

Technical Disclosure Commons

Defensive Publications Series

April 2020

WELDED CASE BOSS

Douglas David Dierksmeier

Jack Dwane Petty Sr.

William Matt Bryant

Follow this and additional works at: https://www.tdcommons.org/dpubs_series

Recommended Citation

Dierksmeier, Douglas David; Petty, Jack Dwane Sr.; and Bryant, William Matt, "WELDED CASE BOSS", Technical Disclosure Commons, (April 06, 2020)

https://www.tdcommons.org/dpubs_series/3098



This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/).

This Article is brought to you for free and open access by Technical Disclosure Commons. It has been accepted for inclusion in Defensive Publications Series by an authorized administrator of Technical Disclosure Commons.

WELDED CASE BOSS

This disclosure relates to mechanical system components that include boss features, such as gas turbine engine cases having one or more bosses.

Gas turbine engine casings typically include a cylindrical container having open ends. In some examples, the casing may include one or more bosses on an internal surface or an external surface of the casing. The bosses may be positioned on the casing for attachment of non-rotatable components of the gas turbine engine to the casing.

In some examples, bosses may be formed on the casing by subtractive manufacturing techniques, such as milling. For example, the casing, including the boss feature, may be milled from a forged part or a cast part using a five-axis milling device or other milling device. In other examples, the casing may be milled, and the bosses may be formed on the milled casing by welding material onto the casing and, optionally, machining the welded material to final dimensions. These subtractive manufacturing techniques may require additional material on the forged part or the cast part for the boss-milling operation or the milling/welding operation. This additional material and milling increases the manufacturing cost and/or manufacturing time relative to techniques that do not require milling.

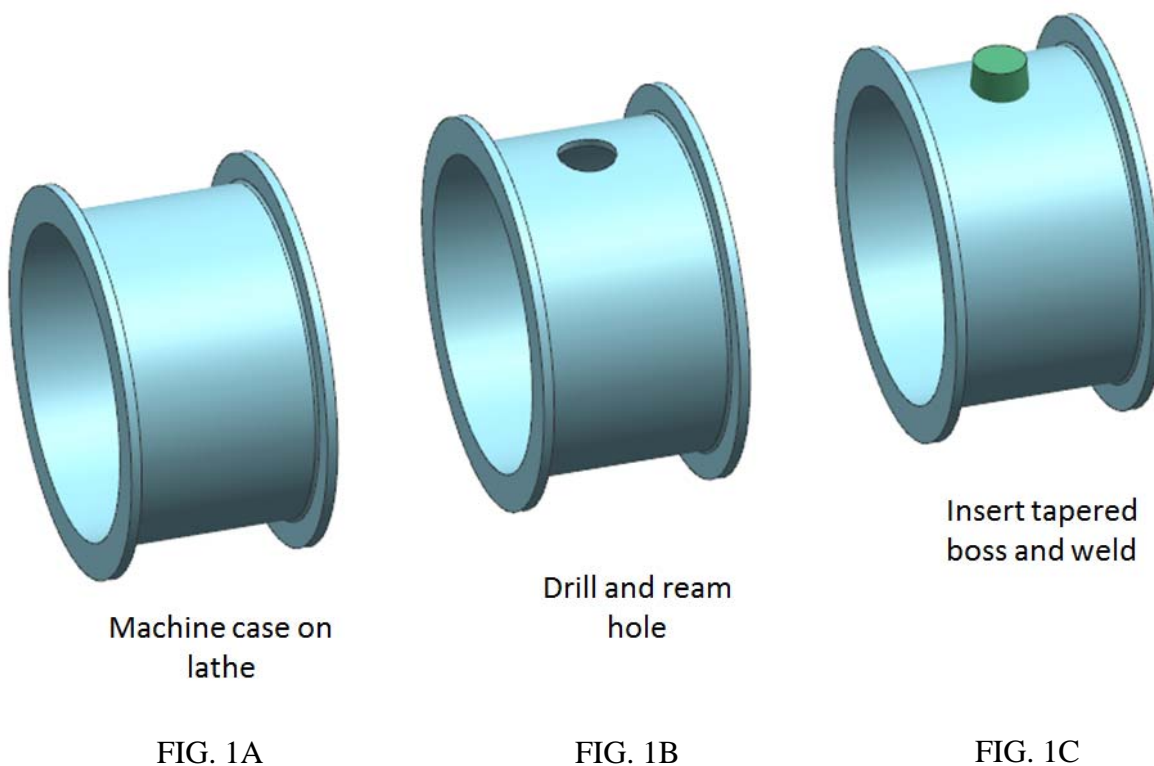
The articles and techniques described herein include cases that are formed by turning, rather than milling, with at least one tapered boss coupled to the turned casing. The tapered boss may be inserted into a hole defined in the wall of the casing. The hole is sized and shaped to receive the tapered boss. The hole may be formed by drilling and, optionally, reaming, to specific tolerances or shape. The tapered shape of the boss may be configured to prevent the separation of the boss from the case during operation when pressure within the casing may be increased.

As illustrated in FIG. 1A, the casing includes a cylindrical wall. The casing is formed by turning on a lathe and selectively removing material to define a selected shape of the casing. In some examples, turning the casing may require removal of less material compared to milling.

Additionally, or alternatively, turning the casing may be relatively less expensive and/or less time consuming relative to, for example, milling the casing.

After turning the casing, a hole may be formed in a wall of the casing, as illustrated in FIG. 1B. For example, as discussed above, the hole may be formed by drilling. In some examples, after drilling the hole, the hole may be reamed to specific tolerances, such as a selected diameter, a selected hole shape, a selected taper of the wall of the casing defining the hole, or the like.

After forming the hole, the tapered boss may be inserted into the hole, as illustrated in FIG. 1C. For example, the boss may be inserted from an interior space defined by the casing into the hole in a radial outward direction.



As illustrated in the partial cross-sectional view of FIG. 2, the tapered boss may extend into the hole defined by the casing such that a surface of the tapered boss is substantially flush with an interior surface of the casing. For example, the surface of the tapered boss may be flush with the interior surface of the casing within common manufacturing tolerances. In other examples, the

boss may be flush with an exterior surface of the casing and extend into an interior cavity defined by the casing. The taper of the boss may be any selected angle. For example, relative to a central longitudinal axis of the boss, an angle of a wall of the boss may be between about 5-degrees and about 30-degrees. In some examples, the wall of the casing defining the hole in the casing may include a taper. The taper of the wall of the casing defining the hole in the casing may correspond to the selected angle of the taper of the boss, or may be a different angle. For example, relative to a central longitudinal axis of the boss, an angle of the wall defining the hole in the casing may be between about 5-degrees and about 30-degrees. In some examples, the angle of the wall of the boss may be selected based on one or more of a thickness of the wall of the casing, a material of the casing, a material of the boss, a surface area of the hole defined by the wall of the casing, and/or an internal pressure within the casing during operation.

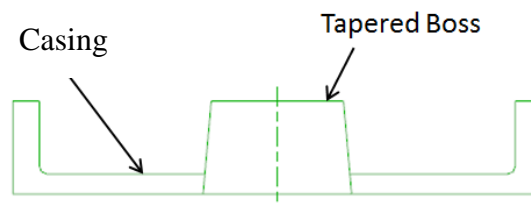


FIG. 2

The boss may be coupled to the casing by any suitable means. In some examples, the boss may be welded into place by using conventional welding techniques. Conventional welding technique may include, for example, metal inter gas (MIG) welding, tungsten inert gas (TIG) welding, shielded metal arc welding, flux-cored arc welding, or the like.

In some examples, the boss may be brazed to the casing. For example, a braze paste may be applied at the weld interface and heat may be applied to the casing and/or the boss to draw the braze material into the weld interface via capillary action. In other examples, the boss may include a presintered perform which may be sintered to the casing by heating the casing and/or the boss.

In some examples, the boss may be coupled to the casing using friction welding. Friction welding may include, for example, inertia friction welding or rotary friction welding. In the example of inertial welding, as illustrated in FIG. 3, the boss may be coupled to a chuck and flywheel having a selected weight that are controllably coupled to a drive motor. The drive motor spins the flywheel and the boss up to a selected rate of rotation to store a selected kinetic energy in the flywheel. Once spinning at the proper speed, the drive motor may be disengaged from the flywheel and chuck, and the boss may be forced radially outward into the wall of the casing. The kinetic energy stored in the rotating flywheel is dissipated as heat at the weld interface as the flywheel speed decreases. The radial force may be kept on the boss after the spinning stops to allow the weld to set as the casing and the boss cool.

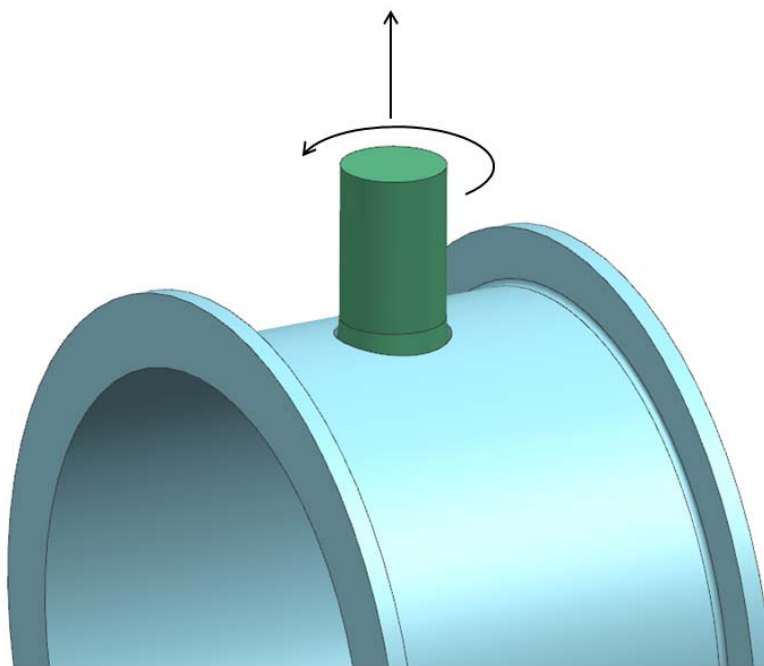


FIG. 3

In some examples, rather than using a flywheel, the drive motor may be coupled to the chuck via a clutch that may disengage the drive motor after a selected amount of heat is generated at the weld interface. In some examples, rather than spinning in a single direction, friction welding may include alternating clockwise and counter-clockwise rotations of a selected degree of the boss, again with a radially outward force applied during rotation. In any case, the heat created by

friction of the rotating boss against the wall of the case allows the metals of the boss and/or the case to bond at the weld interface.

In some examples, friction welding may reduce an amount or duration of heat input into the boss and/or casing compared to other welding technique. Reducing the amount or duration of heat input to the boss and/or casing may reduce changes in the grain structure of the boss or casing. Additionally, or alternatively, the rotational motion may remove debris, such as metal shavings from drilling or contaminants from the surrounding environment, from the weld interface as flash. In this way, friction welding may require less surface preparation compared to other welding methods thereby reducing manufacturing time and/or manufacturing cost.

The casing and the boss may include any suitable materials. In some examples, the casing and the boss may include the same or different metals including, but not limited to, Iron alloys, Nickel alloys, Cobalt alloys, Aluminum alloys, Titanium alloys, or combinations thereof. In some examples, friction welding enables use of dissimilar metals. For example, the casing may include an Iron alloy and the boss may include an Aluminum alloy.