Title: PORTABLE FRICTION WELDER

Abstract: A portable friction welder that applies direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device. The portable friction welder includes an interchangeable adapter 30 configured to receive a fitting 32 for a first workpiece, a variable pressure hydraulic cylinder 12, and a rotational device 50 positioned behind the rear end of the pressurizing device 40. The friction welder 10 is configured to be driven by the rotational device 50, to be interconnected to a clamp assembly 60 holding a second workpiece, and to effect a friction weld to first and second workpieces. The portable friction welder 10 also includes a bearing housing 22, thrusts bearings 24, and a thrust collar 26. Spring washers may be installed in the front end of the hydraulic cylinder 12 to maintain axial load across the bearing housing 22.
PORTABLE FRICTION WELDER

TECHNICAL FIELD

The present invention generally relates to friction welding and, more particularly, to a portable friction welder for welding first and second workpieces together that applies direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device.

BACKGROUND ART

Friction welding is a process that welds metal or thermoplastics in which two members are joined by rubbing the mated parts under pressure. Heat is generated by direct conversion of mechanical energy to thermal energy at the interface of the mated parts, without application of electrical energy or heat from other sources. The weld is made by holding a non-rotating part in contact with a rotating one under constant or gradually decreasing pressure, until the interface reaches a certain temperature, e.g., forging temperature for metal parts. Rotation is then automatically stopped for a short period of time to consolidate the weld. Weld time varies depending on the materials being joined and the stud diameter.

In systems directing the flow of fluids or gases, valves which control the flow of fluids and gases often need to be replaced, repaired, or repacked. Typically, the drill and tap technique is used to join workpieces in the valve repair industry. A drill initially bores a hole into a second workpiece and the bored hole is tapped or threaded. A threaded first workpiece, e.g. a fitting, is then able to be joined to the second workpiece. Constraints in the choice of
workpieces that may be joined, the need to have a threaded first workpiece to join to the bored and tapped second workpiece, extreme care needed to assure the initial drill step does not penetrate too far and go into the pressure or hazardous area and cause a safety and environmental issue, and sufficient remaining wall thickness after drilling and prior to tapping, proper thread sealing are some problems associated with the drill and tap technique.

Prior friction weld techniques used to join workpieces by friction welding use an actuator located between the workpiece and motor surrounding the workpiece. This provides an indirect force on the workpiece. Through the workpiece-actuator-motor mechanism, the first workpiece is rotated and then placed in contact with a second workpiece. The combination of rotational drive, and indirect axial force causes the first workpiece to weld to the second workpiece. This indirect friction welding technique improves upon the weaknesses of the drill and tap technique by decreasing gas or fluid leaks by reducing the number of possible leak points present in tap junctions, reducing the risk of creating sparks, reducing the risk of drilling through the second workpiece, and offering a wider selection in workpieces which may be joined.

However, friction welding has not been successfully implemented due, in part, to two major weaknesses. First, the indirect means of applying force with the indirect workpiece-actuator-motor configuration does not supply the necessary amount of force to provide a sufficiently strong weld, particularly when dealing with curved surfaces. Second, the portion of the second workpiece in contact with flammable materials may reach high surface temperatures resulting in ignition of the flammable materials. Arc welding is currently
used to perform welds on site. However, arc welding is not performed on small fittings (e.g., two inches and lower) because arc welding occurs at temperatures significantly higher than friction welding, and degrades small fittings or base metals due to heat concentration on the small fittings. Friction welding is currently performed with stationary friction welders that are large and are unable to be utilized on live systems. Normally, friction welding work is delivered to a location where a stationary friction welder is present.

A portable friction welder applying direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device would be an improvement over the current arc welders and stationary friction welders because such a portable friction welder would enable a user to carry the portable friction welder on site and operate on live systems, and the motor would be totally independent of the pressurizing device. Such a portable friction welder would be able to effectively weld fittings of two inches and lower because they would operate at significantly lower temperatures than arc welders, and would not degrade small fittings or base metals because the low temperatures would allow heat to be displaced. A portable friction welder would also allow welded work to be contained and purged.

Therefore, a need exists for a portable friction welder which welds workpieces together with sufficient force to provide sufficient weld strengths, minimizes fluid or gas leaks, reduces the surface temperature of the workpiece portion in contact with flammable materials, and provides a simple and effective means to accomplish these goals using a variety of workpiece materials, shapes, and configurations.
The related art is represented by the following references of interest.

U.S. Patent Application Publication No. 2001/0015369 A1, published August 23, 2001 for Edward Litwinski et al., describes a back-up tolling apparatus for supporting the inner side of a hollow cylindrical workpiece during a circumferential friction stir weld that includes a plurality of arcuate shoes configured to mate end-to-end to form a substantially continuous ring, and an expandable support for supporting the shoes and operable to retract and expand the shoes inward and outward. The Litwinski et al. application does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 3,599,857, issued August 17, 1971 to Calvin D. Lloyd, describes a friction welding machine that is adapted to weld workpieces having a wide range of diameters by utilizing a unidirectional drive means which is disposed between rotatable components of the machine and a rotatable workpiece holding spindle. The Lloyd patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 3,616,980, issued November 2, 1971 to John A. Padilla, describes a friction welding apparatus having a rotatable chuck for holding a first workpiece which in operation is caused to rotate and is brought into contact with a second workpiece, during which rotation and axial force is applied to the first workpiece, thereby welding the first workpiece to the second workpiece. The Padilla patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 3,775,834, issued December 4, 1973 to Yuji Ishikawa et al., describes a method and apparatus for friction welding in which two bodies to be welded together are
brought into relative rotation and are also pressed against each other to achieve the welding by making use of the friction heat generated at their contact points. The Ishikawa et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 3,840,979, issued October 15, 1974 to Robert G. Miller et al., describes a friction welding process and a friction welding machine of the kind in which two parts are engaged in rotating contact under contact under an axial load at a common interface to heat the interface to a hot plastic condition. The Miller et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 4,122,990, issued October 31, 1978 to Yoshio Tasaki et al., describes a portable friction welding device which enables metallic parts to be easily united by frictional welding onto structures. The Tasaki et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 4,593,848, issued June 10, 1986 to David E. Hochbein, describes a portable apparatus for friction joining metal pieces to an electrical conductor while the conductor is carrying electrical current. The Hochbein patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 4,735,353, issued April 5, 1998 to Allan R. Thomson et al., describes a method and apparatus for friction welding. The Thomson et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 4,811,887, issued March 14, 1989 to Clive G. King et al., describes a method and apparatus for friction welding a pair of workpieces. The King et al. '887 patent
does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 5,148,957, issued September 22, 1992 to John G. Searle, describes an apparatus for use in welding two workpieces together. The Searle patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 5,261,592, issued November 16, 1993 to Vinci M. Felix et al., describes a process for friction welding molybdenum-rhenium alloys that include from about 10% to about 50% by weight. The Felix et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 5,699,952, issued December 23, 1997 to John W. Fix, Jr., describes a lightweight, portable automated fusion bonding apparatus. The Fix, Jr. '952 patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 5,735,447, issued April 7, 1998 to John W. Fix, Jr., describes a friction welding apparatus and a method for its use where the apparatus includes a plurality of interchangeable components including a drive means, an actuator assembly, a support system, and a control system, the combination operable to friction weld a workpiece to a valve body. The Fix, Jr. '447 patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 5,785,805, issued July 28, 1998 to John W. Fix, Jr., describes a friction welding fusion enhancer apparatus. The Fix, Jr. '805 patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,021,938, issued February 8, 2000 to Johann Böck et al., describes a process and device for the friction welding of workpieces that consist of different
materials or possess different material properties. The Böck et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,095,395, issued August 1, 2000 to John W. Fix, Jr., describes a friction welder drill and fuse fitting apparatus. The Fix, Jr. '395 patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,554,175 B1, issued April 29, 2003 to Jack M. Thompson, describes a friction stir welding machine that includes a table for supporting parts to be welded and a frame extending over the table. The Thompson patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,634,540 B1, issued October 21, 2003 to Paul Afschrift et al., describes a method for welding the far ends of two elongated elements together, whereby the above-mentioned far ends are heated up to forging temperature by rotating a ring clamped between them. The Afschrift et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,691,910 B2, issued February 17, 2004 to Masahito Hirose et al., describes a rod material made of Ti alloy that has a larger diameter portion at the end, which is joined with the end of material made of Ti-Al intermetallic compound, by friction welding, to form a poppet valve for an internal combustion engine. The Hirose et al. patent does not suggest a portable friction welder according to the claimed invention.

U.S. Patent No. 6,703,093 B2, issued March 9, 2004 to Derek J. Foster, describes a friction welded component and a method of manufacture for such a component. The Foster patent
does not suggest a portable friction welder according to the claimed invention.

Japan Patent Application Publication No. 58-20388, published on February 5, 1983, describes a friction welding machine which adapts itself to press welding of long-sized materials by providing a rotary unit which holds an intermediate material between two clamping units for gripping pipes, rotating only the intermediate material and drawing the units on both sides toward each other. The Japan '388 application does not suggest a portable friction welder according to the claimed invention.


None of the above inventions and patents, taken either singly or in combination, is seen to describe the instant invention as claimed. Thus a portable friction welder solving the aforementioned problems is desired.

**DISCLOSURE OF INVENTION**

This disclosure is directed to a portable friction welder method. The method includes providing a portable friction welder with a rotating variable pressure hydraulic cylinder and applying direct axial load to workpieces via the rotating variable pressure hydraulic cylinder.
Also part of the disclosure is directed to a portable friction welder configured to apply direct axial load to workpieces via a rotating variable pressure hydraulic cylinder.

**BRIEF DESCRIPTION OF THE DRAWINGS**

The sole figure is a top view of a portable friction welder according to the present invention.  

**Fig. 1** is a side view of a portable friction welder according to the present invention.  

**Fig. 2** is a side perspective view of a clamp for use with a portable friction welder according to the present invention.  

**Fig. 3** is a block diagram of a portable friction welder according to the present invention.  

Similar reference characters denote corresponding features consistently throughout the attached drawings.

**BEST MODES FOR CARRYING OUT THE INVENTION**

The present invention is a portable friction welder for friction welding workpieces together that applies direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device. The portable friction welder includes an interchangeable adapter configured to receive a fitting for a first workpiece, a variable pressure hydraulic cylinder with a front end and a rear end, and a rotational device positioned behind the rear end of the pressurizing device. The friction welder is configured to be driven by the rotational device, to be interconnected to a clamp assembly holding a second workpiece, and to effect a friction weld to first and second workpieces.
The portable friction welder also includes a bearing housing, thrusts bearings, and a thrust collar. Spring washers may be installed in the front end of the hydraulic cylinder to maintain axial load across the bearing housing. An interchangeable adapter is configured to engage a fitting, and the adapter is removably connectable with the thrust collar. The hydraulic cylinder is configured to be pressurized hydraulically with a pump, through the use of an accumulator, an/or manually by turning or squeezing a nut.

The portable friction welder may include a pressurizing device configured to pressurize the hydraulic cylinder. The pressurizing device may be an accumulator selected from the group consisting of selected from the group consisting of a diaphragm, bladder-type, piston-type, and bellow-type accumulator.

The portable friction welder also includes an interchangeable drive socket configured to receive a rotational device, such as an air motor, an electric motor, etc. The portable friction welder also includes a clamp assembly including a clamp and a shroud. The shroud includes a purge stem and the clamp includes a seat to stabilize the friction welder.

The invention disclosed herein is, of course, susceptible of embodiment in many different forms. Shown in the drawings and described herein below in detail are preferred embodiments of the invention. It is to be understood, however, that the present disclosure is an exemplification of the principles of the invention and does not limit the invention to the illustrated embodiments.

Referring to the drawings, Fig. 1 shows a portable friction welder 10 according to the present invention that applies direct axial load to the workpieces via a rotating
variable pressure hydraulic cylinder 12 placed between the workpieces and a rotational device 50. The friction welder 10 includes a rotatable variable pressure hydraulic cylinder 12, a bearing housing 22, thrusts bearings 24, a thrust collar 26, guide pins 28, an interchangeable adapter 30, a fitting 32, an optional pressurizing device 40, and an interchangeable drive socket 44.

The friction welder 10 is configured to be driven by an interchangeable rotational device 50, and is configured to be interconnected to a clamp assembly 60 to effect the friction weld to workpieces (not shown). When interconnected to the clamp assembly 60 the friction welder 10 preferably has an approximate total length of about ten inches, which total length may be varied as desired. The inventor believes that the particular configuration of the portable friction welder is novel because the inventor is unaware of any friction welder that positions a rotating variable pressure hydraulic cylinder 12 configured to apply a direct axial load to the workpieces between the workpieces and the rotational device 50, increases versatility, reduces overall length, and optimizes the ability to provide unlimited direct axial load to workpieces on the basis of rotation (revolutions per minute) of the rotational device and time.

The variable pressure hydraulic cylinder 12 includes a cylinder with a predetermined diameter, a front end, and a rear end. The front end of the hydraulic cylinder 12 is attached to the rear surface of the bearing housing 22. Spring washers, such as Belleville washers, may be installed in the front end of the hydraulic cylinder 12 to maintain axial load across the bearing housing 22. The rear end of the hydraulic cylinder 12 includes a fluid port and is connected to the optional pressurizing device 40. The hydraulic
cylinder 12 is configured to be pressurized by the pressurizing device 40 and to exert a direct axial load to the adapter 30 and fitting 32. The axial load capability of the hydraulic cylinder 12 may range from zero tons to about one hundred tons.

The bearing housing 22 includes front and rear surfaces. Thrust bearings 24 and a thrust collar 26 are centrally mounted in the bearing housing 22. The thrust collar 26 annularly extends from the front surface of the bearing housing 22. The thrust collar 26 is configured to interchangeably receive various types of adapters 30, and is configured to take direct axial thrust loads from the hydraulic cylinder 12. The rear surface of the bearing housing 22 is interconnected with the front end of the hydraulic cylinder 12. The bearing housing 22 is configured to be inserted into the clamp assembly utilizing the guide pins 28 and it is then locked into position.

The interchangeable adapter 30 includes a socket at one end that may be configured to engage a hex fitting, a square fitting, etc. The other end of the adapter is removably connected with the thrust collar 26 so that adapters configured for various fittings may be removably connected to the thrust collar 26. The adapter 30 is preferably formed of metal, such as iron or steel, and has no sharp edges on its exterior surface. The fitting 32 is a threaded fitting preferably configured for holding a one-quarter inch to about a two inch workpiece, but this dimensional range may vary as desired.

The optional pressuring device 40 has a front end and a rear end, and is illustrated as a gas charged bladder-type diaphragm accumulator. The accumulator 40 has a sealed housing with a valve, such as a Schroeder valve or the like,
to enable the accumulator to be pressurized to a desired pressure. Positioned within the housing is a sheet-like movable diaphragm composed of a flexible material, such as rubber, to subdivide the interior space into two fluid-tight pressure chambers on opposite sides of the diaphragm. One chamber is a fluid chamber into and out of which the working hydraulic fluid of the friction welder 10 is accumulated and expelled under pressure when required. The other chamber is charged with an inert gas, such as argon, nitrogen, xenon, krypton, etc., under high pressure to act as an energy storage medium. In use, the working fluid accumulates in the fluid chamber and when the fluid pressure exceeds the pressure of the trapped gas, the diaphragm is elastically displaced, further compressing the gas on the other side. The gas is later utilized to expel on demand the stored fluid under pressure out of the fluid chamber back into the hydraulic cylinder 12.

Other types of gas charged accumulators may also be used including piston-type and bellow-type accumulators. While the friction welder 10 is illustrated with one type of pressurizing device 40 configured to pressurize the hydraulic cylinder 12, it is to be understood that the hydraulic cylinder 12 may be pressurized in any one of a number of ways including hydraulically with a pump, through the use of an accumulator, and/or manually by turning or squeezing a nut, thereby precluding the need for a pressurizing device.

The interchangeable drive socket 44 is configured to interchangeably receive various types of rotational devices 50, such as air motors, electric motors, etc. The drive socket 44 may be configured as a hex socket, a square socket, etc.
The clamping assembly 60 includes a clamp 62 and a shroud 70. The shroud 70 includes a purge stem 72. The clamp 62 may be adjustably configured for clamping to plates having a diameter ranging from about one to fifty inches. The clamp 62 includes a seat 64 to stabilize the welder 10 (see Fig. 2). The seat 64 terminates and transcends into the shroud 70. The shroud 70 functions as a purge chamber around a workpiece by directing inert gas to the region of the weld when forming the friction weld.

The portable friction welder 10 is configured to be carried by a human operator for friction welding two workpieces to each other. The operation of the portable friction welder 10 is effected by installing the clamp assembly 60 to a first workpiece, e.g. a pipe, a plate, a flange, etc. An appropriately configured adapter 30 is then attached to the thrust collar 26. An appropriately configured fitting 32 is then inserted into the adapter 30.

A second workpiece is attached to the fitting 32. The guide pins 28 of the bearing housing 22 are then inserted into the openings 66 in the clamp 60 and the bearing housing 22 is locked into position. The pressurizing device 40 is then pressurized to an appropriate axial load. The front end of the pressurizing device 40 is then interconnected to the rear end of the hydraulic cylinder 12. An appropriate drive socket 44 is then attached to the rear end of the pressurizing device 40.

An appropriate rotational device 50 is then inserted into the drive socket 44. The rotational device 50 may be inserted to the drive socket 44 at any angle from in-line (e.g., zero degrees) to ninety degrees. The rotational device 50 is then run for a predetermined amount of time. The portable friction welder 10 may be configured with automatic start and stop
elements. The rotational device 50 is then removed from the drive socket 44 and a friction weld is effected between the first and second workpieces. Hydraulic pressure is maintained on the fitting 32 for a predetermined amount of time, such as one minute, after rotation ceases. The bearing housing 22 is then unlocked from the clamp assembly and the clamp assembly is then removed from the welded first and second workpieces.

The portable friction welder 10 produces welds with a joint strength equal to or stronger than the parent materials, at a lower cost per weld than conventional welding devices. The weld preparation is less costly than conventional welds and the weld joints are very reliable. In addition, dissimilar materials can be welded without filler material. The friction weld also provides self-cleaning/decontamination of the weld interface.

The portable friction welder 10 according to the invention that applies direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device. The portable friction welder 10 applies a direct axial load to the workpieces between the workpieces and the rotational device 50, increases versatility, reduces overall length, and optimizes the ability to provide unlimited direct axial load to workpieces on the basis of rotation (revolutions per minute) of the rotational device and time. The portable friction welder 10 applies direct rotation to the portable variable pressure hydraulic cylinder 12 which provides the capability of friction welding various size fittings to a base metal or substrate utilizing various driving devices, thereby increasing versatility and capability over known friction welders.

Accordingly, it is a principal aspect of the invention to provide a portable friction welder and method for friction
welding workpieces together that applies direct axial load to the workpieces via a rotating variable pressure hydraulic cylinder placed between the workpieces and a rotational device.

It is another aspect of the invention to provide a portable friction welder including an interchangeable adapter configured to receive a fitting for a first workpiece, a variable pressure hydraulic cylinder with a front end and a rear end, and a rotational device position behind the rear end of the pressurizing device. The friction welder is configured to be driven by the rotational device, to be interconnected to a clamp assembly holding a second workpiece, and to effect a friction weld to first and second workpieces.

It is a further aspect of the invention to provide a portable friction welder method including the steps of installing a clamp assembly including a thrust collar and a shroud to a first workpiece, attaching an adapter to the thrust collar, inserting a fitting into the adapter, attaching a second workpiece to the fitting, inserting a bearing housing into the clamp assembly and locking the bearing housing into position, pressurizing a pressuring device to a predetermined hydraulic pressure, interconnecting a front end of the pressurizing device to a rear end of the hydraulic cylinder, attaching a drive socket to a rear end of the pressurizing device, inserting a rotational device into the drive socket, running the rotational device for a predetermined amount of time, removing the rotational device from the drive socket and effecting a friction weld between the first and second workpieces, maintaining hydraulic pressure on the fitting for a predetermined amount of time, unlocking the bearing housing from the clamp assembly, and removing the clamp assembly from the welded first and second workpieces.
While the invention has been described with references to its preferred embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the true spirit and scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teaching of the invention without departing from its essential teachings.
In the claims:

1. A portable friction welder method comprising:
   providing a portable friction welder with a rotating variable pressure hydraulic cylinder; and
   applying direct axial load to workpieces via the rotating variable pressure hydraulic cylinder.

2. The portable friction welder method according to claim 1, further comprising:
   installing a clamp assembly including a thrust collar and a shroud to a first workpiece;
   attaching an adapter to a piston;
   inserting a fitting into the adapter;
   attaching a second workpiece to the fitting;
   inserting a bearing housing into the clamp assembly and locking the bearing housing into position;
   pressurizing a pressuring device to a predetermined hydraulic pressure;
   interconnecting a front end of the pressurizing device to a rear end of the hydraulic cylinder;
   attaching a drive socket to a rear end of the pressurizing device;
   inserting a rotational device into the drive socket;
   running the rotational device for a predetermined amount of time;
   removing the rotational device from the drive socket and effecting a friction weld between the first and second workpieces;
   maintaining hydraulic pressure on the fitting for a predetermined amount of time;
   unlocking the bearing housing from the clamp assembly; and
removing the clamp assembly from the welded first and second workpieces.

3. A portable friction welder configured to apply direct axial load to workpieces via a rotating variable pressure hydraulic cylinder.

4. The portable friction welder according to claim 3, further comprising:
   a variable pressure hydraulic cylinder with a front end and a rear end; and
   a rotational device positioned behind the rear end of the pressurizing device.

5. The portable friction welder according to claim 4, wherein said friction welder is configured to have a total length of about ten inches when interconnected to the clamp assembly.

6. The portable friction welder according to claim 4, further comprising a bearing housing, thrusts bearings, and a thrust collar.

7. The portable friction welder according to claim 6, further comprising spring washers installed in the front end of the hydraulic cylinder to maintain axial load across the bearing housing.

8. The portable friction welder according to claim 7, further wherein said spring washers are Belleville washers.

9. The portable friction welder according to claim 4, further comprising an interchangeable adapter configured to receive a fitting for a first workpiece,

   wherein the friction welder is configured to be driven by the rotational device, to be interconnected to a clamp assembly holding a second workpiece, and to effect a friction weld to first and second workpieces.
10. The portable friction welder according to claim 4, wherein said hydraulic cylinder is configured to provide an axial load from zero tons to about one hundred tons.

11. The portable friction welder according to claim 4, further wherein said hydraulic cylinder is configured to be pressurized hydraulically with a pump, through the use of an accumulator, and/or manually by turning or squeezing a nut.

12. The portable friction welder according to claim 4, further comprising a pressurizing device configured to pressurize the hydraulic cylinder.

13. The portable friction welder according to claim 12, wherein said pressurizing device is an accumulator.

14. The portable friction welder according to claim 13, wherein said accumulator is selected from the group consisting of selected from the group consisting of a diaphragm, bladder-type, piston-type, and bellow-type accumulator.

15. The portable friction welder according to claim 4, further comprising an interchangeable drive socket configured to receive the rotational device.

16. The portable friction welder according to claim 15, wherein said rotational device is an air motor.

17. The portable friction welder according to claim 15, wherein said rotational device is an electric motor.

18. The portable friction welder according to claim 4, further comprising a clamp assembly.

19. The portable friction welder according to claim 18, wherein said clamp assembly includes a clamp and a shroud.

20. The portable friction welder according to claim 19, wherein said shroud includes a purge stem.