

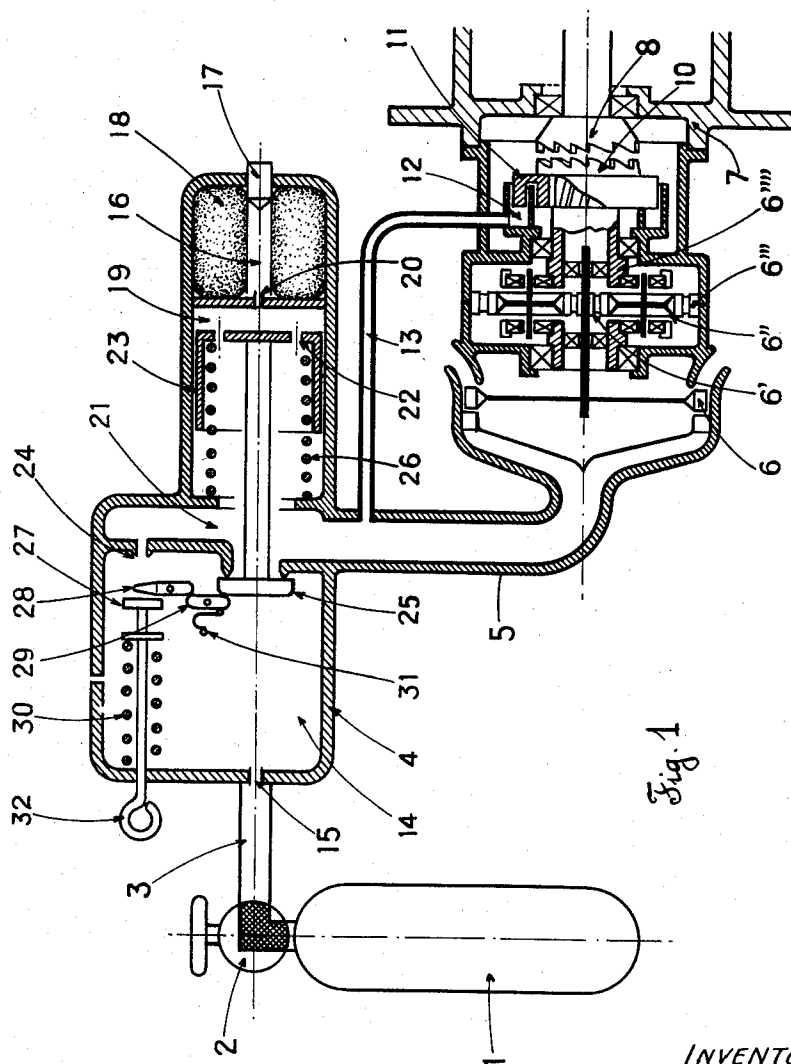
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SYSTEM FOR FEEDING GASES INTO A STARTING TURBINE

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SYSTEM FOR FEEDING GASES INTO A STARTING TURBINE

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My invention has for its object a turbine-operated starting arrangement intended for speeding up rotary machines and it covers more particularly, although not exclusively, an arrangement for starting turbine groups for which it is necessary to ensure a speed of rotation at the start which is higher than that corresponding to the threshold of ignition while it is furthermore preferable for the starting unit to continue rotating with the turbine group during the first part of its running period.

The arrangement described hereinbelow and incorporating my invention shows with reference to all similar extant devices improvements which lead to substantial advantages as to weight, bulk and operation by reason of the technical structure designed for the starting arrangement and also of the supply of energy selected for feeding said arrangement.

My improved arrangement includes chiefly:

The actual starting unit constituted by a gas turbine driving the turbine group or the like rotary machine through the agency of a suitable reducing gear and a pneumatically controlled clutch system; according to a primary feature of my invention, such a starting unit is exceedingly simple in its execution and in its operation, its weight is reduced and its bulk is small; furthermore, it is possible, without modifying the starting unit in any manner whatever both as concerns its execution and its adjustment, to feed it indifferently through any one of a wide range of sources of energy such for instance as gas-generators fed with slow-burning powders, bottles of compressed air, air compressors, steam boilers and the like.

A supply of energy adapted to produce a large amount of gases—several kilograms—within a comparatively short time, say about 10 seconds, under a pressure and at a temperature corresponding to the conditions required for the feeding of the starting unit as defined hereinafter.

An automatic system for feeding the starting unit.

Within the scope of the invention, the supply of energy and the automatic system for feeding the starting unit form together what I may term a generator of energy.

As far as the invention is concerned, I will now consider in the present specification a particular embodiment of such an energy generator, the operation of which is simple and speedy while it is highly adaptable, said embodiment resorting to the thermal energy produced by the combustion of a certain amount of a slow-burning powder.

It should be mentioned that the word powder as used in the present specification is intended to convey in the present case the meaning of any simple or compound product reacting exothermically through ignition or admixture and appearing in a compact or condensed shape.

In the case of the construction of the generator, the thermal energy produced by the burning powder serves for heating a compressed gas, more particularly air, as

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produced by a bottle or a cooled compressor with a view to increasing the available energy of the air and chiefly to avoiding any condensation of liquid inside the turbine or any carrying along of a liquid into the turbine.

5 The amount of powder required is inconsiderable and the chief component of the operative mass of gases is constituted by air. This economical energy generator is, by reason of the presence of a supply of compressed air, comparatively heavy and bulky.

10 The pressures and the temperatures of the gases produced by the generator should be such that the racing speed of the starting unit fed by said gases, when idling, may be lower than the lowermost critical speed of the elements of said starting unit. This essential condition 15 leads to reduced pressures and temperatures, the temperatures being defined also on the other hand by the requirement that no condensation should be produced in the turbine, so that it is possible to resort for the casings and for the turbine to light alloys, which leads in its turn to a reduction in weight and to a greater ease of machining: it leads also to the deletion of the speed limiting device 20 generally used for safety purposes. This speed limiting device may thus be eliminated without any drawback in the case where the energy generator operates only for a limited period; however, some type of speed-limiting device should be incorporated into the starting unit whenever the energy generator is to operate continuously or 25 whenever the energy generator is to run for a period longer than the actual starting period, such a speed limiting device being designed so as to produce a stoppage of the starting unit, as soon as the turbine group has reached a sufficient speed.

The energy generator should also preferably be designed 30 in a manner such that its operation may lead in a first stage to a feeding of the starting unit under a reduced pressure, so as to produce the engagement of the clutch in a gradual manner. This second condition which eliminates any risk of an exaggerated inertia torque due to the engagement of the clutch after the turbine of the starting unit has been set running at a high speed, allows 35 exclusion of any torque limiting device and thus simplification of the starting unit.

It should be remarked that the torque produced by the turbine which is maximum at zero speed is limited 40 by the conditions under which the starting unit is fed.

Further advantages of the arrangements according to my invention will appear in the reading of the following description given, by way of exemplification and by no means in a limiting sense, of my invention selected solely 45 with a view to making my disclosure clearer.

The following description is limited to the general structure and to the particular mechanical details of the starting arrangement. The details of execution which do not 50 form part of my invention and which may be defined after a simple engineering study are not disclosed with a view to simplifying the description.

In the accompanying drawing, I have illustrated in Fig. 1 the above mentioned embodiment of my invention.

60 In Fig. 1, I have shown a particular example of the construction adapted to use as a supply of energy a bottle of air compressed under a high pressure and heated before operation through the gases produced by the combustion of a slowly burning solid powder.

The arrangement illustrated includes a bottle of air 1 65 compressed under high pressure connected through the agency of a cock 2 and of a pipe 3 with a distributor 4. The distributor 4 feeds through the pipe 5 the turbine 6 of the starting unit which is suitably secured to the casing 7 enclosing the clutch 8 adapted to control the transmission leading to the turbine group which is not illus- 70 trated.

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The starting turbine 6 drives into rotation through the toothed wheel 6' keyed to its shaft planet pinions 6'' meshing with the stationary sunwheel 6''' so as to drive the planet carrier 6'''' rigid with the driving section 10 of the clutch. Said section, fitted on the nose of the output shaft of the speed reducing gear so as to revolve therewith, is adapted furthermore to execute a longitudinal translational movement.

Said clutch section 10 is rigid with an annular piston 11 adapted to slide inside a chamber 12 connected with the pipe 5 feeding the starting unit through the branch pipe 13.

The distributor 4 connected with the starting turbine through the pipe 5 includes on the other hand:

An expansion chamber 14 communicating with the supply of compressed air 1-2-3 through a gauged port 15. A powder-containing chamber 16 provided with a priming tube 17 adapted to ignite the cartridge bag 18.

An auxiliary chamber 19 communicating with the powder chamber through one or more gauged ports 20.

A mixing or output chamber 21 into which communicates with the above mentioned pipe 5 and communicating furthermore on the one hand with the auxiliary chamber 19 through the ports 22 provided in the bottom of the movable piston 23 separating the two chambers 19 and 21 and on the other hand with the expansion chamber 14 through two valves 24 and 25, the large valve 25 being controlled by the said piston 23 and being normally held in its closed position by a spring 26.

The head 27 of the smaller valve 24 is normally held in its open position by a pawl 28 controlled by the trigger 29 controlled by the larger valve 25. The spring 30 urges the valve 24 back into its closed position as soon as the trigger 29 releases the pawl 28 as a consequence of the opening movement of the valve 25 engaging said trigger. A spring 31 returns the trigger into its original position when the valve 25 closes again and the ring-shaped end 32 of the valve 24 allows the hand operation of last mentioned valve for resetting it after operation.

The gauged port or ports 20 serve for maintaining inside the powder-containing chamber a pressure suitable for a proper combustion of the powder.

The ports 22 serve for maintaining inside the intermediate chamber 19 the gases produced by the combustion of the powder under a pressure which is sufficient for them to open the valve 25 and to hold it open during the combustion of the powder in the cartridge bag 18.

The gauged port 15 serves for limiting the throughput of the compressed air and consequently the pressure of the gases feeding the starting turbine when the valve 25 is open.

The small valve 24 serves for feeding the starting turbine with a reduced throughput of air which produces a low pressure during the first stage of the starting period.

Taking into account the preceding description and the data relating to the operation of the different ports and members in the distributor, the starting of the turbine group is performed as follows:

The cock 2 being opened, the compressed air flows and expands through the port 15 and the open smaller valve 24 so as to produce an engagement of the clutch element 10 while the starting turbine starts rotating under low pressure conditions.

The cartridge bag is then started burning by causing the priming tube 17 to ignite the cartridge bag 18, the gases produced by the combustion opening then the larger valve 25 which in its turn and through the action of the trigger 29 provides for the closing of the smaller valve 24. The pressure of the air feeding the starting turbine rises immediately to a value corresponding to normal running conditions, since the throughput of air is no longer limited otherwise than through the gauged port 15. The air passing through

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the mixture chamber 21 is heated through admixture with high temperature gases entering said mixing chamber through the ports 22. During this stage, the turbine group is started running at a suitable speed and is ignited. When the powder in the cartridge bag 18 has been entirely burnt, the valve 25 is returned onto its seat by the spring 26. The feeding of the starting turbine is thus cut off, the latter slows down and stops. At the moment at which the speed of the starting turbine drops below the speed of the turbine group, the clutch is disengaged.

The starting operation being at its end, the cock 2 is closed and the small valve 24 is reset through a transient drawing out of the ring-shaped end 32 of the stem of said valve. The arrangement is thus ready to produce a further starting operation provided a sufficient supply of compressed air is available for the purpose.

The cartridge bag is designed in a manner such that it produces a reduced pressure during the first stage of the starting period so that the engagement of the clutch may be performed gradually and without any shocks. This can be obtained in any conventional manner through a suitable succession of combustible layers of different grades, for instance.

When the powder in the cartridge has been completely burnt, the starting unit is no longer fed and it stops as disclosed precedingly.

The preceding description has been given by way of a mere exemplification and by no means in a binding sense both as concerns the nature of the material to be used and the execution of the arrangement and as concerns the number, shape, size, proportions and relative positioning of its different component parts or elements.

In fact, I may resort to any material and to any means and method for building my improved starting arrangement even if such material, means or method have not been specifically mentioned hereinabove, without widening thereby the scope of the invention as defined in the accompanying claims.

What I claim is:

1. In combination with a rotary machine, a starting arrangement comprising a starting turbine, a speed reducing gear controlled by said starting turbine, a clutch operatively inserted between the speed reducing gear and the rotary machine, a supply of compressed gas, a powder charge for igniting same to produce combustion gases, two valves of different sizes mounted in parallel at the output of said supply of compressed gas, means for manually setting the smaller valve in its open position, means wherethrough the combustion gases open the larger valve and close the smaller valve, means returning automatically the larger valve into its closing position as soon as the combustion of the powder is at an end for admixing the combustion gases with the compressed gas to form a compound hot gasiform mixture and feeding said mixture simultaneously to the starting turbine to make the latter rotate and to the clutch to set the latter in its operative condition.

2. A system for feeding gases into a starting turbine, comprising a supply of a gasiform fluid under pressure, a combustion chamber containing a powder charge, means for igniting said charge to produce combustion gases an intermediate chamber to the front of the combustion chamber, communicating with the latter, a piston-shaped member slidably carried therein and provided with at least one calibrated opening in its bottom to allow the combustion gases to pass out of the combustion chamber into the intermediate chamber, a spring urging said piston-shaped member towards the combustion chamber, a mixing chamber into which said intermediate chamber opens unrestrictedly and connected with the supply of fluid under pressure, a valve controlled by said piston and controlling the connection between the supply of fluid under pressure and the mixing chamber and controlling

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thereby the mixing of the combustion gases produced with the fluid under pressure to form therewith a compound hot gasiform mixture, and means connecting the mixing chamber with the starting turbine to feed the latter with said mixture.

3. A system for feeding gases into a starting turbine, comprising a supply of a gasiform fluid under pressure, a combustion chamber containing a powder charge, means for igniting said charge to produce combustion gases, a mixing chamber, two halves of different sizes mounted in parallel at the output end of said supply, means for manually shifting the smaller valve into its open position, means wherethrough the combustion gases open the larger valve and close the smaller valve, means returning automatically the larger valve into its closing position as soon as the combustion of the powder is at an end, a mixing chamber fed with the fluid under pressure through the valve and with the combustion gases from the combustion chamber to form a mixture to be fed to the starting turbine to make the latter rotate.

4. A system for feeding gases into a starting turbine, comprising a container of a supply of gasiform fluid under pressure, said container being provided with two output ports, a combustion chamber containing a powder charge and provided with an output, means for igniting said charge to produce combustion gases, a mixing chamber including in its wall spaced inputs for the combustion gases passing through the output of the combustion chamber and for the gases produced by the supply and passing through the ports in the container, means for uncovering the first port of the container prior to the ignition of the powder charge, auxiliary means through which the combustion gases allow the gases to flow out of the second port of the supply container into the mixing chamber through the second input to mix with the combustion gases and to form therewith a compound hot gasiform mixture, and means connecting the mixing chamber with the starting turbine to feed the latter with said mixture.

5. A system for feeding gases into a starting turbine, comprising a container of a supply of gasiform fluid under pressure, said container being provided with two output ports, a combustion chamber containing a powder charge and provided with an output, means for igniting

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said charge to produce combustion gases, a mixing chamber including in its wall spaced inputs for the combustion gases passing through the output of the combustion chamber and for the gases produced by the supply and passing through the ports in the container, means for uncovering the first port of the container prior to the ignition of the powder charge, auxiliary mechanical means through which the combustion gases open the second input to allow the gases to flow out of the second port of the supply container into the mixing chamber through the said second input to mix with the combustion gases and to form therewith a compound hot gasiform mixture, and means connecting the mixing chamber with the starting turbine to feed the latter with said mixture.

6. A system for feeding gases into a starting turbine, comprising a container of a supply of gasiform fluid under pressure, a combustion chamber containing a powder charge, means for igniting said charge to produce combustion gases, a mixing chamber including in its wall spaced inputs for the combustion gases from the combustion chamber and for the gases produced by the supply, manually-operated means for delivering a first batch of said fluid pressure from the supply into the mixing chamber prior to ignition, auxiliary mechanical means through which the combustion gases open the second input to allow the gases to flow out of the supply container into the mixing chamber through said second input to mix with the combustion gases and to form therewith a compound hot gasiform mixture, and means connecting the mixing chamber with the starting turbine to feed the latter with said mixture.

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