially to the wheel 5, the turbine and rotor drive shaft 4 is situated on an offset plane "e" in relation to plane "E", which passes through a central axis 12 of conducting (FIG. 1 and 3). In an embodiment this maximum height 22 of the conduit 18 is 5,25 mm, i.e. approximately one third of the inside diameter of the pipe 7, and the dimension "d" of the offsetting between the plane "E" which passes through the centre axis 12 of the portion of pipe 7 and plane "e" which passes through the shaft 4 of turbine wheel 5 is 5 mm.

[0016] The conduit pipe 7 has an integral cylindrical

part 7b (FIG. 2) which extends transversely protruding from wall 7a outwards, for the coupling of the alternator body 6. The part 7b of the tube forms a cavity, in which the tubular part 6b of the alternator body engages, provided at the bottom with a flat bearing surface. The height of the wall 6b determines a separation distance 21 between the wheel 5 and the rotor 3. To secure the body 6 to the pipe 7, the wall 6a of the alternator body has a number of peripheral edges 26 bent inwards, and the pipe 7 has a number of peripheral edges bent outwards, forming a bayonet type seal between one another. For the watertight sealing of the rotor chamber 14, a sealing ring 24 is arranged between the alternator body 6 and the outer surface 23 of the pipe 7.

Claims

1. A dynamo-electrical turbo generator assembly incorporated in a domestic water heater provided with a water circuit and a water flow (19) therein, the turbo generator assembly (1,2) comprising a longitudinal portion of conduit pipe (7) interposed in the heater water circuit (19), a turbine wheel (5) driven by said water flow (19), an alternator (2) with a stator (13) and a magnet rotor (3) rotated by the drive shaft (4) of the turbine wheel, a moulded plastic alternator body (6) provided with a chamber (14) housing the rotor, which is mounted on said portion of conduit pipe (7), a main conduit (17) formed in said portion of conduit pipe (7) and fitted with a discharge valve (8), for opening by means of a minimum water pressure, a bypass branch conduit (18) from this main conduit (17) bypassing the discharge valve (8), a wheel housing (10) forming a hydraulic turbine chamber (9) and interposed in the bypass branch conduit (18), and a coupling (6b,7b) of the alternator body (6) to the portion of conduit pipe (7) for the superimposition of both turbine and rotor chambers (9,14) traversed by the common drive shaft (4), **characterised in that** said main conduit (17) fitted with the discharge valve (8) and said bypass conduit (18) with the built-in wheel housing (10) are formed in the longitudinal portion of pipe (7), by means of an internal wall (7c) which divides the heater water flow (19).
2. A turbo generator assembly according to claim 1, **characterised in that** said longitudinal portion of pipe (7) having an external cylindrical wall (7a) and the discharge valve arranged along a central plane (E) of the section of pipe (7), the common drive shaft (4) is positioned according to an offset plane (e) in relation to said central plane (E) for the formation of a tangential outlet (20) of the bypass branch conduit (18) towards the wheel vanes (5), of maximum height (22) above said internal dividing wall (7c).

3. A turbo generator assembly according to claim 1, **characterised in that** said longitudinal portion of pipe (7) which incorporates both the main and bypass water conduits (17,18) incorporates a cylindrical stub pipe (7b), transverse to a ducting centre axis (12) of the pipe portion (7) and provided with edges (27) bent outwards, for coupling of the (6) by direct engaging into the stub pipe (7b), and connecting the alternator body (6) by turning it about the stub pipe (7b). 5 10
4. A turbo generator assembly according to claim 1, **characterised in that** said longitudinal portion of pipe (7) which internally incorporates both the main and bypass conduit (17,18), is provided externally with a flat surface (23) for mounting the alternator body (6) on it and for supporting an intermediate sealing ring (24) on it. 15
5. A turbo generator assembly according to claim 1, **characterised in that** the alternator body (6) formed in tubular shape as a rotor case (6) provided with a sealed dome (6a) on which a toroidal shaped stator is mounted encircling this dome (6a) externally. 20 25

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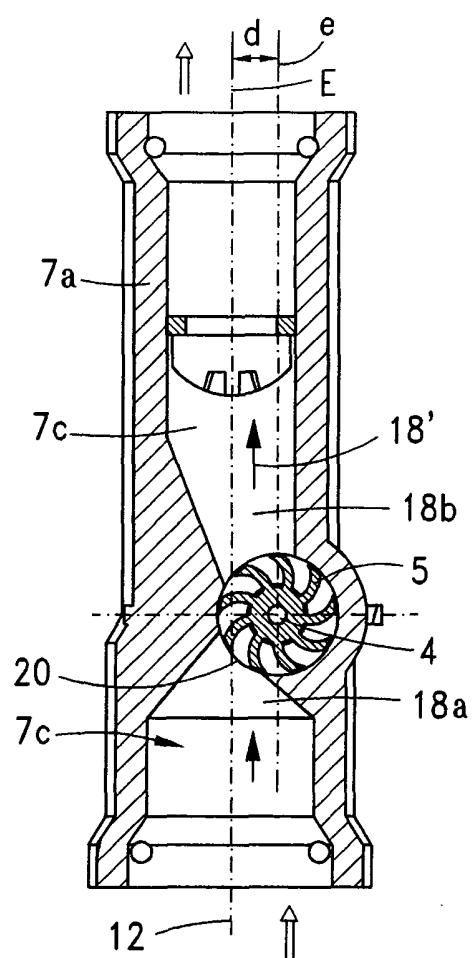
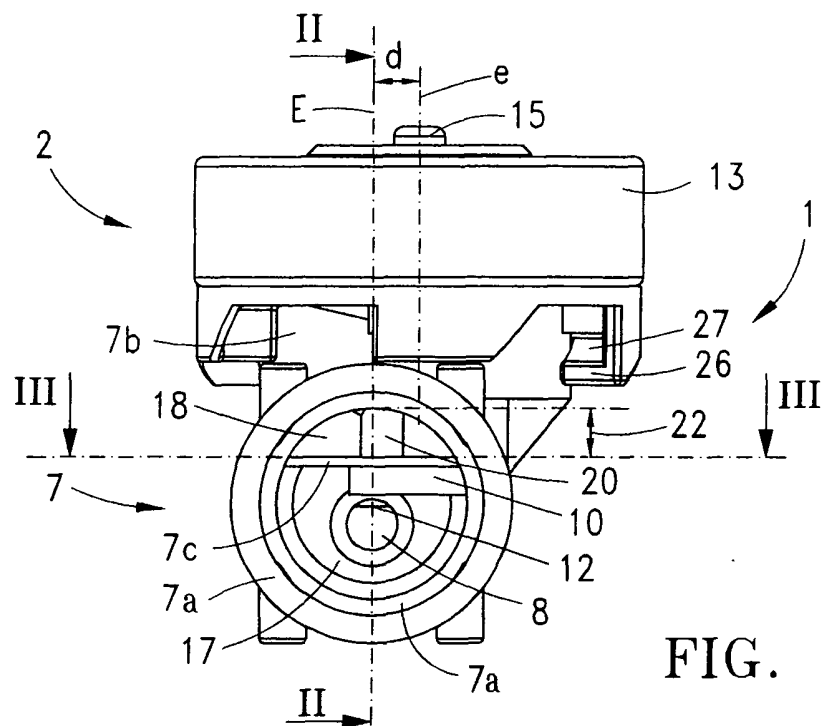
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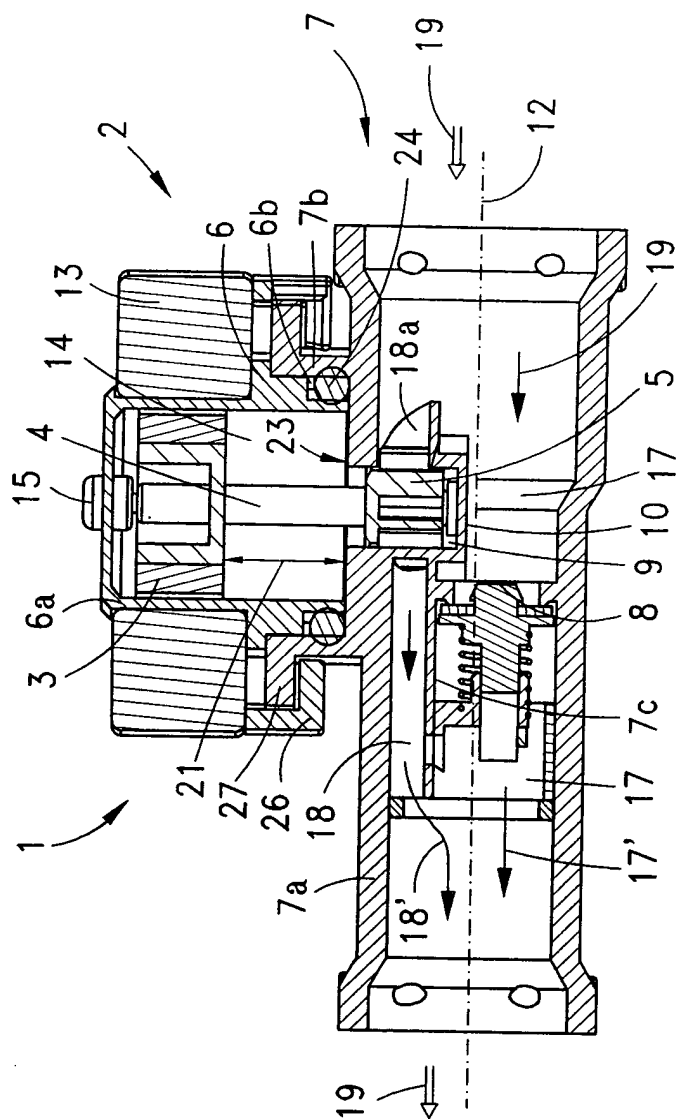


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