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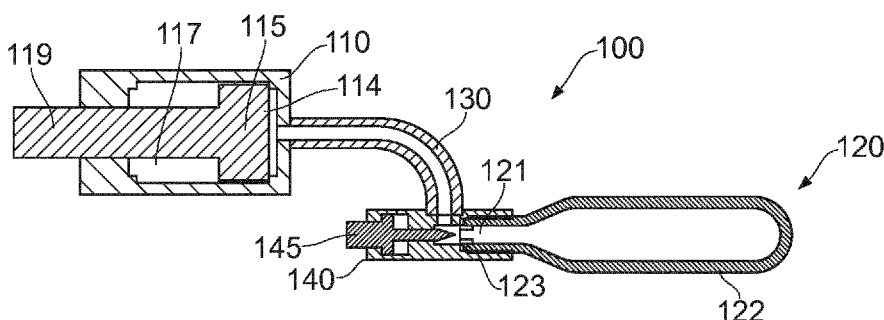


FIG. 1a

(57) Abstract: The present invention relates to a disconnect device (100) for disconnecting a generator from an aircraft engine. The disconnect device (100) comprises a pneumatically actuated disconnect mechanism (110) which is suitable for coupling to a generator of an aircraft engine, and a gas storage means (120) in fluid communication with the pneumatically actuated disconnect mechanism (110). The disconnect device (100) uses gas stored in the gas storage means (120) to cause the pneumatically actuated disconnect mechanism (110) to move from a first connected position to a second disconnected position, thereby allowing disconnection of a generator from an aircraft engine.



Aircraft Engine Generator Disconnect Device

The invention relates to disconnect devices for disconnecting a rotational drive of an aircraft engine from a generator driven by the engine. In particular, the invention relates to a gas powered disconnect device, for use in such aircraft engines.

Background to the Invention

Aircraft engines can comprise electrical generators which generate electricity used by the aircraft during operation. Typically, the electrical generators are driven by a drive shaft which is connected, directly or indirectly, to the main turbine of the aircraft engine.

As with any mechanical system, mechanical failures can happen in the electrical generators of aircraft engine. A disconnect device which can mechanically decouple the electrical generator from the engine's turbine must therefore be provided. Even though the loss of electrical generation capacity through disconnection can be serious, if a malfunctioning generator is not disconnected from the turbine, the aircraft engine as a whole may be damaged or its performance hindered.

The majority of prior art disconnect devices used in this context provide a means by which an axial force can be applied to the drive shaft, causing the drive shaft to move axially which in turn enables a decoupling mechanism to operate. Known methods exist for providing this axial force in the prior art, each of which has its own disadvantages. These three known methods are:

1. Extracting mechanical power from the rotating drive shaft to operate a disconnect mechanism. Whilst this enables very high actuating forces and rapid disconnection, these disconnect mechanisms typically require a selective assembly process and so often prove unreliable under rotor bearing failure with loss of radial location. Therefore, this method has proved to be unreliable in use;
2. Using a large actuator and a mechanical advantage, or using an actuator to release a large and powerful spring. These methods typically have a more robust assembly process and thus prove to be more reliable in service. However, the axial force they can produce is typically limited. Therefore, this method cannot ensure a successful disconnect in all likely failure scenarios;

3. Using hydraulic pressure from the oil cooling system of an aircraft engine to provide the axial force required for disconnection. Whilst this solution can provide very high disconnecting forces, this method does not work in the event of a failure in the oil cooling system. Therefore, this method also cannot ensure disconnect in all likely failure scenarios.

There therefore exists a need for an improved disconnect device.

10 Summary of the Invention

A first embodiment of the invention provides a generator drive disconnect device, of a generator arranged to be driven by an aircraft engine, the generator drive disconnect device comprising: a drive transfer means for transferring drive from an input shaft of the generator to a rotor of the generator, and having a first, connected configuration, and a second, disconnected configuration;

a pneumatically actuated disconnect mechanism, configured to move the drive transfer means from the connected configuration to the disconnected configuration to disconnect the input shaft from the rotor;

a gas storage means for storing a pressurised gas; and

a gas release means, arranged to release gas stored in the gas storage means upon activation, such that the released gas causes the pneumatically actuated disconnect mechanism to move the drive transfer means from the connected configuration to the disconnected configuration.

The drive transfer means may comprises a separable drive transfer device. The transfer of a drive input from one shaft to another can be prevented by separating engaging parts of the device. The drive transfer means may comprise a clutch arrangement or a separable drive shaft.

The pneumatically actuated disconnect mechanism may comprise a pneumatic actuator having a stroke length sufficient to disconnect the separable drive input device.

The gas release means may comprise a stored potential energy device, the stored potential energy device arranged to puncture the gas storage means to release the

stored gas. Any suitable connectable and disconnectable drive transfer mechanism may be used in the disconnect device.

5 The stored potential energy device may comprise a spring loaded mass. The spring loaded mass may be arranged to puncture the gas storage means to release the stored gas.

10 The generator drive disconnect device may further comprise a trigger means, arranged to activate the gas release means.

15 The trigger means may comprise a latch means arranged to hold the trigger means in a first primed condition. Release of the latch means to release the stored potential energy device may cause the stored potential device to puncture the gas storage. The trigger means may comprise an electrical solenoid. The trigger means may comprise a spring assisted lever or an electromagnetic device, such as a solenoid. The gas storage means may comprise a rechargeable pressure chamber. The gas storage means may comprise a single-use pressure chamber.

20 The pneumatically actuated disconnect mechanism may be arranged radially around and spaced from an axis of rotation of the drive transfer means.

The stored gas may comprise gaseous Nitrogen or gaseous Carbon Dioxide (typically).

25 The generator drive disconnect may further comprise a gas escape port, configured to enable the released gas to escape from the piston chamber of the pneumatically actuated disconnect mechanism. The gas escape port may provide a greater flow restriction to the escaping gas than is provided by the flow path from the gas storage means to the piston chamber of the pneumatically actuated disconnect mechanism.

30 The generator drive disconnect device may further comprise a disconnect latch device, configured to hold the disconnect mechanism in the disconnected configuration.

35 The invention further provides an aircraft engine assembly comprising a generator drive disconnect device in with the invention.

The invention further provides an aircraft comprising an aircraft engine assembly in accordance with the second embodiment of the invention.

5 Brief Description of the Drawings

By way of example only, embodiments of the invention will now be described with reference to the accompanying drawings, in which:

10 Figure 1a shows a generator drive disconnect device in accordance with an embodiment of the invention;

Figure 1b shows the generator drive disconnect device of Figure 1a in a second configuration;

15 Figure 1c shows the generator drive disconnect device of Figure 1a in a third configuration;

Figure 2 shows a generator drive disconnect device in accordance with an
20 embodiment of the invention;

Figure 3 shows a generator drive disconnect device in accordance with an embodiment of the invention; and

25 Figure 4 shows the generator drive disconnect device of Figure 3 in a second configuration.

Detailed Description of Preferred Embodiments

30 Embodiments of the invention involve the use of energy stored in the form of a pressurised gas as a power source for the actuation of a disconnect mechanism. The axial force required to actuate the disconnect mechanism of the generator drive disconnect device can be very large. For example, more than 5000 N may be required. Advantageously, the present invention can reliably provide this high level
35 of force and therefore reliably actuate the disconnect mechanism of a generator drive disconnect device, even under the high torque conditions which can be found in the final stages of mechanical failure of an aircraft generator. Advantageously,

the high actuation force can be provided using a relatively low activation or triggering force to release the pressurised gas.

Figure 1a illustrates a first embodiment of a pneumatically actuated disconnect mechanism 110 which can be implemented in a generator drive disconnect device 100 of a generator arranged to be driven by an aircraft engine. The illustrated pneumatically actuated disconnect mechanism 110 is suitable for disconnecting a generator (not shown) from an aircraft engine (not shown), as will become apparent in light of the description of the later drawings. A generator drive disconnect device 100 in embodiments therefore includes a pneumatically actuated disconnect mechanism 110. The pneumatically actuated disconnect mechanism 110 may be coupled at a first end to a drive transfer means connected to a drive shaft or input shaft of a generator in an aircraft engine. The pneumatically actuated disconnect mechanism 110 uses a compressed gas to move a piston 115 from a first position to a second position. Movement between the first and second position, and the effect of such movement, will be discussed in more detail below, but in general terms has the effect of moving a drive transfer means for transferring drive from an input shaft of the generator to a rotor of the generator from a first, connected configuration, to a second, disconnected configuration. This has the effect of disconnecting the rotor of the generator from its input shaft and/or from any other machinery connected to its input shaft.

The generator drive disconnect device 100 also comprises a gas storage means 120. The gas storage means 120 is used to store a gas at a high pressure for later use by the pneumatically actuated disconnect mechanism 110. The gas storage means 120 should be suitable for operation across all temperature ranges that the generator drive disconnect device 100 is likely to encounter. In applications such as aircraft engines this temperature range may be from -50°C to $+150^{\circ}\text{C}$. The gas storage means should also be suitable for storing gas at high pressure, for example 300 Bar or higher. Suitable welded steel and welded aluminium cylinders are commercially available to meet these requirements. The illustrated gas storage means has a body 122 configured to provide a pressure chamber, and an outlet 121. The outlet 121 may comprise a frangible portion 123 which can be provided with a structure configured to allow perforation of the frangible portion at a weakened region of the frangible portion. This can be provided with, for example, a separate cap, or a wall portion, having a thinner wall thickness than the remainder of the container. A repeatable connection means, such as a screw thread, bayonet

connection, or other repeatable fitting which enables repeated connection and disconnection of the chamber 120 from the disconnect mechanism may be provided. This allows renewal and replacement of the gas storage means for maintenance or recharging purposes.

5

Outlet 121 of the gas storage means 120 is arranged to be in fluid communication with the pneumatically actuated disconnect mechanism 110. In Figure 1a, the generator drive disconnect device is shown as having a pipe 130 which provides a fluid connection between the gas storage means 120 and the pneumatically
10 actuated disconnect mechanism 110. The pipe 130 is arranged to transfer gas, when released from the gas storage means 120, to a first side 114 of the piston 115.

The piston 115 is configured to move within a chamber 117, from a first position to
15 a second position, through the force applied on the piston by gas from the gas storage means 120. The piston 115 is operably connected to a shaft 119. At least a portion of the shaft 119 extends outside of the chamber 117 to provide an external actuation movement. This external actuation movement may be used to move a drive transfer means (not shown in Figure 1a) of the generator drive disconnect
20 device from a first, connected, configuration, to a second, disconnected configuration. The drive transfer means will be described in greater detail with reference to Figures 3 and 4.

The generator drive disconnect device 100 also comprises a gas release means 140.
25 The gas release means 140 is arranged to release the gas stored in the gas storage means 120 upon activation. The gas release means 140 may operate by use of a puncture device 145 being operated to puncture a portion of the gas storage means 120. A puncture device is advantageous in that it is both quick and reliable. However, a puncture device may preclude refilling of the gas storage device for re-
30 use, unless a replaceable portion is provided which is punctured when the gas is released, such as a replaceable cap.

Figure 1a illustrates the generator drive disconnect device 100 before it has been activated. Figures 1b and 1c illustrate the same generator drive disconnect device
35 100 as it is triggered.

In Figure 1b, the gas release means 140 has been triggered causing the puncture device 145 to move from a first, primed, position to a second, activated, position. In the activated position, the puncture device has punctured the gas storage means 120.

5

Figure 1c illustrates the next step in the operation of the disconnect device. In figure 1c, the gas storage means 120 has been punctured. The force of the now unrestrained gas in the gas storage means 120 causes the puncture device 145 to be driven away from the gas storage means and out of the perforation made in the gas storage means, to the left in the image of Figure 1b, opening a fluid pathway between the gas storage means 120 and the pipe 130. Therefore, the gas stored in the gas storage means 120 is free to move through the pipe 130 and hence reach the first side 114 of piston 115. Given the pressure differential between the gas storage means and the pipe 130, stored gas will move rapidly from the gas storage means 120 through the pipe 130 to the piston 115, until a pressure equilibrium has been reached. The force of the high pressure gas acting on the piston 115 causes the piston 115 to move from the first, resting, position to the second, actuated, position.

The distance between the first resting position of the piston 115 and the second actuated position (i.e. the stroke length of the pneumatically actuated disconnect mechanism) is set to provide an actuation length sufficient to disconnect a drive transfer means of a generator of an aircraft engine. The drive transfer means can comprise a clutch mechanism arranged to selectively transfer drive from the input shaft 387 (see Figures 3/4) to the rotor shaft 390 of the generator. Other arrangements for such a drive transfer means can include a separable drive shaft including a separable connection such as a spline connection which, when driven apart axially disconnects a drive transfer between the input shaft and the rotor of the generator. Any device which can be disconnected by application of either a linear or radial translation of mating components can perform such a function and embodiments preferably include a pneumatically actuated disconnect mechanism, as described in the present description. A spline 389 may be provided to connect the generator to a gearbox of an aircraft engine (not shown) via its output shaft 387.

35

A stored high pressure gas in conjunction with a pneumatic actuator can provide the requisite axial force required to ensure disconnect of a drive shaft of a generator

in an aircraft engine (not shown) under all likely failure conditions. Having an independent stored gas source of sufficient pressure to actuate the drive transfer means to a disconnected configuration ensures that the generator drive disconnect device 100 is not affected by a loss of pressure, power or motion in other connected systems or components. The use of a pressurised gas source also enables a relatively small input force (from the gas release means 140) to produce a very large output force (through release of stored gas acting on the pneumatically actuated disconnect mechanism 110).

Being able to initiate the generator drive disconnect device 100 with a small input force is particularly advantageous in protecting against mechanical failures in electrical generators, as little or no mechanical or electrical power may be available to the generator drive disconnect device in certain cases of generator failure or failure of other aircraft systems. The presently described system requires such a small input force that an independent battery powered release mechanism, such as a solenoid, a gravity driven mass system or a spring driven mass system can provide the requisite input force. This can further increase the reliability of the system.

An exemplary gas release means 240, which can be implemented in any of the embodiments described herein, is illustrated in more detail in Figure 2. The gas release means 240 has a puncture device 245 which is operable to puncture a gas storage means 220. The puncture device 245 has both a sharp piercing end, for puncturing the gas release means 240, and an input end, which may be substantially blunt, for receiving an input striking force. When the puncture device 245 is struck at the blunt end, the puncture device is driven from a first, resting position, to a second position which punctures the gas storage means 220.

The puncture device 245 can be restrained into its first resting configuration by a retaining or biasing means, such as a spring 250, in order to avoid accidental puncturing of the gas storage means 220. The spring 250 can be provided with sufficient resistive force to restrain the puncture device 245 during movement of the gas release means 240, yet a low enough resistive force to enable the puncture device 245 to puncture the gas storage means 220 when triggered.

The gas release means 240 also has an actuation plunger 260. The actuation plunger is arranged to move between a first, primed, position and a second,

released, position when released. In the primed position the actuation plunger 260 is biased against a spring 265 and held in said primed position by a latch 270. Release of the latch 270 can release the actuation plunger 260 from being held in the primed position. The biasing force of the spring 265 then drives the actuation
5 plunger 260 from the primed position to the released position. In arriving at the released position, the actuation plunger 260 strikes the input end of the puncture device 245 and drives it into the puncture device's second position thereby puncturing the gas storage means 220. The plunger 260 may be provided with wear
rings 261 to allow movement within the chamber 241 of the gas release means.

10

The gas release means therefore may form a stored potential energy device. The stored potential energy device being arranged to puncture the gas storage means 220 to release the stored gas. In the above example, the stored potential energy device comprises a spring loaded mass (actuation plunger 260). It is the spring
15 loaded mass that is arranged to puncture the gas storage means to release the stored gas. Alternatively, the gas release means may make use of stored gravitational potential energy, or a further compressed gas means as a source of energy, or other sources of stored potential energy.

20

The use of a relatively high-mass actuation plunger 260 and/or a relatively strong spring 265 enables a large force to be applied to the puncture device 245 with a very low input force. To further reduce the required input force, the latch 270 may comprise a lever and/or a pivot and/or a bias spring 271 to hold the latch in its latched position. The release of the latch 270 to actuate the gas release means can
25 lower the requisite force to release the actuation plunger 260. The use of a mass and a striker (puncture device) of the form described allows use of a weaker spring 265 for driving the plunger 260, due to the kinetic energy of the mass gathered during acceleration of the mass by the spring translating to a large puncturing force on impact with the gas storage means 220, due to a more rapid deceleration
30 provided by the plunger 260 of the puncture device impacting the gas storage means.

35

The presently described generator drive disconnect device may be combined with any known system which requires a substantially linear force to cause separation
of a drive shaft of an electrical generator, or of a drive transfer means connecting such a drive shaft, to effect a disconnect of the generator. Figure 3 illustrates an
exemplary generator drive disconnect device 300, comprising a clutch, which may

be used to disconnect a generator. The clutch arrangement is illustrated as comprising a dog clutch 380, but any suitable type of clutch may be used.

5 In one example, a plunger 260 of mass 0.125kg is driven by a spring having an average force over its stroke of 28N. This can create a puncturing force, preferably of between 220N - 340N, to puncture a gas storage means capable of retaining Nitrogen at up to 3000psi.

10 Generator drive disconnect device 300 can comprise a dog clutch 380, or any suitable connectable and disconnectable drive transfer device, which can couple two drive shafts together, or can couple a drive shaft to a drive input. In Figure 3, dog clutch 380 is coupling a rotor shaft 390 (of a generator) to an input shaft 387 of the generator, which in turn connects to gearbox drive shaft 395 (of an aircraft engine). In a first, coupled, state, illustrated in Figure 3, a spring 382 of the dog
15 clutch 380 causes a first plate 384 (which is coupled to the rotor shaft 390 of the generator) to contact a second plate 386 (which is coupled to the gearbox drive shaft 395, preferably via the separate input shaft 386). Friction between the first plate 384 and the second plate 386 in the case of a friction based clutch mechanism, and/or the meshing of teeth of dogs or face gears of the respective first and second
20 plates in certain embodiments, couples a rotational driving torque between the rotor shaft 390 and the gearbox drive shaft 395, allowing the gearbox drive shaft to drive the rotor shaft (or vice versa, which can allow the generator to function as a starter-generator if required).

25 The generator drive disconnect device also comprises a pneumatically actuated disconnect mechanism 310, which functions in accordance with the broad aspects of the previously described embodiments. The pneumatically actuated disconnect mechanism 310 is arranged to be engageable with a first plate 384 of the drive transfer means to disengage the drive transfer means 380. This is preferably
30 achieved by engaging a flange 383 of the plate 384. The pneumatically actuated disconnect mechanism 310 uses a compressed gas to move piston 315 from a first position to a second position. Movement between the first and second positions, and the effect of such movement, will be discussed in more detail in connection with Figure 4.

35 The generator drive disconnect device 300 also comprises a gas storage means (not shown) in accordance with the previously described embodiments of the invention.

An outlet of the gas storage means is arranged to be in fluid communication with the pneumatically actuated disconnect mechanism 310. In Figure 3, the generator drive disconnect device 300 is shown as having a conduit 330 which provides a fluid connection between the gas storage means (not shown) and the pneumatically actuated disconnect mechanism 310. The pipe 330 is arranged to transfer gas when released from the gas storage means, to one side of the piston 315. Seals 311 may be provided to prevent the gas leaking past the piston walls. A spring 312 can be provided to bias the piston to a retracted position in which the drive transfer means 380 is left engaged. This helps to avoid unwanted actuation of the disconnect device.

For improved packaging of the overall disconnect mechanism, the piston 315 can be arranged radially around and spaced from the axis of rotation 340 of the drive transfer means 380. A shaft delivering drive to and/or from the rotor of the generator can therefore pass through the piston 315. The piston is therefore arranged around the shaft delivering drive to or from the rotor of the generator. The piston 315 is preferably substantially annular. Piston 315 can be configured to move within a chamber 317. The chamber 317 can also be arranged around the shaft in a similar manner to the piston, in order to accommodate the piston. The chamber 317 can be substantially annular to receive a substantially annular piston 315. The piston 315 can move from a first position to a second position, through the force applied on the piston by gas from the gas storage means. The piston 315 is operably connected to a mounting portion which may take the form of a shaft 319. A portion of the shaft 319 can extend away from and preferably outside of the chamber 317. This can transfer a force associated with movement of the piston to provide an external actuation movement. This external actuation movement is used to move the drive transfer means 380 from the first, connected, configuration to the second, disconnected, configuration.

The shaft 319 is coupled to a set of stationary bearings 388. The stationary bearings can be moved into contact with the plate 384 of the clutch 380 to provide an axial force to the plate 384, while the bearings allow rotation of the plate 384 relative to the piston 315, while still transferring the axial movement of the piston to the plate 384. Linear movement of the non-rotating piston 315 can therefore cause linear movement of the shaft 319 in an axial direction, which causes the set of stationary bearings 388 to contact the first plate 384. With sufficient force behind the piston 315, the stationary bearings can provide sufficient axial force to the first plate 384

to disconnect the rotor shaft 390 from the gearbox drive shaft 395. This is done by translating the plate 384 away from the plate 386 to disconnect the drive transfer means, in the illustrated case a dog clutch 380.

- 5 The generator drive disconnect device 300 also comprises a gas release means (not shown) in accordance with the previously described embodiments of the invention. The gas release means is arranged to release the gas stored in the gas storage means upon activation, thereby causing the generator drive disconnect device to operate. As will be evident from the above description, this is achieved by delivering
10 the released gas to the inlet 330 to the chamber 317.

- The drive transfer means 380 may further comprise a disconnect latch device 392, configured to hold the disconnect mechanism in the disconnected configuration once the disconnect mechanism has moved to the disconnected configuration.
15 Disconnect latch device 392 can take any suitable form but for the purposes of illustration is schematically shown as a spring biased lever, arranged to cooperate with a locking means 394 provided on the body of the translating portion or plate 384 of the clutch 380. However, any suitable mechanical or other latch means may be used to retain the disconnect mechanism in the disconnected state. This can
20 help to prevent re-engagement of the drive transfer means (clutch) 380 in the case where the pressure initially delivered to the chamber 317 vents out of the chamber 317.

- Figure 4 illustrates the exemplary generator drive disconnect device of Figure 3 in
25 a disconnected state. Similar reference numerals are used for equivalent features, but prefixed with a 4 rather than the 3 used in Figure 3. In Figure 4, the gas release means (not shown) has been operated, causing the gas storage means (not shown) to release the stored gas via conduit 430 into the chamber 417, where it meets one end of piston 419. Piston 419 moves through the cylinder 417 causing shaft 419
30 and the set of stationary bearings 488 to move towards first plate 484. The stationary bearings 488 are caused to contact the first plate 484 thereby separating first plate 484 from second plate 486 (and hence uncoupling rotor shaft 490 from gearbox drive shaft 495 and the input shaft 487). The disconnect latch 492 can retain the disconnect device in a disconnected state regardless of the pressure in
35 the chamber 417.

In the above described exemplary devices, the gas storage means 120/220 is illustrated as a separate but connected component in the system. In some embodiments, the gas storage means may be integrated into one or more components of the generator drive disconnect device in order to reduce the form factor of the generator drive disconnect device.

Figures 3 and 4, illustrates an example which uses a cylinder formed around a shaft connected to the drive transfer means (e.g. clutch) of the pneumatically actuated disconnect mechanism. This makes use of otherwise un-used space in the generator housing in order to locate the cylinder required to generate the actuation force.

In the above described exemplary devices, the gas storage means 120/220 is punctured in order to release stored gas. Alternatively, the gas storage means may be opened by use of a valve operated by an solenoid valve actuator.

In the above described exemplary devices, the gas storage means 120/220 may be a single-use gas storage means, such as a single-use cylinder, which must be entirely replaced after each discharge. Alternatively, the gas storage means may be rechargeable. Rechargeable gas storage means could be less reliable (due to the possibility of leakage through recharge valves) and heavier due to their longer life and a need to be durable enough to survive repeated use. However, a rechargeable gas storage means may be more cost effective if the generator drive disconnect device is expected to be used multiple times. Reliability may be improved in view of the replacement of the component each time the device is activated.

Where a rechargeable gas storage means is used, the generator drive disconnect device may further comprise an optional gas input port (e.g. 221 in Figure 2), in fluid communication with the rechargeable cylinder. This port enables the rechargeable cylinder to be recharged from an external high pressure gas source. Alternatively, the rechargeable cylinder may be removed from the generator drive disconnect device and re-filled separately from the device. A replaceable cap which is punctured each time the device is discharged may be incorporated into the gas storage means in these instances.

In the above described exemplary devices, the gas storage means 120/220 may be suitable for storing any suitable gas. Due to the extreme pressures and temperatures likely to be experienced by the gas, the gas stored in the gas storage

means is preferably an inert gas, such as Nitrogen, Helium or Carbon Dioxide. The gas may preferably be Carbon Dioxide due to its wide availability, low cost and stable characteristics across the expected temperature and pressure range. However, it is considered that Nitrogen is better suited to the broad temperature
5 ranges experienced in aircraft engines.

The above described generator drive disconnect devices may further comprise a gas escape means (230 of Figure 2) provided in the chamber in which the piston operates. The gas escape means enables the gas, once released from the gas
10 storage means to escape the generator drive disconnect device. The escape rate of the gas must be sufficiently low so as not to hinder actuation of the pneumatic disconnect device. Allowing the gas to escape the generator drive disconnect device ensures that after a period of time, the internal pressure of the generator drive
15 disconnect device lowers to a point that it can be safely disassembled by a service technician. The flow restriction through the gas escape port is therefore higher than the flow restriction provided for gas to flow from the gas storage means to the piston chamber.

Features of the present invention are defined in the appended claims. While
20 particular combinations of features have been presented in the claims, it will be appreciated that other combinations, such as those provided above, may be used.

The above example describe one way of implementing the present invention. It will be appreciated that modifications of the features of the above examples are
25 possible within the scope of the independent claims and that any and all compatible features of any embodiments described separately above, can be combined within a single embodiment of a device in accordance with the invention.

CLAIMS

1. A generator drive disconnect device, of a generator arranged to be driven by an aircraft engine, the generator drive disconnect device comprising:
 - 5 a drive transfer means for transferring drive from an input shaft of the generator to a rotor of the generator, and having a first, connected configuration, and a second, disconnected configuration;
 - a pneumatically actuated disconnect mechanism, configured to move the drive transfer means from the connected configuration to the disconnected configuration
 - 10 to disconnect the input shaft from the rotor;
 - a gas storage means for storing a pressurised gas; and
 - a gas release means, arranged to release gas stored in the gas storage means upon activation, such that the released gas causes the pneumatically actuated disconnect mechanism to move the drive transfer means from the connected
 - 15 configuration to the disconnected configuration.
2. The generator drive disconnect device of claim 1, wherein the drive transfer means comprises a separable drive transfer device.
- 20 3. The generator drive disconnect device of claim 2, wherein the drive transfer means comprises a clutch arrangement or a separable drive shaft.
4. The generator drive disconnect device of any preceding claim, wherein the pneumatically actuated disconnect mechanism comprises a pneumatic actuator
- 25 having a stroke length sufficient to disconnect the separable drive input device.
5. The generator drive disconnect device of any preceding claim, wherein the gas release means comprises a stored potential energy device, the stored potential energy device arranged to puncture the gas storage means to release the stored
- 30 gas.
6. The generator drive disconnect device of any preceding claim, wherein the stored potential energy device comprises a spring loaded mass, the spring loaded mass arranged to puncture the gas storage means upon activation, to release the
- 35 stored gas.

7. The generator drive disconnect device of any preceding claim, further comprising a trigger means, arranged to activate the gas release means.
8. The generator drive disconnect device of claim 7, wherein the trigger means
5 comprises a latch means, arranged to hold the stored potential energy device in a first primed condition, wherein release of the latch means to release the stored potential energy device allows the stored potential energy device to puncture the gas storage.
- 10 9. The generator drive disconnect device of claim 7 or claim 8, wherein the trigger means comprises an electromagnetic device or a spring assisted lever.
10. The generator drive disconnect device of any preceding claim, wherein the gas storage means comprises a rechargeable pressure chamber or a single-use
15 pressure chamber.
11. The generator drive disconnect device of any preceding claim, wherein the pneumatically actuated disconnect mechanism is arranged around and spaced from an axis of rotation of the drive transfer means.
- 20 12. The generator drive disconnect device of any preceding claim, wherein a shaft for delivering a drive to or from the rotor of the generator passes through a piston of the pneumatically actuated disconnect mechanism.
- 25 13. The generator drive disconnect device of any preceding claim, wherein the stored gas comprises gaseous Nitrogen or gaseous Carbon Dioxide.
14. The generator drive disconnect device of any preceding claim, further comprising a gas escape port, configured to enable the released gas to escape from
30 the piston chamber of the pneumatically actuated disconnect mechanism.
15. The generator drive disconnect device of claim 14, wherein the gas escape port provides a greater flow restriction to the escaping gas than is provided by the flow path from the gas storage means to the piston chamber of the pneumatically
35 actuated disconnect mechanism.

16. The generator drive disconnect device of any preceding claim, further comprising a disconnect latch device, configured to hold the disconnect mechanism in the disconnected configuration.
- 5 17. An aircraft engine assembly comprising a generator drive disconnect device in accordance with any of claims 1 to 16.
18. An aircraft comprising an aircraft engine assembly in accordance with claim 17.

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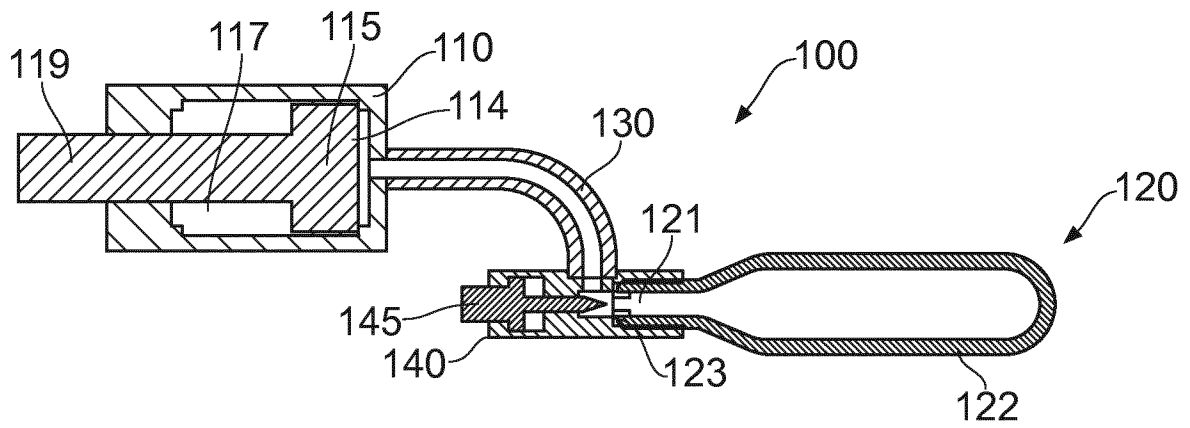


FIG. 1a

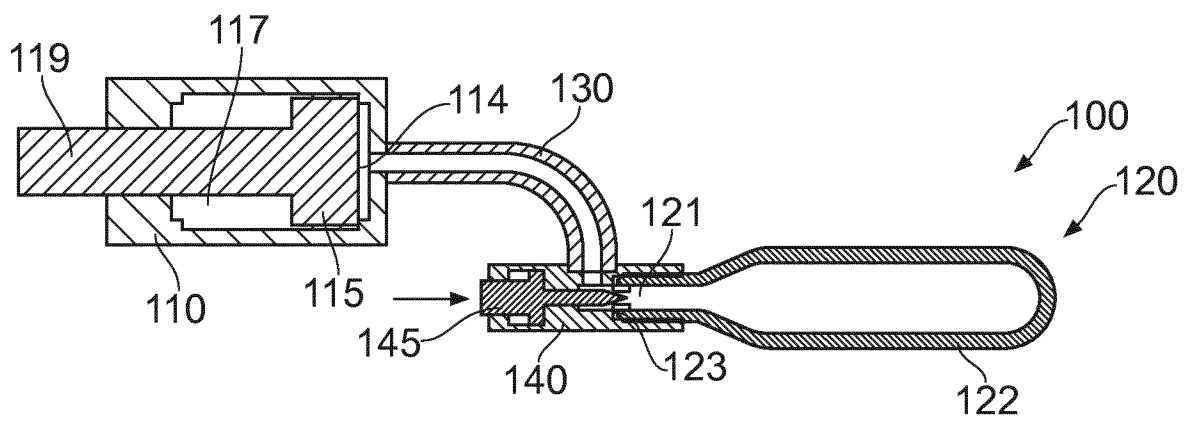


FIG. 1b

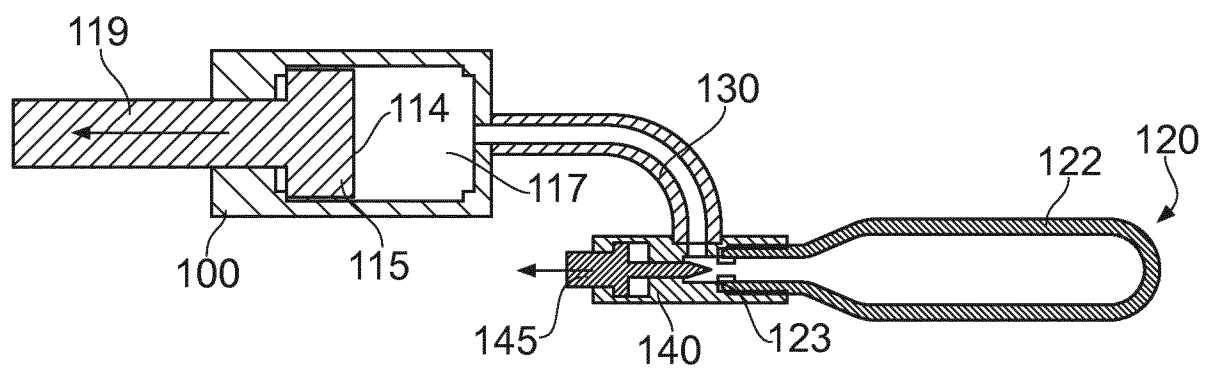


FIG. 1c

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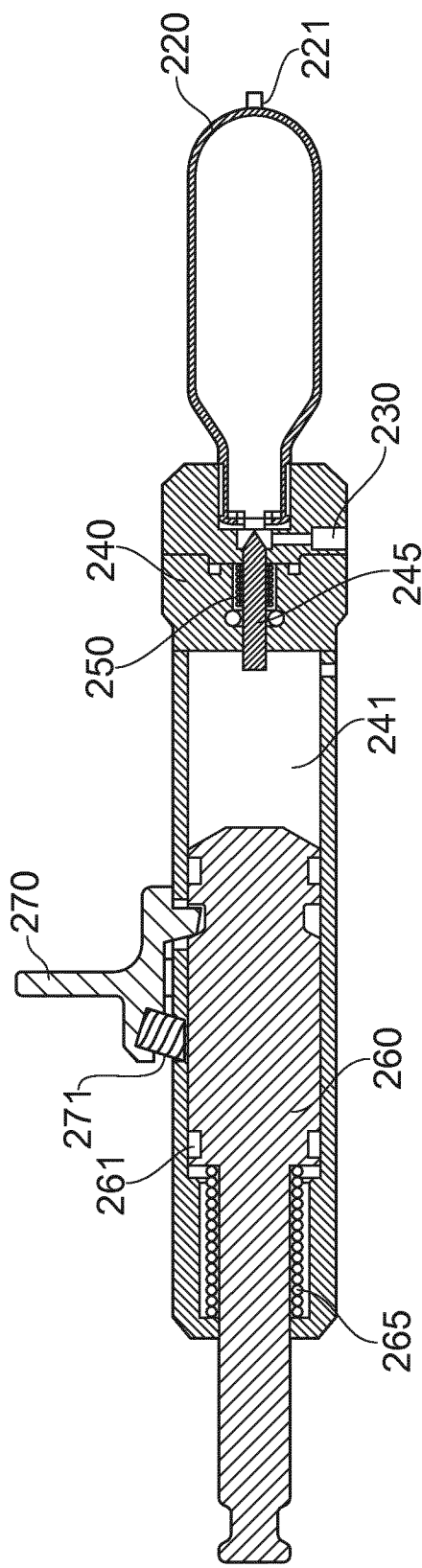


FIG. 2

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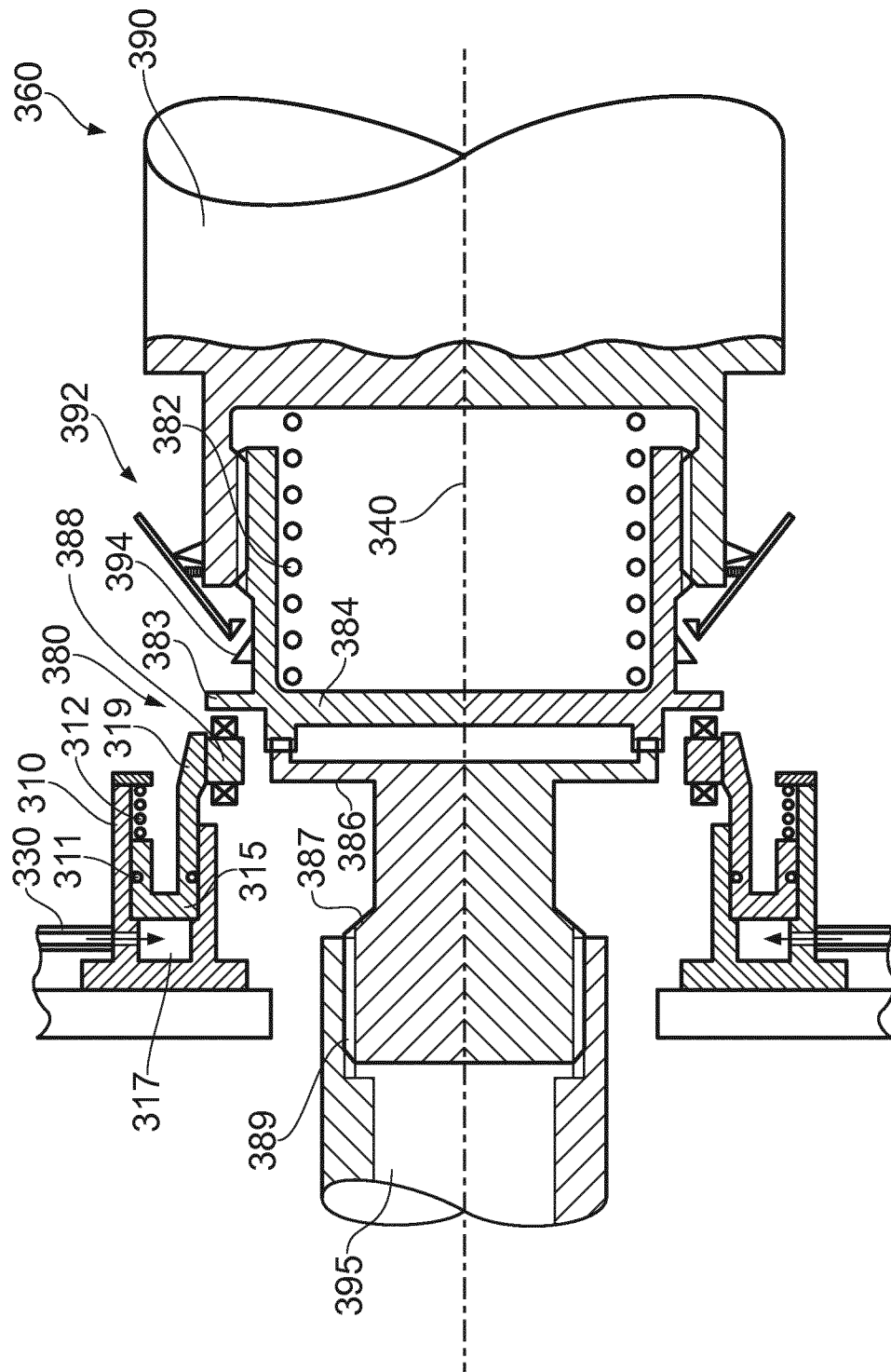


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2018/083354

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16D9/00 F16D11/10 F16D43/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F16D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 391 621 A2 (GOODRICH CONTROL SYS LTD [GB]) 25 February 2004 (2004-02-25)	1-4,7, 10-15, 17,18
Y	paragraph [0021] - paragraph [0028]; figures 1,2	5,6,8,9, 16
Y	----- US 5 051 018 A (APPELL BO [SE] ET AL) 24 September 1991 (1991-09-24) column 3, line 19 - column 4, line 30; figures 1-4	5,6
Y	----- US 4 167 695 A (PHILLIPS ERNEST L) 11 September 1979 (1979-09-11) column 3, line 55 - column 4, line 34; figures 2,3	8,9,16
	----- -/-	



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

7 February 2019

Date of mailing of the international search report

18/02/2019

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SU 941 747 A1 (INST NADEZHNOSTI DOLGOVECHNOST [SU]; Z GOMSELMASH [SU]) 7 July 1982 (1982-07-07) abstract; figure 1 -----	1-3
X	US 4 991 800 A (SCHWARZ ROBERT A [US]) 12 February 1991 (1991-02-12) page 3, line 8 - page 4, line 65; figures 1-4 -----	1-3,17, 18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2018/083354

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