

DUAL FUEL BURNER

The patent described in the following was designed as a tool to burn coal powder with the help of an auxiliary gas burner in small power plants up to 1 MW thermal power input. Scale-up of apparatus is possible.

The patent is about a burner of coal dust or any other solid fuel and it includes a powder fuel metering device and an enbloc combustion head having horizontal axis which is supplied by said metering device and includes a plurality of tubular coaxial ducts, i.e. a central cylindrical duct for supplying coal dust mixed with air which is provided with an atomising nozzle, a concentric tubular duct for the swirling air, a duct for the air-gas mixture which is provided with a ring of auxiliary firing holes, and a duct for the combustion air surrounding the whole assembly and provided at its end with a ring of holes converging to the axis and axially misaligned so as to cause the air to swirl. The coal powder metering unit includes a pair of rotors having parallel axes and opposite directions of rotation which are provided with vanes defining a plurality of little compartments or pockets which are extremely closed by the lining of the stationary casing of said rotors and communicates at the upper side with the exterior through the charging opening at the bottom of the hopper and at the lower side with a chamber at the base of the metering unit.

The said chamber at the base of the metering unit is discharged of powder via a Venturi where a flow of slightly compressed air –called primary air- receives from the top the powder and conveys it to the atomising nozzle. A coaxial flow of slightly compressed air –called tertiary air- is mixed in the atomising nozzle with the mixture of air/coal dust via a ring of holes.

The unit is completed with a separated manifold of ring gas burners whose supply is built coaxially to the enbloc of coal powder/air flow. They may stay on fire all around the coal burner as long as it is needed and then turned off.

A secondary air flow is forced in an annular channel built in the enbloc combustion head and is discharged in the quarrel through a ring of holes that are counter oriented with respect to the holes of coal powder nozzles, in order to enhance turbulence and mixing.

The patent foresees a sequence of actions in order to set the unit on run safely.

The firing steps are as follows:

- pre-washing (gas circulation) the combustion chamber for eliminating any gas residue
- firing the fuel gas drive burner and waiting for the fire stabilization
- after the drive burner is fired, the auxiliary pre-firing gas burner formed of the nozzle ring (28 in drawings) is fired.
- After the pre-firing gas burner is fired, a certain time is needed so that the combustion chamber can reach the requested minimum temperature; once the desired temperature is reached, the combustion secondary air , the primary carrier air and the tertiary swirling air and the dust at the minimum flow rate are let in
- After the dust is fired with the aid of the auxiliary flame, the flow rate of the solid fuel is automatically adjusted to the desired value
- At this point the gas of the auxiliary burner is shut off and the combustion is supported only by the dust fuel
- repeating in succession the above steps of the firing cycle of the dust burner

The following six images give an idea of the basics behind the design and construction of the prototype.

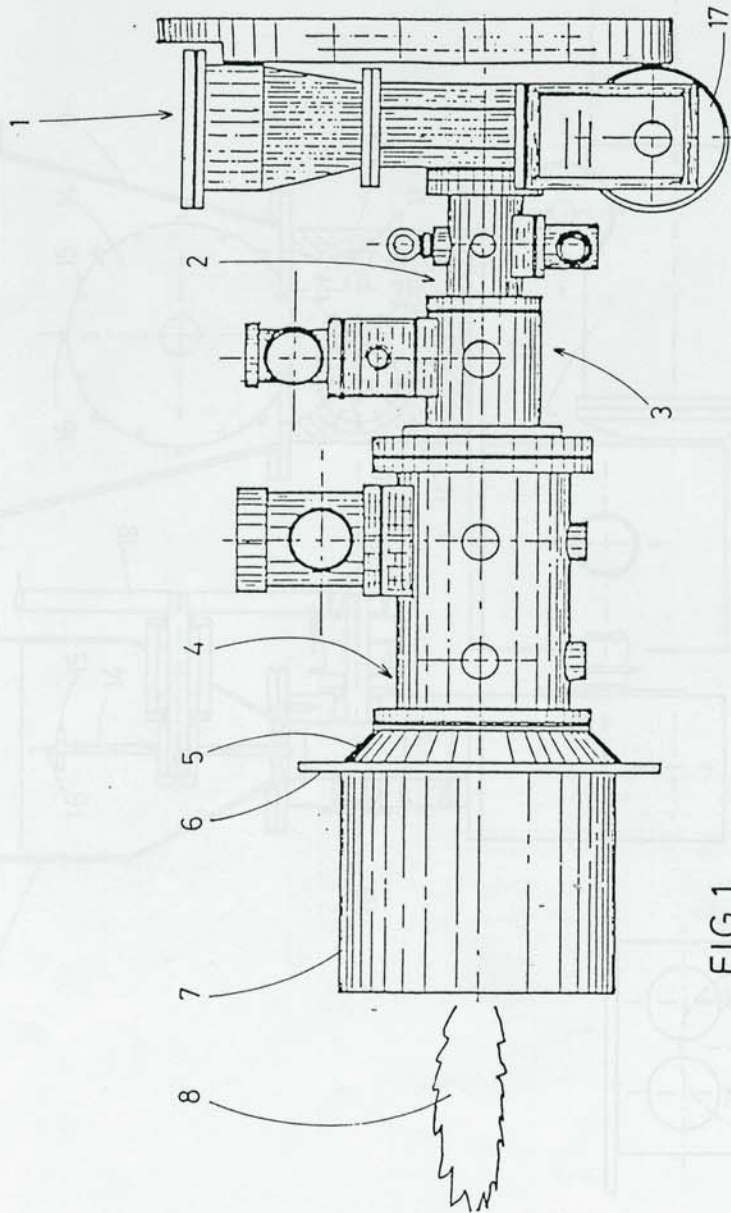


FIG. 1

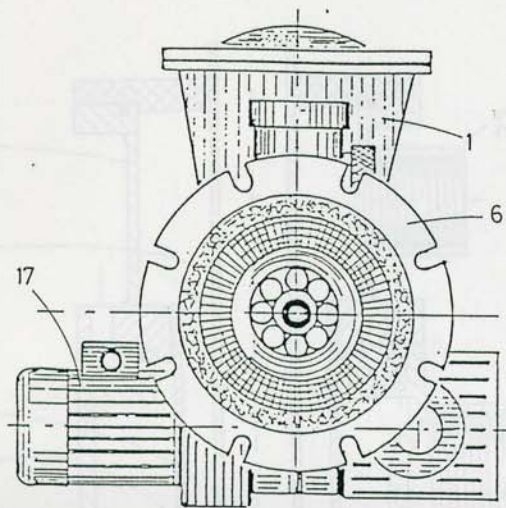


FIG.2

FIG.6

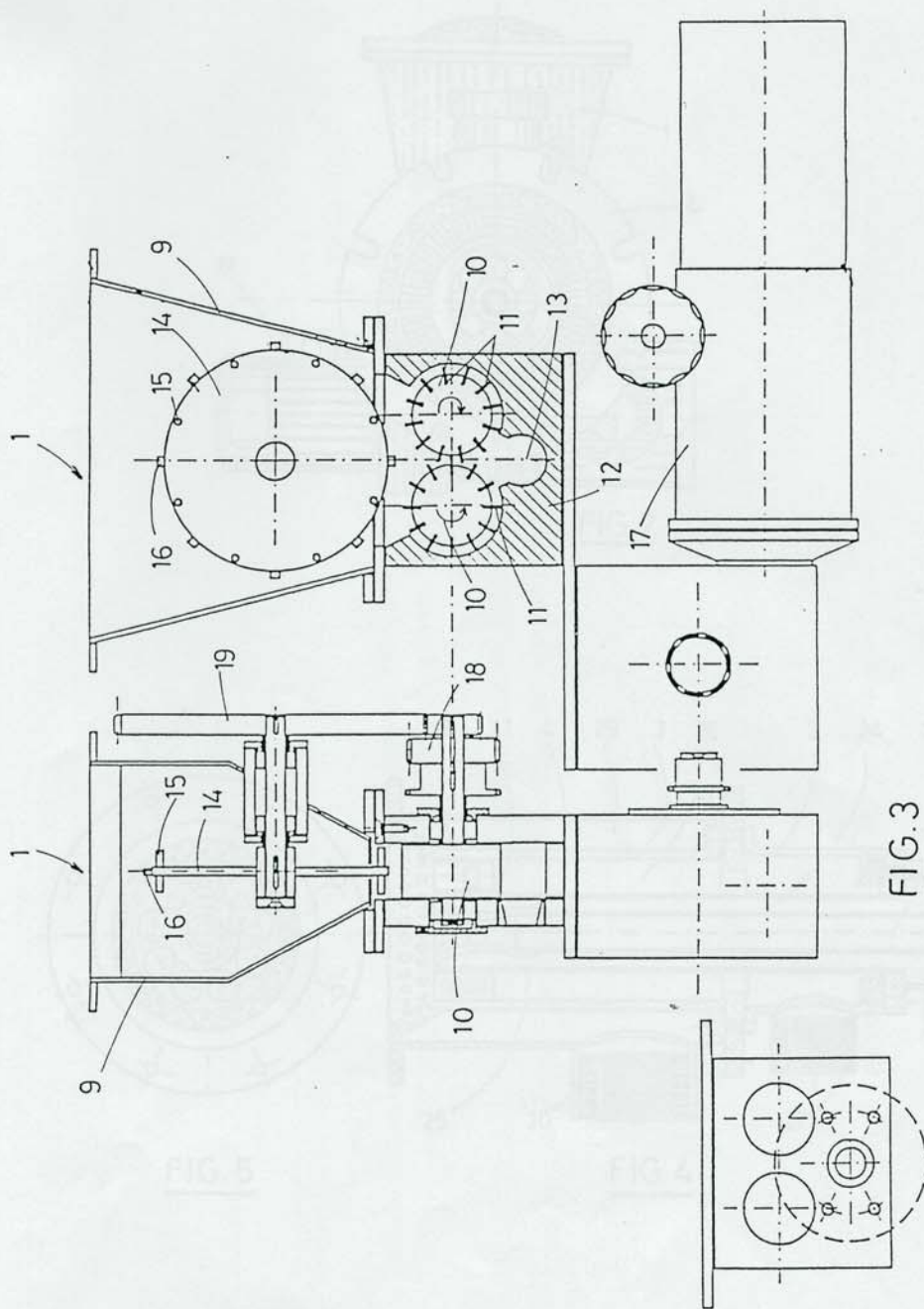


FIG. 3

FIG. 5

FIG. 4

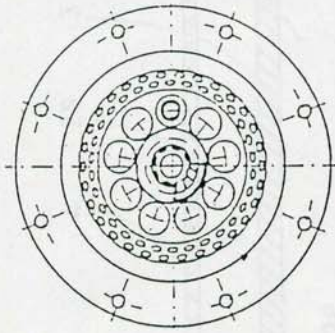


FIG. 5

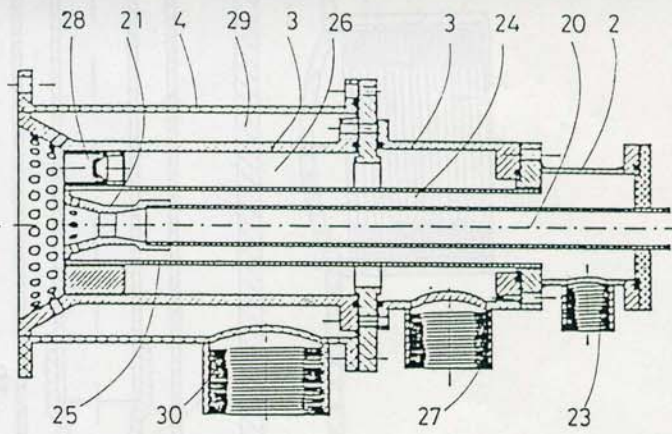


FIG. 4

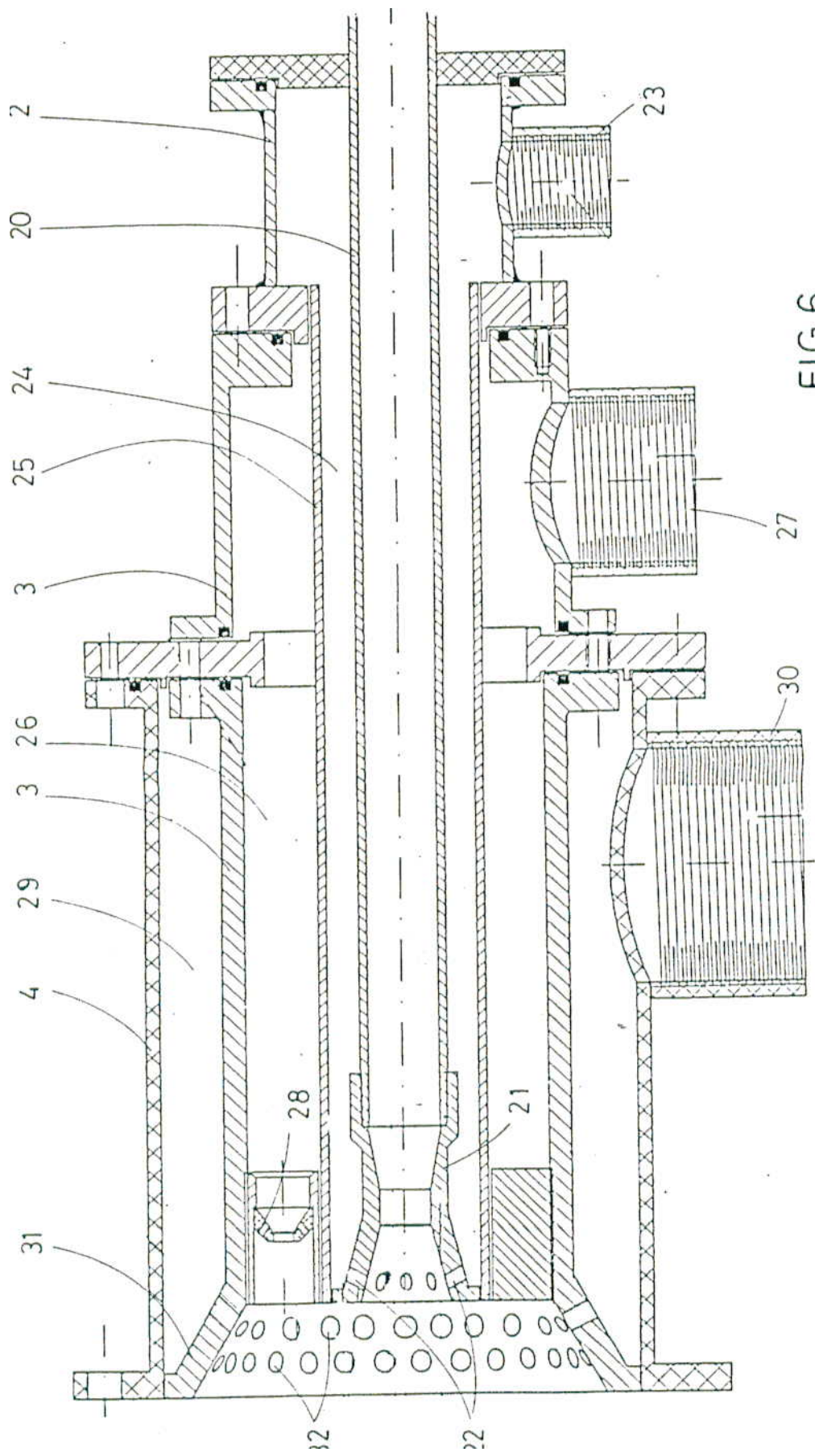


FIG. 6