EMERGENCY OIL/MIST SYSTEM

The subject invention relates to an emergency oil/mist system embodied in the main lubrication system for a bearing or gear box assembly of a gas turbine engine, and more particularly, to an emergency lubrication supply system for providing a pressurized spray of lubricant so as to create extremely small droplets of a uniform distribution of oil on the bearing for a limited period of time after failure of the main lubrication supply system.

In gas turbine engines, as employed in high speed aircraft, the rotational shafts are journalled within bearing boxes for rotation with respect to the engine frame members, and thus the bearings must be continually supplied with a stream of lubricant. Generally, the main lubrication supply system includes a large reservoir of lubricant, and pump means are provided for distributing the lubricant through conduits to the various bearings and gear box assemblies. The latter are usually housed within enclosed sumps such that the oil collected at the bottom of each sump is returned to the main reservoir by scavenging devices, after which the lubricant is again pumped in a continuous circuit back to the bearings or gear box assemblies. As is readily apparent, it is of extreme importance that the movable bearings or gear box assemblies are continuously lubricated in order to prevent premature failure by seizing of the relatively movable parts. The various components of the main lubrication supply system, because of their size, are generally located external to the engine casing where they are susceptible to damage, as in the case of a gas turbine engine as embodied in a military aircraft where the exposed components of the main lubrication supply system are vulnerable to enemy fire. As is readily apparent, in the case of a rupture or puncture in the oil lines or components in the main lubrication supply system, the oil pressure and flow to the individual bearings or gear box assemblies will be quickly interrupted, and continued operation of the gas turbine engine will rapidly result in seizure of the bearings and/or gear box assemblies, resulting in engine failure.

Heretofore in order that the gas turbine engine and the aircraft may continue to safely operate for a limited period of time after rupture or puncture of a component in the main lubrication supply system, an emergency oil reservoir has been suggested for providing lubricant to a lubricated part for a limited duration after failure of the main lubrication supply system. The inclusion of the emergency oil reservoir is of critical importance particularly for military aircraft operating under combat conditions, and generally it has been suggested that a plurality of emergency oil reservoirs be strategically located throughout the aircraft gas turbine engine in the vicinity of the bearings and gear box assemblies. Generally each emergency oil reservoir is filled from the main oil supply system and may include either a gravity feed drain or an air pressure means for supplying a stream of oil to the bearings, with the supply of oil from each emergency reservoir being generally closed off by a series of check valves during normal operation. In the event of a loss of oil pressure or supply, manual or automatic actuation of the check valves is required to open the supply of emergency oil. The disadvantage of such an emergency supply system is that closing off of the emergency oil reservoirs during normal engine operation results in oil stagnation which gradually leads to heat degradation of the oil, and the gravity feed system of most conventional emergency oil supply systems may not provide a sufficient stream of air to adequately lubricate the contacting surfaces of the lubricated parts and does not supply a cooling air flow to the lubricated parts.

It has also been known to provide an emergency lubrication supply system including an oil reservoir in substantial proximity to the lubricated part, with conduit means extending from the emergency reservoir having an outlet located adjacent the bearing to be lubricated. Pressurized air flow is continuously provided over the emergency reservoir outlet means for creating a suction therein for drawing lubricant through the conduit both during normal operation, and during emergency operation when the main oil source has been disabled. Accordingly, with this emergency lubrication supply system, lubricant within the emergency reservoir is continually being depleted during normal operation of the aircraft engine.

Accordingly, it is an object of the subject invention to provide a new and improved emergency oil supply system for providing, for a limited duration after failure of the main lubrication supply system, a pressurized spray of lubricant mist to the bearing in the form of small droplets of a uniform distribution of oil on the bearing for preventing seizure of the relatively movable parts, thereby precluding catastrophic engine failure.

It is a further object of the subject invention to provide an emergency oil supply system wherein the emergency oil reservoir is disposed in the circuit extending between the main lubrication supply and the bearing, such that the oil within the emergency reservoir is continually recirculated, and thus is not susceptible to becoming stagnant.

It is still a further object of the subject invention to provide an emergency oil supply system wherein the oil is aspirated from an emergency oil reservoir and is sprayed under high pressure in order to form extremely small droplets of oil which are uniformly distributed over the bearing, thereby expanding the period of time during which the emergency oil system is operative.

It is another object of the subject invention to provide an emergency oil supply system which is fully operative following failure of the main lubrication supply system.

The above and other objects and advantages of the invention are achieved by the subject emergency oil/mist system embodied in the main lubrication system of an aircraft gas turbine engine and including an auxiliary reservoir which is operatively connected in the conduit means extending between the main source of pressurized lubricant and the nozzle for applying oil onto a bearing or gear box assembly. The nozzle is capable of either directing a stream of oil to the bearing (when the main lubrication system is fully operative) or a mist of lubricant comprised of lubricant aspirated from the emergency reservoir and high pressure air (when the main supply lubrication supply system has failed). A control piston valve interconnects the emergency reservoir to an atmospheric vent, and also connects a source of pressurized air to the air aspirator nozzle. Upon failure of the main lubrication system, the control valve is actuated such that pressurized air is provided to the nozzle and, by air aspiration, withdraws oil remaining in the emergency reservoir. The valve also connects the emergency reservoir to the atmospheric vent thereby providing an effective control on the amount of oil aspirated from the emergency reservoir. By this ar-