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PNEUMATIC DRIVE OF THE GYROSCOPES
ON BOARD AIRCRAFT
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Fig. 1

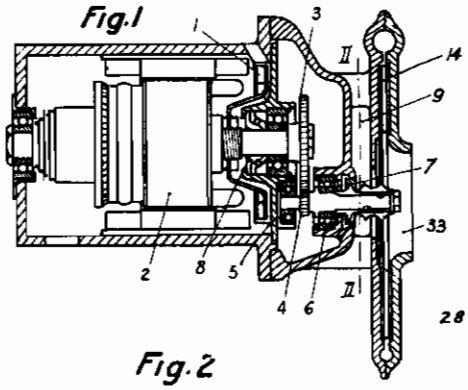


Fig. 6

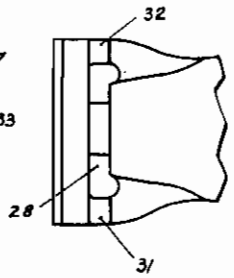


Fig. 2

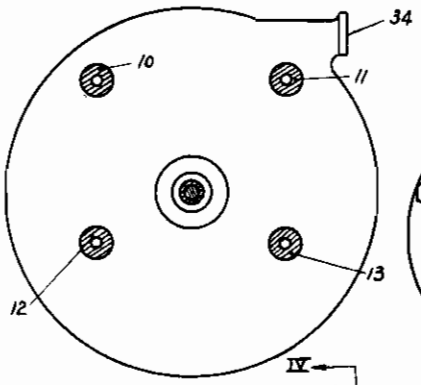


Fig. 5

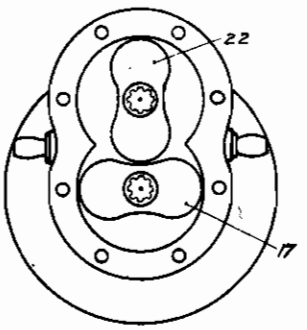


Fig. 4

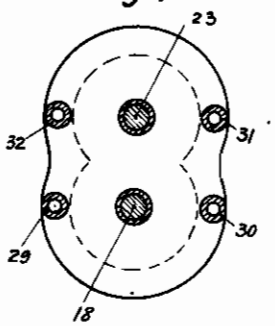
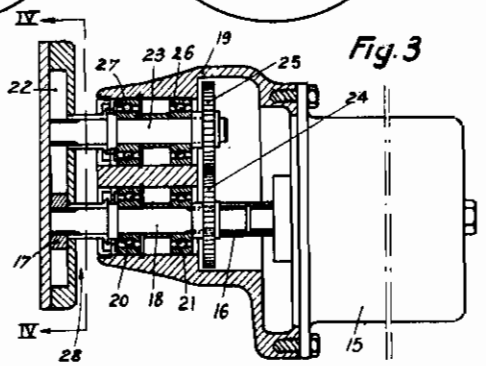


Fig. 3



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ALIEN PROPERTY CUSTODIAN

PNEUMATIC DRIVE OF THE GYROSCOPES ON BOARD AIRCRAFT

Charles Raymond Waseige, Rueil, Seine-et-Oise, France; vested in the Alien Property Custodian

Application filed October 25, 1941

The gyros of board instruments are presently driven by low pressure air. A pump, usually driven by the engine, sucks air off a sealed casing of the gyro; this casing comprises an injection nozzle through which air from the outside enters under the influence of the depression produced by the suction of the pump, the jet being suitably directed onto the blades of the gyro so as to ensure its rotation. The depression or the pressure differential necessary between the outside and the inside of the casing to secure the normal run of the gyro amounts to about 130g. It will thus be readily apparent that at high levels, when the ambient atmospheric pressure falls to low values, this depression can only be obtained with much difficulty, even with a pump having a good efficiency.

It has been suggested to utilize the delivery of a volumetric pump of the vane type blowing into the gyro nozzle, the casing being connected with the open air. This solution requires however the provision of a perfect oil purifier in order to free the air from the oil used to lubricate the pump, inasmuch as the board instruments cannot resist to the gumming caused by impurities carried by the air delivered by the pump.

This invention relates to combinations of means aiming to provide a flow of air under pressure by means of a pump, the air thus delivered being entirely free from impurities, more particularly from oil droplets.

The invention consists essentially in that those driving and bearing members of the pump which require to be lubricated are arranged in a first sealed casing while the air pulsating members of the same pump are arranged in a second casing having no communication whatever with the first casing. The shaft of the pump proper is thus supported in the first casing, while it is overhanging and free from bearings in that casing through which the entrained air flows.

Means are further provided in order to prevent oil particles from running along said shaft extending from the drive casing to the air pulsating casing.

According to one embodiment, the two casings are separated by an open space.

In the case of a centrifugal pump, the roll gearings and the driving gear wheels of the impeller are mounted in the lubricated casing, the impeller itself being mounted upon an overhanging part of its shaft and free from bearings in the pump casing proper.

In the case of a volumetric pump of the vane-type, the driving gear wheels are mounted in the lubricated casing while the vanes, mounted upon overhanging parts of the shafts of said wheels, rotate in the pump casing without any bearings and without lubrication.

A pump of this type, electric drive being assumed, may be located in the neighbourhood of the board instruments, thus doing away with long piping and losses of head.

In the case of a stratospheric airplane having a sealed cabin, the pump, located inside the cabin, sucks off the air at a pressure higher than the ambient pressure, which allows the use of a pump of smaller volume for a given capacity in weight of air.

Other features and advantages of this invention will moreover be apparent from the following description of various embodiments shown, solely by way of an example, on the annexed drawings in which:

Fig. 1 is a sectional view of a centrifugal pump according to the invention.

Fig. 2 is a section on the line II—II of Fig. 1.

Fig. 3 is a sectional view of a volumetric pump of the vane type.

Fig. 4 is a section on the line IV—IV of Fig. 3.

Fig. 5 is an end view of Fig. 3, the casing cover being removed.

Fig. 6 is a fragmentary plan view of the pump of Figs. 3, 4 and 5.

The centrifugal pump shown in Fig. 1 is driven by an electric motor which is provided with a cooling device comprising a small turbine 1 keyed on the rotor shaft 2 and which, by means of gear wheels 3 and 4, operates the shaft driving the centrifugal pump impeller, the pump shaft being supported by two roll bearings 5, 6. An oil retaining ring 7 is provided for sealing the gear casing, and a gasket 8 is provided for sealing the same casing relatively to the electric motor.

The gear case is separated from the pump body by an air gap 9, the two casings being connected together by means of lugs 10, 11, 12 and 13. The impeller 14 of the centrifugal pump is preferably of the closed conduit type.

Fig. 2 is a sectional view in a plan between the gear case and the pump proper, showing the free space around the impeller driving shaft.

The high speed electric motor drives the impeller, preferably at an elevated speed, through a suitable train of gears, the air being admitted through the inlet 33 and delivered through the outlet 34 to the conduit leading to the instrument gyros.

The air thus delivered enters under a suitable pressure into an injection nozzle of the apparatus,

The jet of air is directed upon the blades of conventional type carried by the gyro and rotates the latter. The centrifugal pump proper operates on air free from oil since it is distinctly separated from the gear case, the gear wheels of which require oiling. The air delivered by the pump is thoroughly dry, thus avoiding the gumming of the board instrument members which would be detrimental to the satisfactory working of the same.

Fig. 3 shows a two-vane pump driven by an electric motor 15. One vane, 17, is directly driven by said motor through a splined sleeve 16. This vane is mounted upon a shaft 18 which is carried in the casing 19 by means of bearings 20, 21. The other vane, 22, is driven by the shaft 23 and the gears 24, 25. Its shaft is also supported at some distance by bearings 28, 27. The case containing the gears and bearings supports the vane shafts and is separated from the pump casing proper as shown by the space 26. This gear case is sealed by oil retaining rings of conventional design.

The lugs 29, 30, 31 and 32 connecting the pump and gear casings together are shown in Fig. 4.

Fig. 6 shows the connecting lugs 31, 32 and the open gap 26 around the vane shafts.

The driving gears and bearings may thus be lubricated, the two casings being distinctly separated from each other. The vane pump proper operates without any lubrication and delivers dry air under a suitable pressure for the same purpose as indicated relatively to the centrifugal pump or any other purpose.

The invention is in nowise limited to the embodiments shown and described as these are given only as an example.

The gyros of board instruments are presently driven by low pressure air. A pump, usually driven by the engine, sucks air off a sealed casing of the gyro; this casing comprises an injection nozzle through which air from the outside enters under the influence of the depression produced by the suction of the pump, the jet being suitably directed onto the blades of the gyro so as to ensure its rotation. The depression or the pressure differential necessary between the outside and the inside of the casing to secure the normal run of the gyro amounts to about 130 g. It will thus be readily apparent that at high levels, when the ambient atmospheric pressure falls to low values, this depression can only be obtained with much difficulty, even with a pump having a good efficiency.

It has been suggested to utilize the delivery of a volumetric pump of the vane type blowing into the gyro nozzle, the casing being connected with the open air. This solution requires however the provision of a perfect oil purifier in order to free the air from the oil used to lubricate the pump, inasmuch as the board instruments cannot resist to the gumming caused by impurities carried by the air delivered by the pump.

This invention relates to combinations of means aiming to provide a flow of air under pressure by means of a pump, the air thus delivered being entirely free from impurities, more particularly from oil droplets.

The invention consists essentially in that those driving and bearing members of the pump which require to be lubricated are arranged in a first sealed casing while the air pulsating members of the same pump are arranged in a second casing having no communication whatever with the first casing. The shaft of the pump proper is thus supported in the first casing, while it is overhanging and free from bearings in that casing through which the entrained air flows.

Means are further provided in order to prevent oil particles from running along said shaft extending from the drive casing to the air pulsating casing.

According to one embodiment, the two casings are separated by an open space.

In the case of a centrifugal pump, the roll gearings and the driving gear wheels of the impeller are mounted in the lubricated casing, the impeller itself being mounted upon an overhanging part of its shaft and free from bearings in the pump casing proper.

In the case of a volumetric pump of the vane-type, the driving gear wheels are mounted in the lubricated casing while the vanes, mounted upon overhanging parts of the shafts of said wheels, rotate in the pump casing without any bearings and without lubrication.

A pump of this type, electric drive being assumed, may be located in the neighbourhood of the board instruments, thus doing away with long piping and losses of head.

In the case of a stratospheric airplane having a sealed cabin, the pump, located inside the cabin, sucks off the air at a pressure higher than the ambient pressure, which allows the use of a pump of smaller volume for a given capacity in weight of air.

Other features and advantages of this invention will moreover be apparent from the following description of various embodiments shown, solely by way of an example, on the annexed drawings in which:

Fig. 1 is a sectional view of a centrifugal pump according to the invention.

Fig. 2 is a section on the line II—II of Fig. 1.

Fig. 3 is a sectional view of a volumetric pump of the vane type.

Fig. 4 is a section on the line IV—IV of Fig. 3.

Fig. 5 is an end view of Fig. 3, the casing cover being removed.

Fig. 6 is a fragmentary plan view of the pump of Figs. 3, 4 and 5.

The centrifugal pump shown in Fig. 1 is driven by an electric motor which is provided with a cooling device comprising a small turbine 1 keyed on the rotor shaft 2 and which, by means of gear wheels 3 and 4, operates the shaft driving the centrifugal pump impeller, the pump shaft being supported by two roll bearings 5, 6. An oil retaining ring 7 is provided for sealing the gear casing, and a gasket 8 is provided for sealing the same casing relatively to the electric motor.

The gear case is separated from the pump body by an air gap 8; the two casings being connected together by means of lugs 10, 11, 12 and 13. The impeller 14 of the centrifugal pump is preferably of the closed conduit type.

Fig. 2 is a sectional view in a plan between the gear case and the pump proper, showing the free space around the impeller driving shaft.

The high speed electric motor drives the impeller, preferably at an elevated speed, through a suitable train of gears, the air being admitted through the inlet 33 and delivered through the outlet 34 to the conduit leading to the instrument gyros.

The air thus delivered enters under a suitable pressure into an injection nozzle of the apparatus. The jet of air is directed upon the blades of conventional type carried by the gyro and rotates the latter. The centrifugal pump

proper operates on air free from oil since it is distinctly separated from the gear case, the gear wheels of which require oiling. The air delivered by the pump is thoroughly dry, thus avoiding the gumming of the board instrument members which would be detrimental to the satisfactory working of the same.

Fig. 3 shows a two-vane pump driven by an electric motor **15**. One vane, **17**, is directly driven by said motor through a splined sleeve **16**. This vane is mounted upon a shaft **18** which is carried in the casing **19** by means of bearings **20**, **21**. The other vane, **22**, is driven by the shaft **23** and the gears **24**, **25**. Its shaft is also supported at some distance by bearings **26**, **27**. The case containing the gears and bearings supports the vane shafts and is separated from the pump casing proper as shown by the space **28**. This gear case is sealed by oil retaining rings of conventional design.

The lugs **29**, **30**, **31** and **32** connecting the pump and gear casings together are shown in Fig. 4.

Fig. 6 shows the connecting lugs **31**, **32** and the open gap **28** around the vane shafts.

The driving gears and bearings may thus be lubricated, the two casings being distinctly separated from each other. The vane pump proper operates without any lubrication and delivers dry air under a suitable pressure for the same purpose as indicated relatively to the centrifugal pump or any other purpose.

The invention is in nowise limited to the embodiments shown and described as these are given only as an example.

While I have described what I at present consider preferred embodiments of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the spirit and the scope thereof.

CHARLES RAYMOND WASEIGE.