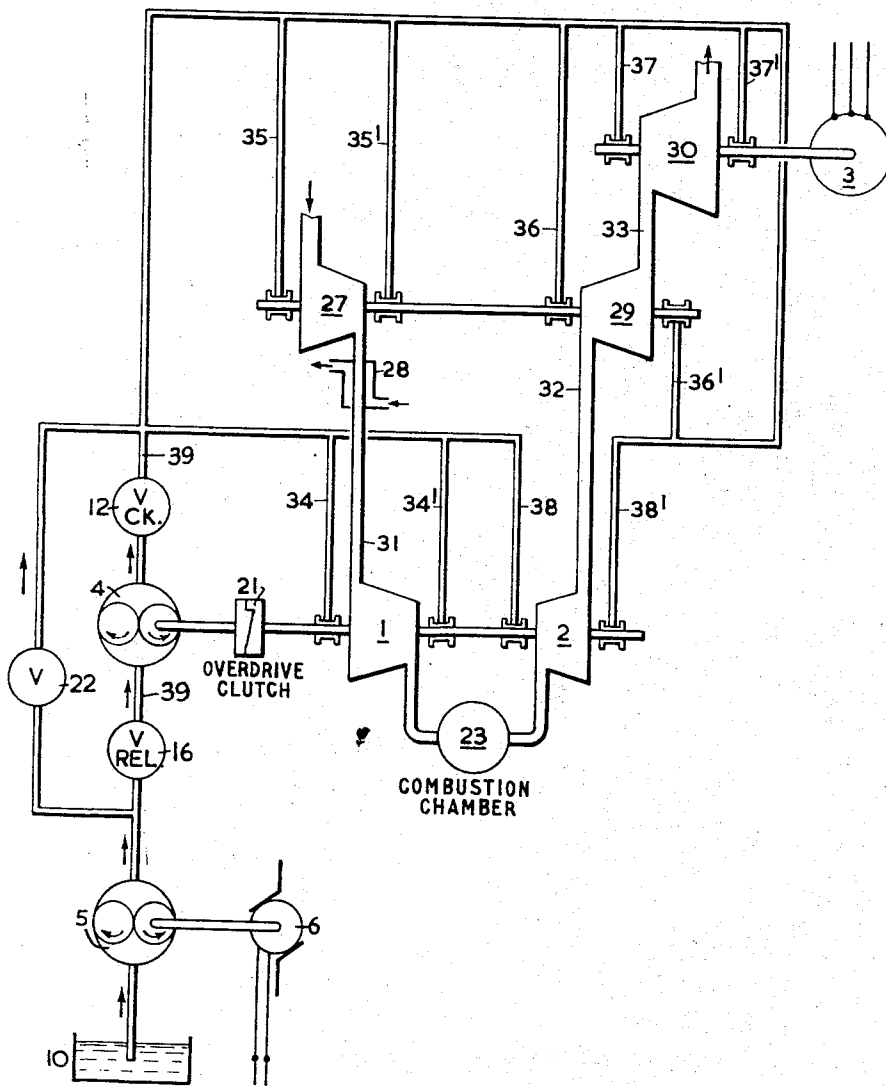


June 21, 1955

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ARRANGEMENT FOR STARTING A PRIME MOVER BY
INDEPENDENTLY DRIVEN LUBRICATING PUMP
Filed July 13, 1951

2,711,071



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ARRANGEMENT FOR STARTING A PRIME MOVER BY INDEPENDENTLY DRIVEN LUBRICATING PUMP

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Application July 13, 1951, Serial No. 236,665

Claims priority, application Great Britain July 18, 1950

4 Claims. (Cl. 60—39.14)

The invention relates to the starting of prime movers such as gas turbines or internal combustion engines which have to be driven up to a certain speed before they become self-driving.

Such prime movers are often equipped with two sets of auxiliary pumps such as lubricating oil pumps or fuel pumps, one of which is mechanically coupled to the prime movers and supplies the same during ordinary operation, while the second set is independently driven, say by an electric motor, to supply the prime mover during the starting period and to serve as a stand-by set which is automatically put into operation to take over the function of the first mentioned set in case of breakdown of the latter.

According to the main feature of the invention an arrangement for starting a prime mover which has to be driven up to a certain speed before it becomes self-driving comprises in combination: a prime mover, a hydraulic motor coupled to the said prime mover, a supply source of liquid, an independently driven auxiliary pump hydraulically connected between the said source and the said hydraulic motor, automatic pressure relief means connected between the said auxiliary pump and the said hydraulic motor, the discharge side of said hydraulic motor being hydraulically connected to the region of the prime mover using said liquid in operation, a non-return valve connected between said hydraulic motor and the said region, a by-pass line leading from the discharge side of the said auxiliary pump directly to the said region, and a stop valve connected into the said by-pass line.

In order that the invention may be better understood and readily carried into effect an embodiment thereof will now be described with reference to the accompanying diagrammatic drawing, which shows a compound gas turbine plant wherein the stand-by lubrication pump drives a hydraulic starter motor.

Referring now to this drawing, a low pressure compressor 27 is connected through an intercooler 28 and a pipe 31 in series flow with a high pressure compressor 1 mechanically coupled to a high pressure turbine 2, and in fluid communication therewith through a combustion chamber 23. This low pressure compressor 27 is driven mechanically independent of turbine 2 by a turbine 29 which is in series flow connection with the said turbine 2 and with another mechanically independent turbine 30 through pipes 32, 33, respectively. Thus turbine 2 is the high pressure turbine, driving the high pressure compressor 1 only; turbine 29 is the medium pressure turbine, driving the low pressure compressor 27 only, and turbine 30 is the low pressure turbine driving the useful load 3.

For starting this compound gas turbine plant it suffices to drive the high pressure set consisting of the compressor 1 and turbine 2 up to self-driving speed, when the exhaust gases from this turbine 2 will automatically set the turbines 29 and 30 in rotation.

In this arrangement a pump 5, driven by an electric

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motor 6, serves as lubricating pump during the whole of the normal operation, a unit 4 serving as a hydraulic starter motor only. This hydraulic starter motor 4 is coupled to the turbine 2 and compressor 1, for example by means of a freewheel or overdrive clutch 21 which automatically disengages itself when the turbine 1 reaches its self-driving speed.

The pump 5 feeds oil from a sump 10 under pressure through a stop valve 22 into the lubrication system of all three turbine sets including the pipes 34, 34' to the bearings of the high pressure compressor 1, pipes 35, 35' to the bearings of the low pressure compressor 27, pipes 36, 36' to the bearings of the medium pressure turbine 29, pipes 37, 37' to the bearings of the low pressure turbine 30, and pipes 38, 38' to the bearings of the high pressure turbine 2. There is a by-pass line 39 shunted over valve 22 which contains in series: the pressure relief valve 16, the hydraulic motor 4 and a non-return valve 12. For starting purposes the stop valve 22 is closed so that the oil pressure delivered by the pump 5 will then be as high as permitted by the pressure relief valve 16, and high enough to drive the hydraulic motor 4. The oil leaving this motor at reduced pressure is then fed through the non-return valve 12 into the lubricating system of the turbines, compressors and load.

As soon as self-driving speed is attained, valve 22 is opened, and the pump 5 feeds lubricating oil through it directly into the lubricating system. The pressure will then be higher behind the non-return valve 12, and the latter will prevent oil from flowing back through the hydraulic motor 4, which is brought to a standstill and is uncoupled from the turbine 2 and compressor 1 by the automatic clutch 21.

Where hereinabove single pumps or hydraulic motors are shown or described, two or more such pumps or hydraulic motors operating in series or in parallel can be used instead.

The arrangement of a hydraulic motor coupled to the prime mover by means of a freewheel or overdrive clutch and supplied by an independently driven auxiliary pump, which during the ordinary operation continues supplying the prime mover with liquid such as lubricating oil or fuel, described hereinabove, could be simplified by omitting the said freewheel or overdrive clutch.

While I have described hereinabove what may be considered as particularly useful embodiments of my invention, I wish it to be understood that I do not limit myself to the particular arrangements shown and described, for obvious modifications will occur to a person skilled in the art according to the special requirements and circumstances under which my invention may be used.

What I claim as my invention and desire to secure by Letters Patent is:

1. An arrangement for starting a prime mover which has to be driven up to a certain speed before it becomes self-driving comprising in combination: a prime mover, an automatic overdrive clutch, a hydraulic motor coupled to the said prime mover by the said clutch, a supply source of liquid, an independently driven auxiliary pump hydraulically connected between the said source and the said hydraulic motor, automatic pressure relief means connected between the said auxiliary pump and the said hydraulic motor, the discharge side of said hydraulic motor being hydraulically connected to the region of the prime mover using said liquid in operation, a non-return valve connected between said hydraulic motor and the said region, a by-pass line leading from the discharge side of the said auxiliary pump directly

to the said region, and a stop valve connected into the said by-pass line.

2. An arrangement for starting a prime mover which has to be driven up to a certain speed before it becomes self-driving, comprising in combination: a plurality of compressors in series flow connection with and mechanically independent of one another, a plurality of gas turbines in series flow connection with and mechanically independent of one another, the high pressure gas turbine being in driving connection with the high pressure compressor and forming with it the said prime mover, each of the other compressors being in driving connection with another one of the said turbines, and the low pressure turbine delivering the useful power output, a hydraulic motor, an automatic overdrive clutch mechanically connecting the said hydraulic motor to the said prime mover, an auxiliary pump, independent driving means in driving connection with the said auxiliary pump, a supply source of a liquid hydraulically connected to the inlet side of the said auxiliary pump, hydraulic connecting means connecting the delivery side of the said auxiliary pump to the inlet side of the said hydraulic motor, automatic pressure relief means arranged in the said hydraulic connecting means, hydraulic connecting means connecting the outlet side of the said hydraulic motor to the region of the said prime mover using in operation the said liquid, a non-return valve connected between the said hydraulic motor and the said region, a by-pass line leading from the delivery side of the said auxiliary pump directly to the said region, and stop valve means connected into the said by-pass line.

3. An arrangement for starting a prime mover which has to be driven up to a certain speed before it becomes self-driving comprising in combination: a prime mover, a hydraulic motor coupled to the said prime mover, a supply source of liquid, an independently driven auxiliary pump hydraulically connected between the said source and the said hydraulic motor, automatic pressure relief means connected between the said auxiliary pump and the said hydraulic motor, the discharge side of said hydraulic motor being hydraulically connected to the region of the prime mover using said liquid in operation, a non-return valve connected between said hydraulic motor and the said region, a by-pass line leading from the discharge side of the said auxiliary pump directly

to the said region, and a stop valve connected into the said by-pass line.

4. An arrangement for starting a prime mover which has to be driven up to a certain speed before it becomes self-driving, comprising in combination: a plurality of compressors in series flow connection with and mechanically independent of one another, a plurality of gas turbines journaled mechanically independent of one another, a high pressure gas turbine being in driving connection with the high pressure compressor and forming with it the said prime mover, each of the other compressors being in driving connection with another one of the said turbines, and a low pressure turbine delivering the useful power output, a hydraulic motor connected to the said prime mover, an auxiliary pump, independent driving means in driving connection with the said auxiliary pump, a supply source of a liquid hydraulically connected to the inlet side of the said auxiliary pump, hydraulic connecting means connecting the delivery side of the said auxiliary pump to the inlet side of the said hydraulic motor, automatic pressure relief means arranged in the said hydraulic connecting means, hydraulic connecting means connecting the outlet side of the said hydraulic motor to the region of the said prime mover using in operation the said liquid, a non-return valve connected between the said hydraulic motor and the said region, a by-pass line leading from the delivery side of the said auxiliary pump directly to the said region, and stop valve means connected into the said by-pass line.

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