

Jan. 14, 1947.

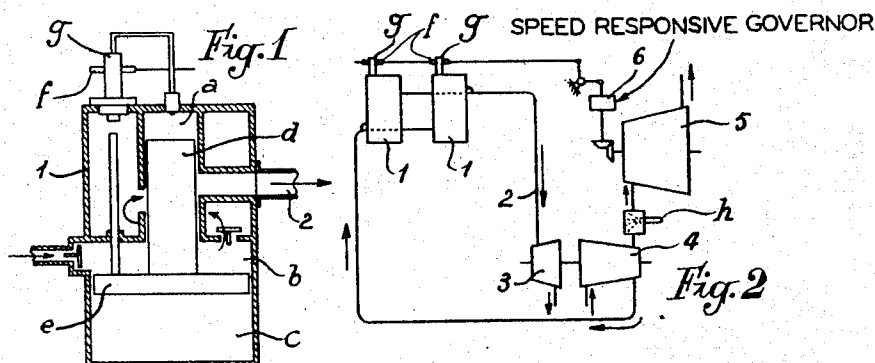
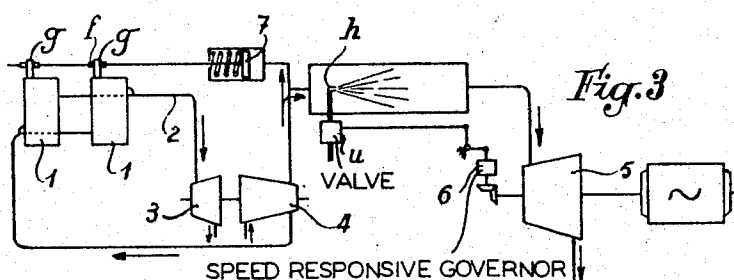
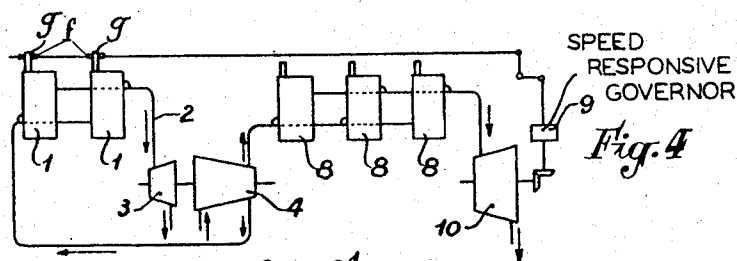
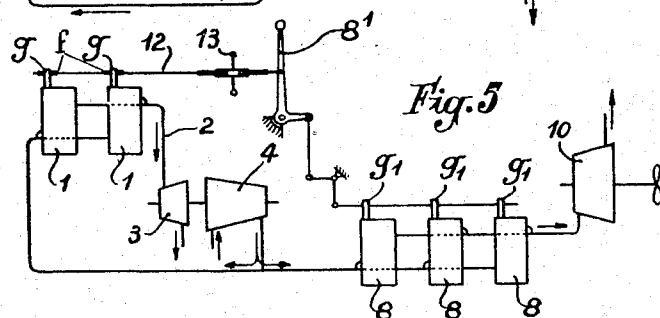
R. PATERAS PESCARA

2,414,166

COMPRESSED AIR INSTALLATION

Filed Aug. 20, 1942

3 Sheets-Sheet 1



Inventor

R. P. Pescara

By Bailey, Stephens & Huetting
Att'ys

Jan. 14, 1947.

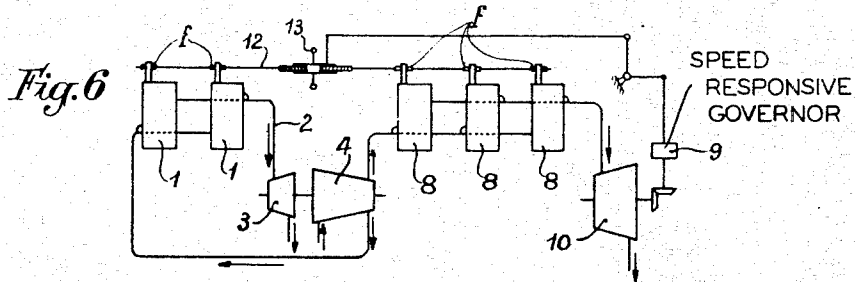
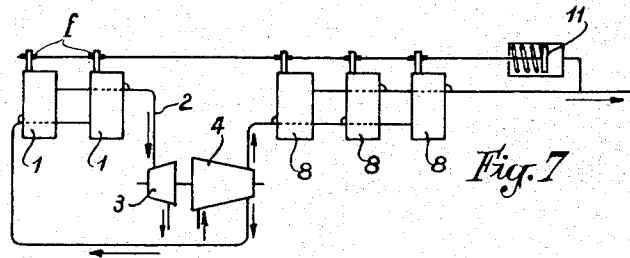
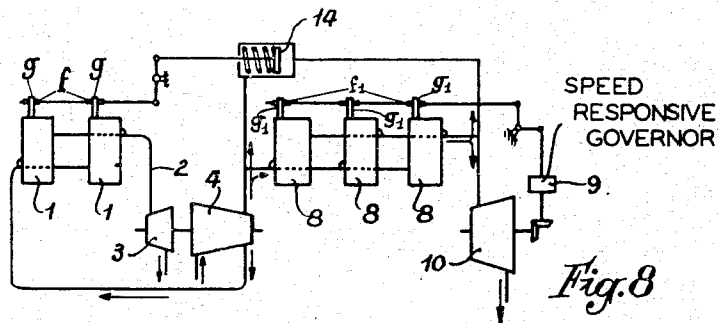
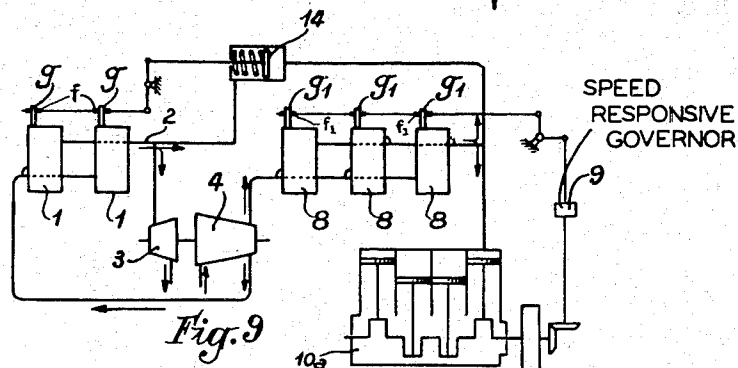
R. PATERAS PESCARA

2,414,166

COMPRESSED AIR INSTALLATION

Filed Aug. 20, 1942

3 Sheets-Sheet 2



Inventor

R. P. Pescara

By Bailey, Stephens & Huetting
Att'ys

Jan. 14, 1947.

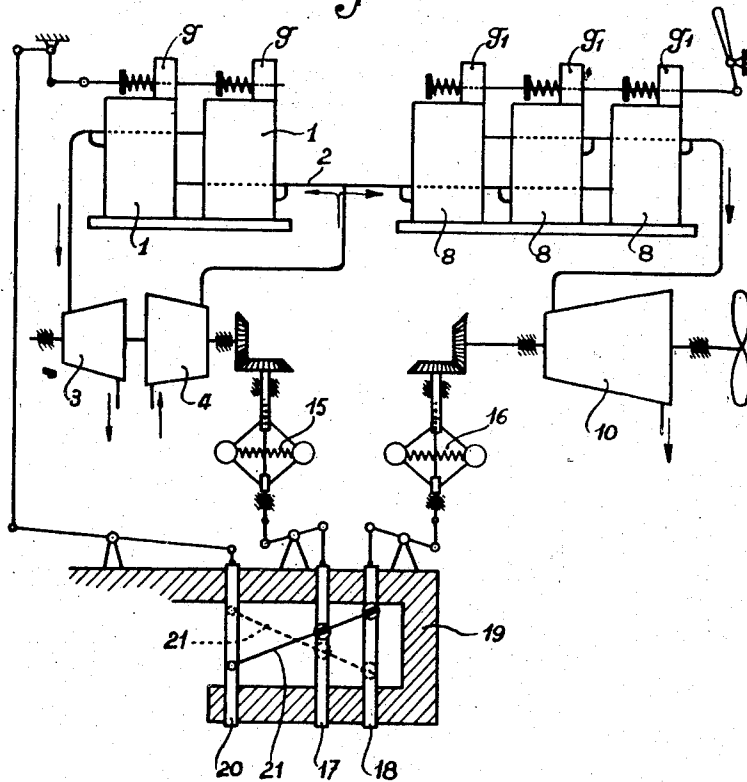
R. PATERAS PESCARA
COMPRESSED AIR INSTALLATION

2,414,166

Filed Aug. 20, 1942

3 Sheets-Sheet 3

Fig. 10



Inventor

R. P. Pescara

By Bailey, Stephens & Huttig

Attys

UNITED STATES PATENT OFFICE

2,414,166

COMPRESSED AIR INSTALLATION

Raul Pateras Pescara, Lisbon, Portugal

Application August 20, 1942, Serial No. 455,482
In France April 20, 1942

11 Claims. (Cl. 60—11)

1

My invention relates to assemblies comprising a compressed-air generator and a plant fed by same and it refers more particularly to such assemblies including an air-compressor supercharging a prime mover system.

A first object of my invention consists in using as compressed-air generator a free piston auto-generator, the exhaust gases of which are forced under pressure into the turbine element of a turbo-blower machine, and in providing means to control the output of the auto-generator in accordance with at least one of the functional factors of the plant to which compressed air is supplied by the blower element of the turbo-blower.

Other objects of my invention will be more fully understood from the following detailed description with reference to the annexed drawings in which:

Fig. 1 is a diagrammatical longitudinal section of a free piston auto-generator.

Figs. 2 to 10 diagrammatically represent nine assemblies in accordance with my invention.

In Fig. 1 a free piston auto-generator 1 comprises a motor cylinder *a*, a compressor cylinder *b*, preferably supercharged by a part of the compressed air delivered by the turbine-blower machine, an air cushion chamber *c*, and a movable structure formed of two pistons *d* and *e* respectively cooperating with cylinders *a* and *b*. The operation may briefly be described as follows: When pistons *d* and *e* are oscillated, cylinder *b* forces air under pressure into the annular chamber surrounding cylinder *a* which operates as a two-stroke internal combustion engine with fuel injection by means of an injection pump *g* directly actuated by the movable structure. The exhaust gases are delivered under pressure through conduit 2. The air cushion chamber *c* in the lower part of cylinder *b* ensures the return stroke of the movable structure. A rod *f* permits of adjusting the injection pump *g*.

In Fig. 2 two free piston auto-generators 1 deliver exhaust gases under pressure through a common conduit 2 to an exhaust gas turbine 3 coupled with a rotary blower 4. The air from blower 4 is heated by a burner *h* and the hot gases produced are supplied to a turbine 5 forming a prime mover.

The injection pump *g* of the two free piston auto-generators 1 are controlled in known manner by means of rods *f* and the latter are actuated by a centrifugal speed governor 6 driven by turbine 5. Fuel injection to auto-generators 1 is thus controlled in accordance with the speed of the turbine or prime mover 5.

2

In the arrangement of Fig. 3, there is a pneumatic device 7 connected to the supply line between blower 4 and burner *h* responsive to the pressure of the air supply in the line for controlling rods *f*. A governor 6 controlled by the speed of turbine 5 regulates valve *u* which controls burner *h*.

In Fig. 4 the air from blower 4 is supplied to three auto-generators 8 and the exhaust gases of the latter are fed to a turbine 10. The control rods *f* of auto-generators 1 are actuated by a centrifugal speed governor 9 driven by turbine 10, whereby fuel injection in auto-generators 1 is varied in accordance with the speed of the prime mover, as in the case of Fig. 2.

In the arrangement shown in Fig. 5, the rods *f* controlling fuel injection to auto-generators 1 (auxiliary group of auto-generators) are actuated by the lever 8¹ used to control auto-generators 8 (main group of auto-generators). The output of the auxiliary group of auto-generators is thus varied in accordance with the output of the main group.

It is of advantage in such a case to provide means permitting to vary the relative positions of the respective controlling devices, such means being inserted in the gear connecting the fuel injection controlling devices. It is thus possible to vary the quantity of fuel injected into the auxiliary auto-generators 1 with respect to the quantity injected into the main auto-generators 8. In the example shown in Fig. 5, there is provided an adjustable connecting rod 12 of the conventional type comprising two threaded rods with right and left hand threads co-operating with a tubular member 13 provided with right and left hand threads at its ends. The length of connecting rod 12 may thus be varied at will by rotating member 13.

Such an adjustment is more particularly used when it is desired to obtain rapidly a variation in the total output of both groups of auto-generators. Supposing the output is to be increased, the injection ratio between the main and auxiliary groups is first reduced, care being taken to maintain the total output. This output is afterwards increased and the normal injection ratio between the groups is resumed. When it is desired to reduce the output, the injection ratio is first increased.

In the form shown in Fig. 6, the rods of the fuel injection devices *f* of an auxiliary group of auto-generators (1) and of a main group (8) are jointly controlled by a governor 9 driven by turbine 10. An adjustable connection 13 is pro-

3

vided between the fuel injection devices of the two groups so that their relative operations may be varied.

The form shown in Fig. 7 differs from that of Fig. 6 in that the fuel injection devices of both groups are jointly controlled by a pneumatic device 11 responsive to the output pressure of the main group.

The device controlling the auxiliary group of auto-generators may be responsive to a functional factor of the main group and at the same time to a functional factor of the auxiliary group, whereby the second-named factor may maintain the output of the auxiliary group to the value required for the main group.

Such a method permits the inlet pressure of the main group to remain a function of the exhaust pressure of the said group; or the working pressure of the auto-generators of the auxiliary group to remain a function of the exhaust pressure of the main group; or the speed of the turbo-blower to remain a function of the prime mover speed.

In the example illustrated in Fig. 8, the two functional factors are respectively the air pressure at the outlet of blower 4 and the exhaust pressure of the main group of auto-generators 8. These pressures act on opposite sides of a piston 14 connected by an appropriate gearing with the rods *f* controlling the injection pumps *g* of the auxiliary group 1. The rods *f*₁ controlling the injection pumps *g* 1 of the main group 8 are actuated by the centrifugal governor 9 of the prime mover 10.

The example of Fig. 9 is substantially similar but the two pressures acting on pistons 14 are respectively the exhaust pressure of the autogenerators 1 of the auxiliary group and the exhaust pressure of the autogenerators 8 of the main group. In this case the prime mover is a reciprocating machine 10a.

In the arrangement of Fig. 10 the turbo-blower 3, 4 associated with the auxiliary group derives a centrifugal governor 15 while the prime mover 10 drives another centrifugal governor 16. Centrifugal governors 15 and 16 respectively actuate parallel rods 17 and 18 axially sliding in a frame 19. There is also provided a third slidable rod 20 parallel to rods 17 and 18, and rods 17, 18 and 20 are connected by means of a lever 21 articulated at its ends to rods 20 and 18 and at an intermediate point to rod 17, such articulations being provided with play or other means permitting movements of the rods. And rod 20 is connected by an appropriate gearing with the rods controlling the injection pumps *g* of the auxiliary group 1.

The position of lever 21 shown in full lines corresponds to a full load while the reduced load position is illustrated in dashed lines.

It is to be understood that the above description has been given merely by way of example to disclose practical and efficient embodiments of my invention, but that I do not wish to be limited thereto, since the details may be varied within the scope of the appended claims. Especially, the device fed by the blower of the auxiliary group does not be necessarily a power plant but can be a network of compressed air.

I claim:

1. A system comprising a rotary blower; a turbine driving said blower; at least one first free piston auto-generator of the internal combustion type adapted to supply exhaust gases under pressure to said turbine; at least one second free

4

piston auto-generator of the internal combustion type to which compressed air is supplied by said rotary blower; a machine to which exhaust gases under pressure are supplied by said second-named auto-generator; and means responsive to a condition which varies with variation in the load on said machine and adapted to control said first-named auto-generator.

2. In a system as claimed in claim 1, said machine being a prime mover of the class including turbines and reciprocating engines.

3. In a system as claimed in claim 1, said machine being a prime mover of the class including turbines and reciprocating engines and said means being responsive to the speed of said prime mover.

4. A system comprising a rotary blower; a turbine driving said blower; at least one first free piston auto-generator of the internal combustion type adapted to supply exhaust gases under pressure to said turbine; at least one second free piston auto-generator of the internal combustion type to which compressed air is supplied by said rotary blower; a machine to which exhaust gases under pressure are supplied by said second-named auto-generator; means to control said first-named auto-generator; means to control said second-named auto-generator; and a positive connection between said first-named and second-named means.

5. In a system as claimed in claim 4, said connection being adjustable to permit of varying the ratio of control between said first-named and said second-named auto-generator.

6. A system comprising a rotary blower; a turbine driving said blower; at least one first free piston auto-generator of the internal combustion type adapted to supply exhaust gases under pressure to said turbine; at least one second free piston auto-generator of the internal combustion type to which compressed air is supplied by said rotary blower; a machine to which exhaust gases under pressure are supplied by said second-named auto-generator; means to control said first-named auto-generator; means to control said second-named auto-generator; a positive connection between said first-named and said second-named means; and means responsive to a condition which varies with variation in the load on said machine and adapted to actuate in unison said first-named and said second-named means.

7. In a system as claimed in claim 6, said machine being a prime mover of the class including turbines and reciprocating engines, and said last-named means being responsive to the speed of said prime mover.

8. In a system as claimed in claim 6, said last-named means being responsive to the pressure of the gases supplied to said machine.

9. A system which comprises a first group including a rotary blower, a turbine driving said blower, and at least one free piston auto-generator of the internal combustion type adapted to supply exhaust gases under pressure to said turbine; a second group including at least one free piston auto-generator of the internal combustion type to which compressed air is supplied by said rotary blower and a machine to which exhaust gases under pressure are supplied by said second-named piston auto-generator; means to control the auto-generator of said first named group, said means being responsive to a condition which varies with variation in the load on said second-named group and also to a condi-

5

tion which varies with variation in the load on said first-named group; and means to control said second group.

10. In a system as claimed in claim 9, said means to control the free piston auto-generator of said first group being actuated by a pneumatic device of the class embodying the piston and cylinder system, such device being itself actuated in opposed relation by air pressure at the outlet of said rotary blower and by exhaust gas pressure at the outlet of the free piston auto-generator of said second group.

11. A power plant which comprises a first group including a rotary blower, a turbine driving said blower and at least one free piston auto-gener-

6

ator of the internal combustion type adapted to supply exhaust gases under pressure to said turbine; a second group including at least one free piston auto-generator of the internal combustion type to which compressed air is supplied by said rotary blower and a machine to which exhaust gases under pressure are supplied by said second-named free piston auto-generator; and means to control the free piston auto-generator of said first group, said means being responsive to a condition which varies with variations in the load on said first group and also to a condition which varies with variation in the load on said machine.

RAUL PATERAS PESCARA.