

TOOL FOR REMOVING COLLARS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Application No. 61/898,501, filed November 1, 2013.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] This invention was made with government support under Contract No. F33657-99-D-2051, awarded by the United States Air Force. The Government has certain rights in this invention.

BACKGROUND OF THE INVENTION

[0003] This application relates to a method and tool for removing collars from gas turbine engine systems.

[0004] Gas turbine engines are known and, typically, include a fan delivering air into a compressor where it is compressed and then delivered into a combustion section. The compressed air is mixed with fuel and ignited in the combustion section and products of this combustion pass downstream over turbine rotors driving them to rotate.

[0005] There are many additional systems that may be incorporated into a gas turbine engine. As an example, exhaust liners may be positioned downstream of the turbine section and may include pivoting nozzle members which allow control of the exit of gases from the exhaust.

[0006] Systems, such as the liners, may have hundreds of threaded studs holding various components secured together. The studs typically receive a collar which secures the components together.

[0007] During maintenance, it is sometimes necessary to remove the collars from the studs to disassemble the system. In the existing art, hand held vice grips are utilized to remove the collars. This is not efficient.

[0008] As an example, when such a system is utilized to disassemble a divergent liner for one gas turbine engine, the disassembly alone could require several work days.

SUMMARY OF THE INVENTION

[0009] In a featured embodiment, a method comprises the steps of providing a tool over a collar secured to a stud on a gas turbine engine system. The collet is driven to rotate and remove the collar from the stud.

[0010] In another embodiment according to the previous embodiment, the collet includes a plurality of collet fingers. The collet fingers are driven between a released and a secured position. The collet fingers are in the released position when initially placed over the collar, and then driven to the locked position prior to the collet fingers being driven to rotate to remove the collar.

[0011] In another embodiment according to any of the previous embodiments, the collet fingers move with a piston within a housing. Hydraulic fluid drives the piston to move the collet fingers to the relaxed position at which they define the released position. A spring operates in opposition to the hydraulic fluid to drive the piston and the collet fingers to the secured position.

[0012] In another embodiment according to any of the previous embodiments, a single trigger is actuated to supply the hydraulic fluid to drive the piston, then to release the hydraulic fluid to allow the spring to move the piston and then to actuate a motor to drive the collet fingers.

[0013] In another embodiment according to any of the previous embodiments, the gas turbine engine system is a portion of an exhaust nozzle.

[0014] In another embodiment according to any of the previous embodiments, the portion of the exhaust nozzle is a liner.

[0015] In another embodiment according to any of the previous embodiments, the piston has a conical surface which is forced against an edge surface of an opening in the housing. The conical surface is forced against the edge surface to move the collet fingers to the secured position.

[0016] In another embodiment according to any of the previous embodiments, the piston has a conical surface which is forced against an edge surface of an opening in the housing. The conical surface is forced against the edge surface to move the collet fingers to the secured position.

[0017] In another embodiment according to any of the previous embodiments, the piston has a conical surface which is forced against an edge surface of an opening in the

housing. The conical surface is forced against the edge surface to move the collet fingers to the secured position.

[0018] In another embodiment according to any of the previous embodiments, the gas turbine engine system is a portion of an exhaust nozzle.

[0019] In another embodiment according to any of the previous embodiments, the portion of the exhaust nozzle is a liner.

[0020] In another embodiment according to any of the previous embodiments, the piston has a conical surface which is forced against an edge surface of an opening in the housing. The conical surface is forced against the edge surface to move the collet fingers to the secured position.

[0021] In another embodiment according to any of the previous embodiments, the gas turbine engine system is a portion of an exhaust nozzle.

[0022] In another embodiment according to any of the previous embodiments, the portion of the exhaust nozzle is a liner.

[0023] In another embodiment according to any of the previous embodiments, a tool for removing collars from studs comprises a driver having a housing and receiving a piston moveably within the housing. A spring drives the piston. The housing also has a drive for selectively moving the piston in opposition to a force from the spring. Collet fingers are moveable between a released position and a secured position.

[0024] In another embodiment according to any of the previous embodiments, the drive includes a hydraulic fluid supply opening for selectively receiving a hydraulic fluid to move the piston in opposition to the force from the spring, and supply of hydraulic fluid controlling the movement of the collet fingers between the released position and the secured position.

[0025] In another embodiment according to any of the previous embodiments, the supply of hydraulic fluid drives the piston to the released position and when the hydraulic fluid is released, the spring drives the piston to move the collet fingers to the secured position.

[0026] In another embodiment according to any of the previous embodiments, the housing has an opening and there is a conical surface on the piston. The conical surface is forced against edges of the opening in the housing to cam the collet fingers to the secured position.

[0027] In another embodiment according to any of the previous embodiments, an electric motor drives a shaft having splines which in turn rotate with the piston, but the piston can move axially relative to the splines.

[0028] In another embodiment according to any of the previous embodiments, the collet fingers are separated by slots. The slots are reduced in size when the collet fingers are cammed to the secured position.

[0029] These and other features may be best understood from the following drawings and specification.

BRIEF DESCRIPTION OF THE DRAWINGS

- [0030] Figure 1A schematically shows a gas turbine engine.
- [0031] Figure 1B shows a tool for disassembling systems on the engine.
- [0032] Figure 1C is a detailed view of that tool.
- [0033] Figure 2 shows a first step in disassembling a collar from a stud.
- [0034] Figure 3 shows a subsequent step.
- [0035] Figure 4 shows a final step.

DETAILED DESCRIPTION

[0036] Referring to Figure 1, a gas turbine engine 10 includes a fan section 12, a compressor section 14, a combustor section 16, and a turbine section 18. Air entering into the fan section 12 is initially compressed and fed to the compressor section 14. In the compressor section 14, the incoming air from the fan section 12 is further compressed and communicated to the combustor section 16. In the combustor section 16, the compressed air is mixed with gas and ignited to generate a hot exhaust stream 28. The hot exhaust stream 28 is expanded through the turbine section 18 to drive the fan section 12 and the compressor section 14. In this example, the gas turbine engine 10 includes an augmenter section 20 where additional fuel can be mixed with the exhaust gasses 28 and ignited to generate additional thrust. The exhaust gasses 28 flow from the turbine section 18 and the augmenter section 20 through an exhaust liner assembly 22. Figure 1B shows a tool 11 including a collar driving portion 120 positioned above a base 19. As shown, the tool 11 includes an adjustable frame 17 which can adjust the vertical position of the driver 120. In addition, wheels 13 are provided for making the tool 11 easily transported.

[0037] A system, such as a liner, as shown schematically in Figure 1A, may be placed on the base 19 and the driver 120 may be utilized to disassemble the system for repair.

[0038] Figure 1C shows detail of the driver 120. As shown, collet fingers 32 are spaced by slots 33. The collet moves with a piston 36. A spring 34 normally biases the piston 36 outwardly of a housing 35.

[0039] However, when a trigger 46 is actuated hydraulic fluid from a source 37 is delivered through a port 38 into a chamber 40. This moves the piston 36 back into the housing 35 and against the force of the spring 34.

[0040] As can be seen, the piston 36 has a conical portion 42 moving within an opening 44 in housing 35.

[0041] If the hydraulic fluid is released, then the spring 34 drives the piston 36 back such that the conical surface 42 is forced against edges of the housing opening 44. This cams the fingers 32 together to a driving position as will be explained below. As also shown in Figure 1C, an electric motor 71 drives a shaft 100 which extends through the spring 34. The shaft 100 rotates with a splined member 200 which will drive the piston 36 to rotate when the motor 71 is actuated to turn. Of course, this will drive the collet fingers 32 to turn. As should be understood, due to the splines, the piston 36 can move axially relative to shaft 100. A housing 35 encloses the operational components as described.

[0042] While a hydraulic drive is disclosed, it may be possible to include an electric motor drive in some applications.

[0043] As shown in Figure 2, a liner 22 for a gas turbine engine has studs 25 receiving collars 24 to secure an element 23. Threads 26 are formed on the stud 25. The collet fingers 32 are shown on the collar 24.

[0044] To remove the collar 24, the trigger 46 is initially actuated. This allows hydraulic fluid to move into the opening 38 and force the piston 36 back into the housing 35. Thus, the collet fingers 32 are allowed to move away from each other to a relaxed or released position and can fit over the collar 24.

[0045] As shown in Figure 3, once the collet fingers 32 are positioned about the collar 24, the hydraulic fluid is released, either automatically or with a subsequent actuation of a switch, such as trigger 46. Once the hydraulic fluid is released, the spring 34 drives the piston 36 outwardly such that the edges of the opening 44 force the conical portion 42 to cam

the fingers 32 together and lock on an outer surface of the collar 24. This reduces the size of slots 33, such that fingers 32 are locked.

[0046] Once the collet fingers 32 are locked or in a secured position on the collar 24, an electric motor 71 for driving the piston 36 and, hence, the collet fingers 32 is actuated. When the collet fingers 32 are actuated to turn, they remove the collar 24 as shown in Figure 4. The actuation of the electric motor 71 may be automatic at a point after the driving of the housing outwardly by the spring or may be actuated by a subsequent switch actuation such as the trigger 46. The torque on the motor can be minimized or reduced by controlling the amount of voltage supplied to the electric motor. In one aspect, a PLC controller controls the voltage supplied to the electric motor.

[0047] The present method and tool greatly reduce the challenge of removing the hundreds of collars which may securing together a typical liner for a gas turbine engine.

[0048] The embodiments, examples and alternatives of the preceding paragraphs, the claims, or the following description and drawings, including any of their various aspects or respective individual features, may be taken independently or in any combination. Features described in connection with one embodiment are applicable to all embodiments, unless such features are incompatible.

[0049] Although an embodiment of this invention has been disclosed, a worker of ordinary skill in this art would recognize that certain modifications would come within the scope of this invention. For that reason, the following claims should be studied to determine the true scope and content of this invention.

CLAIMS

1. A method comprising the steps of:

providing a tool having a collet over a collar secured to a stud on a gas turbine engine system which is a liner portion of an exhaust nozzle; and

driving said collet to rotate and remove said collar from said stud,

wherein said collet includes a plurality of collet fingers and said collet fingers being driven between a released and a secured position, with said collet fingers being in said released position when initially placed over said collar, and then driven to said locked position prior to said collet fingers being driven to rotate and remove said collar,

wherein said collet fingers move with a piston within a housing and hydraulic fluid drives said piston to move said collet fingers to a relaxed position at which they define the released position, and a spring operating in opposition to said hydraulic fluid to drive said piston and said collet fingers to said secured position, the movement to the relaxed position includes a piston moving into the housing whereas the movement to the secured position is movement outwardly of the housing,

wherein a single trigger is actuated to supply said hydraulic fluid to drive said piston, then to release the hydraulic fluid to allow said spring to move said piston and then to actuate a motor to drive said collet fingers, and

wherein said piston has a conical surface which is forced against an edge surface of an opening in said housing, with said conical surface being forced against said edge surface to move said collet fingers to said secured position.

2. The method as set forth in claim 1, wherein said gas turbine engine system is a portion of an exhaust nozzle.

3. The method as set forth in claim 2, wherein said portion of said exhaust nozzle is a liner.

4. The method as set forth in claim 1, wherein said piston has a conical surface which is forced against an edge surface of an opening in said housing, with said conical surface being forced against said edge surface to move said collet fingers to said secured position.

5. The method as set forth in claim 1, wherein said gas turbine engine system is a portion of a combustor.
6. The method as set forth in claim 5, wherein said portion of the combustor is a liner.
7. A tool for removing collars from studs comprising:
a driver having a housing accommodating a hydraulically moveable piston within said housing;
a plurality of moveable collet fingers operatively linked to the piston;
a spring biasing the piston, the housing also having a drive including a hydraulic fluid supply opening for selectively receiving a hydraulic fluid to move the piston in opposition to the bias, to control the movement of collet fingers between a released position and a secured position, when hydraulic fluid flows through the opening; and
a trigger to actuate the flow of hydraulic fluid;
their arrangement being such that the movement of the fingers to the relaxed position occurs when the piston moves inwardly of the housing and the movement of the fingers to the secured position occurs when the piston moves outwardly of the housing, the piston having a conical surface which is forced against an edge surface of an opening in the housing, when the latter occurs to force the collet fingers to the secured position.
8. The tool for removing collars from studs as set forth in claim 7, wherein the tool further comprises a supply of hydraulic fluid and when the trigger is actuated the hydraulic fluid drives said piston and the collet fingers to said released position and when the hydraulic fluid is released, said spring drives said piston to move the collet fingers to the secured position.
9. The tool for removing collars from studs as set forth in claim 7, wherein an electric motor drives a shaft having splines which in turn rotate with said piston, but wherein said piston can move axially relative to said splines.
10. The tool for removing collars from studs as set forth in claim 9, wherein said collet fingers are separated by slots, and wherein said slots are reduced in size, when said collet fingers are cammed to said secured position.