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Jig for manufacturing of firearm lower receiver

Abstract

An improved jig for manufacturing a firearm lower receiver is comprised of a power tool mount; an adapter; a guide plate with plate screws; a rear support with mounting screws; a front support; and at least one of a carriages with at least one locating pin. A guide plate is disposed below the top surface of a lower receiver in conjunction with an adapter. The jig is a universal fitment and includes a bearing to support a rotary tool and at least one guiding feature can be used to facilitate in the guidance of the rotary tool without placing the rotary tool in direct contact with any of the guidance features. A removable locating pin is situated a long the front and rear takedown pin holes of a firearm receiver that is not threaded and is provided with at least one of a pull, string or other handle.

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Background/Summary

RELATED APPLICATIONS (1) This application is a continuation of U.S. application Ser. No. 16/931,165, filed Jul. 16, 2020, entitled JIG FOR MANUFACTURING OF FIREARM LOWER RECEIVER, which application is a continuation of U.S. application Ser. No. 16/206,878, filed Nov. 30, 2018, entitled IMPROVED JIG FOR MANUFACTURING OF FIREARM LOWER RECEIVER, which application is a continuation of U.S. application Ser. No. 15/979,322, filed May 14, 2018, entitled IMPROVED JIG FOR MANUFACTURING OF FIREARM LOWER RECEIVER, which application is a continuation of U.S. application Ser. No. 15/726,351, filed Oct. 5, 2017, entitled IMPROVED JIG FOR MANUFACTURING OF FIREARM LOWER RECEIVER, which application claims the benefit of U.S. Provisional Application Ser. No. 62/404,710, filed Oct. 5, 2016, entitled IMPROVED JIG FOR MANUFACTURING OF FIREARM LOWER RECEIVER, the entire disclosures of each of which applications are hereby incorporated by reference.

FIELD OF THE INVENTION
(1) This invention relates to systems and methods for manufacturing an 80% (partially unfinished) firearm receiver, with a high rate of success with improved quality, by an unskilled user.
BACKGROUND OF THE INVENTION
(2) A market exists for incompletely/partially manufactured firearm lower receivers. A firearm lower receiver is unregulated until a minimum level of manufacturing is completed. This level is typically known as “80%”. Firearm lower receivers completed to this level are typically referred to as “80%” lower receivers. These firearms must then be completed by the end user to be operable. In a typical configuration the lower receiver is cast and/or forged and is partially machined, with certain aspects of the inner slot (in which the trigger mechanism resides) remaining uncut. The finishing task cuts this remaining slot with appropriate dimensions and accuracy.
(3) The completion of these lower receivers can be time consuming and quality results may be difficult to achieve with prior art. In accordance with the prior art, the technique for finishing the receiver can place a rotary power tool in a position that is effectively too far away from the lower receiver. As such this prior art technique can produce poor results and broken tooling. Additionally, the prior art technique can involve placement of a rotating tool in direct contact with guiding areas of a jig, which can result in premature wear.
(4) It would be desirable to provide a jig assembly that effectively reduces the unsupported distance between the rotary power tool and the 80% lower receiver and that avoids direct contact between the rotating tool and its guiding features.
SUMMARY OF THE INVENTION
(5) This invention overcomes the disadvantages of the prior art by providing a device that reduces the distance between the lower receiver and the rotary power tool and by using additional features to guide the rotary tool instead of placing it in direct contact with any of the plurality of guiding

features. An improved jig for manufacturing a firearm lower receiver is comprised of a power tool mount; an adapter; a guide plate with plate screws; a rear support with mounting screws; a front support; and at least one carriage with at least one locating pin. A guide plate is disposed around and below the top surface of a lower receiver and is mounted to the carriage(s) in conjunction with a rotary power tool adapter. The jig is a universal fitment. The jig includes a bearing to support a rotary tool and is constructed and arranged to provide for use of at least one guiding feature to facilitate in the guidance of the rotary tool without placing the rotary tool in direct contact with any of a plurality of guidance features for firearm lower receiver manufacturing. A removable locating pin is situated in a location along the front and rear takedown pin holes of a firearm receiver that is not threaded and is provided with at least one of a pull, a string or other handle for firearm lower receiver manufacturing.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

(1) The invention description below refers to the accompanying drawings, of which:

(2) FIG. **1** is an exploded right side view of an improved jig, according to an illustrative embodiment;

(3) FIG. **2** is a right side view of the improved jig, according to the illustrative embodiment;

(4) FIG. **3** is an exploded rear view of the improved jig, according to the illustrative embodiment;

(5) FIG. **4** is a rear view of the improved jig, according to the illustrative embodiment;

(6) FIG. **5** is an exploded left side view of the improved jig, according to the illustrative embodiment;

(7) FIG. **6** is a left side view of the improved jig, according to the illustrative embodiment;

(8) FIG. **7** is an exploded front view of the improved jig, according to the illustrative embodiment;

(9) FIG. **8** is a front view of the improved jig, according to the illustrative embodiment;

(10) FIG. **9** is a exploded perspective view of the improved jig, according to the illustrative embodiment;

(11) FIG. **10** is a perspective view of the improved jig, according to the illustrative embodiment;

(12) FIG. **11** is a top view of the improved jig, according to the illustrative embodiment;

(13) FIG. **12** is a top view of the improved jig, according to the illustrative embodiment;

(14) FIG. **13** depicts a method of jig assembly according to one or more aspects of the disclosure;

(15) FIG. **14** depicts a method of drilling with a jig assembly according to one or more aspects of the disclosure;

(16) FIG. **15** depicts a method of milling with a jig assembly according to one or more aspects of the disclosure;

(17) FIG. **16** depicts a method of milling with a jig assembly according to one or more aspects of the disclosure;

(18) FIG. **17** depicts a method of milling with a jig assembly according to one or more aspects of the disclosure;

(19) FIG. **18** depicts a method of drilling with a jig assembly according to one or more aspects of the disclosure;

(20) FIG. **19** depicts a method of lower receiver removal using a jig assembly according to one or more aspects of the disclosure;

(21) FIG. **20** depicts various components of a jig assembly with reference to FIGS. **13-19** and **21-27**;

(22) FIGS. **21**A-P depict various stages of the method of FIG. **13**;

(23) FIGS. **22**A-I depict various stages of the method of FIG. **14**;

(24) FIGS. **23**A-K depict various stages of the method of FIG. **15**;

(25) FIGS. **24**A-K depict various stages of the method of FIG. **16**;
(26) FIGS. **25**A-E depict various stages of the method of FIG. **17**;
(27) FIGS. **26**A-G depict various stages of the method of FIG. **18**; and
(28) FIGS. **27**A-E depict various stages of the method of FIG. **19**.

DETAILED DESCRIPTION

(29) The primary function of a jig is to provide repeatability, accuracy, and interchangeability in the manufacturing of products. In FIG. **1**, an improved jig **100** is assembled by placing left carriage **302** (see FIG. **3**, not shown in FIG. **1**) on the left side of a lower receiver **116** and by placing right carriage **114**, on the right side of the lower receiver **116**. The lower receiver in this example is a form of popular AR-style receiver (for example the semi-automatic version of the AR-15, M-16, M-4 carbine, and variants thereof). The lower receiver is the portion of the firearm that includes a shoulder stock, pistol grip, trigger mechanism and magazine well. The upper receiver includes the barrel, chamber and bolt assembly. The lower receiver is attached to the upper receiver by two takedown pins. The firearm is available in fully automatic and semi-automatic versions. Note that the jig is adapted to finish the receiver with holes and cuts appropriate to the semi-automatic version. However, the jig can be adapted for the use by licensed manufacturers to finish other versions (e.g. fully automatic) of the firearm. The jig **100** is an assembly that is comprised of a rotary power tool mount **103**, an adapter **122**, a guide plate **108** with plate screws **106**, **120**, a threaded rear support **110** with mounting screws **112**, a front support **118**, and at least one carriage **114** with at least one locating pin **306**. As described below, the plate screws **106** are machine screws with an appropriate diameter, thread size and length, and the screw **120** can also be a machine screw (for example, a #8-32 flat head machine screw), sheet metal screw, or another form of self-tapping screw. The receiving hole of the front support **118** is drilled and/or tapped to accommodate the screw **120**. The illustrative jig defines a universal fitment. A removable locating pin **306** (See FIG. **3**) is readily inserted through all three parts **302**, **116** and **114** to hold them in alignment relative to each other. This renders assembly highly straightforward for use by even an inexperienced user. In an embodiment, the jig assembly can be provided as a kit with appropriate instructions (printed, on electronic media and/or available via the Internet). See for example, the instructions in attached Appendix A, which describe setup and use of the jig assembly. The kit can include a rotary power tool having and appropriate size, shape, torque and power supply.

(30) As described herein, the lower receiver **116** includes a buffer mount **117** for receiving a buffer assembly within the shoulder stock at one end, and the front surface of the magazine well **119** at the other. As defined herein, the buffer mount **117** is at the “rear” end of the lower receiver, while the magazine well **119** is at the “front” end of the lower receiver. As presented in FIG. **1**, the rear end of the lower receiver **116** is on the left side and the front end of the lower receiver **116** is on the right side and the visible face of the lower receiver is the “right” side. The right carriage **114** is resting on the right side of the lower receiver **116**. Thus, the relative orientation of the jig assembly **100** (i.e. left, right, front, rear, top and bottom) is described with respect to the corresponding, confronting sides of the lower receiver **116**.

(31) Note that the carriage plate **114** is provided with three drill guide holes, **132**, **134**, **136**, along its side for the location of and drilling of appropriate diameter pin holes into the lower receiver **116**. These guide holes are used to guide and align a drill bit to bore desired holes into the lower receiver side. By way of non-limiting example drill guide hole **132** is a guide hole for a hammer pivot/pin hole, for the subsequent mounting of an assembly that retains the hammer mechanism within the lower receiver. Drill guide hole **134** is a guide hole for a trigger pivot/pin hole, for the later mounting of a trigger pivot/pin to retain the trigger mechanism. Drill guide hole **136** is a guide hole for a selector/safety pivot hole, for the subsequent mounting of a selector/safety lever. These carriage guide holes provide for the accurate and precise placement of the pin holes and are constructed so that an unskilled user can properly place the pivot/pin holes for completion of the assembly of a functioning lower receiver. Holes can be provided on each of opposing carriage

plates to drill each side of the receiver in an embodiment. In alternate embodiments holes are provided on one side and the drill passes through both sides of the receiver. The thickness of the carriage plate(s) and close tolerance of the hole to the drill shaft is sufficient to ensure minimal skew or wobble as the drill passes into the receiver side.

(32) The rotary power tool mount **103** is adapted to receive an appropriately sized and shaped rotary power tool **102**, as described further below. The rotary power tool retains an appropriate rotary tool **104** in accordance with various embodiments. The term "rotary tool" shall be taken broadly herein to mean any one of a variety of rotating cutting elements that can be mounted removably (or permanently) within a chuck or arbor of the rotary power tool **102**. For example a two-flute or four-flute end mill of appropriate diameter (for example, a ¼ inch diameter, or another appropriate diameter between (e.g.) ⅛ inch and ½ inch) can be mounted within the rotary power tool. The mill can include a cutting end and a shaft that is free of cutting surfaces. The shaft is adapted to confront the jig so as to avoid cutting its sides while the cutting end is adapted to reside within the receiver so as to cut the appropriate slot(s) in conjunction with the jig's outline(s). The rotary tool **104** can be constructed from a variety of high-strength materials, such as high-speed steel, tungsten carbide, etc.

(33) As shown, the rear support **110** is threaded into lower receiver **116** via the receiver's rear buffer mount (a large round hole at the rear of the receiver in which a buffer assembly normally resides when assembled into a firearm). Front support **118** is placed between two mounting ears on the lower receiver **116** before an easily removable locating pin **704** inserted through the mounting ears of the lower receiver **116** and through the hole in the front support **118**. Illustratively, the front support **118** resides where the front pivot/takedown pin between the upper and lower receiver on a complete firearm normally resides. The pivot hole in this arrangement has been drilled by the supplier of the 80% receiver, and is, thus available for use in mounting the front support via pin **306**. As with other receiver holes and structures relied upon to engage the jig assembly, they are reliably located by the manufacturer using sophisticated tooling so that the jig accurately and repeatable mounted to the lower receiver **116**, and the corresponding cutting performed by the user is equally reliable and accurate.

(34) After mounting the front support **118**, a guide plate **108** is then placed atop the assembly by aligning the holes in the guide plate **108** with the threaded holes in the front support **118**, the threaded holes in the rear support **110**, and the threaded holes in both the left and right carriages **302** and **114** respectively. The guide plate **108** has a thickness TC**1** of between ⅜ and up to ½ inch and a length LC**1** of approximately 8 inches (±0.5 inches). The adapter plate **122** has a thickness TC**2** of approximately ½ inch and a length LC**2** of approximately 4 inches (±0.5 inches). In other embodiments, these thicknesses and widths can vary greater or lesser, depending on the materials used. Once aligned, carriage-to-guide plate screws **106** are inserted through the guide plate **108** and tightened to connect the carriages **114** and **302** to the guide plate **108**. The rear support-to-guide plate screws are inserted through the holes in the guide plate **108** and tightened into the rear support **110**. The front support-to-guide plate screws **120** are inserted through the guide plate **108** and tightened into the front support **118**. These screws **120** can be sheet-metal screws or flat head screws (for example, a #8-32 flat head screw) and the hole(s) in the front support **118** can be sized to receive such screws. The carriage screw **304** is threaded to a corresponding female thread in the left carriage **302** and continued through a threaded hole in the right carriage **114**. Illustratively, both the left carriage **302** and right carriages **114** are threaded so if the assembly is placed into the jaws of an external vice or other clamp, it will tend to resist deformation that could damage the lower receiver **116** sandwiched therebetween. The screw **304** can have a recessed drive head (e.g. hex, star, etc.) so that it avoids interference with a clamping jaw (if any). The above thus defines the full set of components of the jig assembly, which are connected either directly or indirectly to the lower receiver **116**.

(35) The illustrative jig assembly is depicted as retaining a rotary power tool **102** in the power tool

mount **103**, but it is contemplated that the power tool can be a non-rotary tool. The jig provides for the use of at least one of the various guiding features (for example, left carriage **302**) to be utilized to aid in the guidance of a power tool **102** without placing the tool in direct contact with any guiding feature.
(36) Note that a wide variety of rotary power tools can be employed in association with an embodiment of the jig assembly—for example a small router, drill, hand piece of a flexible-shaft unit or Dremel®-style tool. The rotary tool can be cordless or powered by (e.g.) wall current via a power cable.
(37) FIG. **2** depicts the jig **100** holding the rotary power tool **102** in engagement with the lower receiver **116** so that finishing work can be performed on the lower receiver. The receiver **116** is situated between the carriages **114** and **302** so that it remains in place during the finishing operation. There is a narrow gap between the carriages and the walls of the lower receiver **116**. The gap prevents contact between the surfaces of the carriages with the surface of the lower receiver and thereby prevents possible scratching of the surface coating of the lower receiver. In an alternate embodiment, the carriages can have an external flexible coating (for example, a polymer) and make contact with the surface of the lower receiver or a removable foam pad can be provided during assembly to avoid inadvertent contact between the carriage plate and the receiver during assembly of the jig. The various plates of the jig assembly can be constructed from a variety of materials, or combination of materials—for example aluminum alloy, steel, polymer (e.g. Delrin® (from DuPont), polycarbonate, acrylic, etc.). The thickness of each plate **108**, **122** is also highly variable, and depends in part upon the choice of material(s). By way of non-limiting example, the thickness of the jig assembly plate(s) can be between ⅛ and ½ inch, or greater, for sufficient strength and rigidity. For example, the carriage plates **114** and **302** should define a sufficient thickness to receive the screws **106** within threaded holes formed in the top edge of each plate. Likewise, the guide plate **108** should be sufficiently thick to allow the rotary tool **104** to resist wobble. The various plates can be constructed from sheet stock and milled to shape using, e.g. CNC manufacturing techniques. Other methods of constructing the plates can be employed in alternate embodiments—for example stamping or casting with finish milling, 3D printing, molding, etc.
(38) The following is a description further views and representations of the assembled jig assembly **100** and corresponding rotary power tool (**102**) arrangement.
(39) With reference to FIG. **3**, a rear-oriented exploded view of the jig assembly **100** is shown, with the rear support **110** with mounting screws **112** visible within the buffer mount **117** within the lower receiver **116**. In an embodiment the carriage plates **114** and/or **302** can define a thickness TC**3** of approximately ½ inch (+⅛ inch). This dimension is highly variable in alternate embodiments an, in part, facilitates the formation or female-threaded holes for receiving screws **106**. Note that, while two carriage plates are employed in the depicted embodiment, at least one carriage plate can be used in alternate arrangements. Such a single plate can include appropriate brackets or other structures to maintain it in confronting, accurate engagement with the lower receiver side.
(40) With reference to FIG. **4** a rear view of the assembled jig **100** is shown in operation on the lower receiver **116**. The carriage plates **114**, **302** are situated on their respective sides of the lower receiver **116** and are held in place by removable pins **306** and **704**. Each of the pins is removably locked in place by a detent **307** located at one end and a ring **309** at the other. Opening **402** in the tool mount **103** serves to provide air circulation within the area of the machining, a portal for the egress of machining debris and a visible window to allow a view of the machining in process.
(41) FIG. **5** is an exploded left side view of the jig **100** in an assembled state, with a rotary power tool **102**, a rotary power tool adapter **122**, a rotary tool **104**, a guide plate **108**, a rear support **110**, a left carriage **302**, a lower receiver **116**, a front support **118** and related mechanisms. The buffer mount **117** protrudes through guide plate **108**. Plates **108** and **122** support the rotary power tool above the lower receiver **116** such that the rotary power tool is not resting upon the lower receiver.
(42) As described above, the left carriage plate **302** is also provided with three drill guide holes,

632, **634**, **636**, for the location of and drilling of pivot/pin holes into the lower receiver **116** that are aligned with the right carriage holes **132**, **134** and **136**, respectively and define the same dimensions. In embodiments in which a pin/pivot defines different diameters on each side, or is eccentric the diameter or placement of the left carriage hole can vary relative to that of the right carriage hole.

(43) FIG. **6** is a collapsed view of FIG. **5** illustrating; a rotary power tool **102**, a rotary power tool adapter **122**, a guide plate **108**, a left carriage **302**, a lower receiver **116** and a front support **118**.

(44) FIG. **7** is an exploded front view of the illustrative jig **100**. Pin **704** is positioned to be inserted through takedown pin mounts **702**, such that the pin **704** passes through the front support **118** and the pin mounts **702**, thereby locking the front support **118** to the lower receiver **116**. The pin mounts are through holes in the lower receiver **116**. In another embodiment, pins **306** and **704** can define a bolt with a removable nut for locking the bolt in place.

(45) FIG. **8** is a collapsed view of the jig **100** with particular attention called to the placement of the locating pins **306**, **704** in the pin mounts **702** and are held in place by detents **307**. The locating pin **306** is removable and is situated in a location along the front and rear takedown pin holes of a firearm receiver that is not threaded and is provided with at least one of a pull, a string or other handle for firearm lower receiver manufacturing.

(46) FIG. **9** is a bottom view of the jig **100**. The bottom surface of adapter **122** includes a plurality of wells **901** of various sizes, angles and shapes disposed across the surface of the adapter **122**. A rotary power tool support bearing **902** is inserted into the rotary power tool adapter **122** (for example—using a press or other biasing device) in a circular well **901** located near the center point of the adapter **122**. Bearing **902** allows movement of a rotary power tool which further supports the rotary tool, thereby increasing rigidity, user control, and thus, quality. The rotary tool **104** is then inserted into the rotary tool support bearing **902** and the rotary power tool adapter **122** is connected to the rotary power tool **102** by inserting adapter screws **906** into their respective wells **901** in the adapter **122** and tightened into adapter **103**. The guide pins **908** are connected to the adapter **122** by inserting an adapter screw **904** through the guide pins **908** and tightened into the adapter plate. The above thus defines the components of the tooling assembly.

(47) In use, the rotary power tool **102** and mount **103** and adapter **122** are placed on top of the guide plate **108** and assembled, as described above, to form the jig. The guide pins **908** are placed into the guide cavities **1202** located within the guide plate **108**. The rotary tool **104** protrudes by a predetermined length from adapter **122** so as to interface with the lower receiver **116** situated below guide plate **108**. The geometry of the walls of the lower receiver are generally vertical, with the walls of each side parallel to each other up and down and front to back. This geometry provides an opportunity for the unskilled user to complete the machining of the receiver and the performance of the machining tools is optimized by the stability of the jig. The rotary power tool **102**, adapter **122**, rotary tool **104**, guide pins **908**, and connecting screws **904** and **906**, are then guided within the guide cavities **1202**. The location of the guide pins **908** and guide cavities **1202** are placed as to locate the rotary tool **104** in a predetermined location within the lower receiver **116** to achieve the desired results without placing the rotary tool **104** in direct contact with any components other than the lower receiver **116**, thus reducing premature wear. Window **920** is a cutout slot at the rear of adapter **122** and provides visual and physical access to the lower receiver during machining operations, as well as preventing contact with the buffer mount **117**.

(48) FIG. **10** is a collapsed view of FIG. **9** showing the protrusion of the rotary tool **104**. Window **920** is aligned to the rear of the jig.

(49) FIG. **11** is a top view of the jig **100** without the rotary power tool. Indices **1102**, **1104**, **1106** are located along a surface of guide plate **108** and are depth references for the end milling process. Each of the indices is a cavity, as shown in FIG. **1**. Indices **1102**, **1104** and **1106** relate to three different lengths for guide pins and the guide cavities are stepped at three different heights so that as the pins get longer, the guide describes a smaller area. The alignment of the view of FIG. **11** is

that the top of the view is the front of the jig and the bottom of the view corresponds to the rear of the jig. Buffer mount **117** is depicted as protruding through guide plate **108**.

(50) FIG. **12** is the same view as FIG. **11** with the rotary power tool adapter viewed as semi-transparent, allowing a better view of a rotary tool **104**, a guide plate **108** incorporating guide cavities **1202**; a lower receiver **116** and guide pins **908** residing within their respective wells **901**. The shape of the guide cavities **1202** corresponds to the shape of the internal walls of the lower receiver **116** such that when the rotary tool **104** is inserted into the lower receiver **116**, the operator maneuvers the guide pins **908** against the walls of the guide cavities **1202** and can accurately machine the internal surfaces of the lower receiver **116**.

(51) In operation, the user places carriages **114** and **302** in a vise or other clamping device to hold steady. The protrusion depth of the rotary tool **104** is set using indices **1102**, **1104**, **1106**. In practice, this is done by placing rotary tool **104** within the indices and aligning to the appropriate hash mark for the required milling step and moving the rotary power tool adapter **122** into contact with the edge of guide plate **108** therefore setting the protrusion depth to the appropriate hash mark relative to the bottom surface of adapter **122**

(52) The assembled rotary power tool **102**, mount **103**, rotary tool **104**, adapter **122** and guide pins **908** are engaged with the guide plate **108** and guide cavities **1202**. When the assemblies are placed atop each other with guide pins **908** within guide cavities **1202** the rotary power tool is switched on and rotary tool **104** begins to rotate at a high rate of angular velocity. The user grasps either the rotary power tool **102**, mount **103** or adapter **122** and slide the adapter **122** along the guide plate **108**. The protruding guide pins **908** contact the walls of the guide **1202** preventing rotary tool **104** from milling into the incorrect locations. This task is continued until guide pins **908** have been translated through the entire guide cavities **1202** removing all the material that rotary tool **104** has contacted within the lower receiver **116**. The rotary power tool **102** is then switched off and the rotary tool **104** is allowed to come to rest. The assembled rotary power tool **102**, mount **103**, rotary tool **104**, adapter **122** and guide pins **908** are then lifted off of the guide plate **108**. The rotary tool **104** is then placed back into indices **1102**, **1104**, **1106** to adjust the protrusion depth to the next hash mark of the respective index. When the depth is properly set, the assembled rotary power tool **102**, mount **103**, rotary tool **104**, adapter **122** and guide pins **908** are re-engaged with guide plate **108** and guide cavities **1202**. The same procedure is followed to remove this material with rotary tool **104** from lower receiver **116**. This procedure is similarly followed until all material is removed from lower receiver **116**. Chips can be removed periodically during each cutting task using a vacuum or by rotating the receiver and jig assembly upside down.

(53) In order to guide rotary **104** properly in lower receiver **116** to allow for proper function, guide cavities **1202** have additional cavities contained within them. For example, the entire guide cavity **1202** is milled to a depth greater than 1/16 inch but less than ⅛ inch. A further reduced area within guide cavity **1202** is milled to a depth greater than ⅛ but less than 3/16 inch. Yet another area within the reduced area is milled to a depth greater than 3/16 inch. This allows for two reduced area cavities within the larger guide cavity **1202**. Guide pins **908** can be interchanged with varying lengths to allow for the assembled rotary power tool **102**, mount **103**, rotary tool **104**, adapter **122** and guide pin **908** unit to be engaged in either the full guide cavities **1202** or within the reduced area cavities within guide cavities **1202**. If a guide pin **908** has a length greater than zero but less than ⅛ of an inch, it would guide within the entire guide cavities **1202**. If a guide pin **908** has a length greater than ⅛ but less than 3/16 of an inch, similarly it would guide within the reduced area within the guide cavities **1202**. Finally, if a guide pin **908** has a length greater than 3/16 of an inch it would be guided within the cavity within the reduced area cavity which is within the guide cavities **1202**. With this arrangement, the assembled rotary power tool **102**, mount **103**, rotary tool **104**, adapter **122** and guide pins **908** can guide the rotary tool **104** to various shapes within the lower receiver by interchanging the guide pins **908** length.

(54) FIGS. **13-19** depict various methods with reference to FIGS. **20-27**.

(55) FIG. **13** depicts a method **1300** of jig assembly according to one or more aspects of the disclosure.
(56) At block **1302**, and with reference to FIGS. **21**A-B, thread the buffer adapter **7** into lower receiver. The buffer adapter **7** should sit just below surface of the lower receiver with threaded holes sitting horizontal. If the buffer adapter **7** is difficult to thread, #8-32 screws **15** can be installed for leverage.
(57) At block **1304**, and with reference to FIGS. **21**C-D, orient side plates **3**, **4** on each side of the lower receiver, taking note of right and left as it would be oriented in a shooting position. Insert long quick release pin **10** through right side plate, through receiver rear takedown, and out left side.
(58) At block **1306**, and with reference to FIGS. **21**E-F, place the drill guide **2** between side plates as shown and align screw holes. It should align only one way. Pinch side plates against drill guide and tighten four #8-32 screws **15**.
(59) At block **1308**, and with reference to FIGS. **21**G-H, use 3/16″ Allen wrench to thread ¼-20×2″ screw **13** through left side plate **4** and into right plate **3** using care not to cross-thread.
(60) At block **1310**, and with reference to FIGS. **21**I-J, align the front takedown adapter **8** between front takedown holes. Push the short quick release pin **11** through receiver and adapter as shown.
(61) At block **1312**, and with reference to FIGS. **21**K-L, place the guide plate **1** atop side plates **3**, **4** as shown. Align screw holes on guide plate **1** with buffer adapter **7** screw holes. Thread two #8-32 screws **15** and leave loose.
(62) At block **1314**, and with reference to FIGS. **21**M-N, align front takedown adapter **8** (not shown) with holes in guide plate **1**. Insert and tighten two #8-32 screws **15**, tightening each screw a little at time. Now, tighten two #8-32 screws **15** from blocks **1302-1312**. The buffer adapter **7** will self-center in buffer mount. Guide plate **1** may move as these are tightened. Allow guide plate to move freely during tightening.
(63) At block **1316**, and with reference to FIGS. **210-**P, loosely thread six ¼-20×½″ screws **14** through guide plate **1** and into side plates **3**, **4**. Tighten screws using 3/16″ Allen wrench. The jig assembly is now complete.
(64) FIG. **14** depicts a method **1400** of drilling with a jig assembly according to one or more aspects of the disclosure.
(65) At block **1402**, and with reference to FIG. **22**A, slide ⅜″ drill stop onto shank of ⅜″ drill bit. Insert drill bit to full depth of depth gauge #2 **1104**. Place the drill stop against the edge of the guide plate **1**. Secure drill stop onto drill bit.
(66) At block **1404**, and with reference to FIGS. **22**B-C, spray WD-40 into hole #2 of the drill guide **2**. Insert ⅜″ drill bit into hole. Do not start drill until bit is fully inserted. Start drill and apply firm pressure. Periodically, lift drill to assist in chip removal. Reapply WD-40 as necessary. Stop drilling just before the drill stop touches the drill guide **2**.
(67) At block **1406**, and with reference to FIGS. **22**D-E, prior to drilling, ensure that jig assembly is level. Spray WD-40 into hole #3 of drill guide **2**. Insert 5/16″ drill bit into hole. Do not start drill until bit is fully inserted. Start drill and apply firm pressure. Periodically, lift drill to assist in chip removal. Reapply WD-40 as necessary. Stop drilling when the drill bit exits the bottom of the fire control pocket. Take care not to drill into the trigger guard. In this example, keep the drill bit perpendicular to the lower receiver. Drilling at a large angle can result in an oblong trigger slot.
(68) At block **1408**, and with reference to FIGS. **22**F-G, remove four #8-32 screws **15** and remove the drill guide **2**. It may be necessary to loosen the vise and/or use a screwdriver to gently pry the drill guide from between the side plates. Insert the screw driver shank into hole #2 and gently pry upward.
(69) At block **1410**, and with reference to FIGS. **22**H-I, remove long quick release pin **10** from rear takedown hole.
(70) FIG. **15** depicts a method **1500** of milling with a jig assembly according to one or more aspects of the disclosure.

(71) Initially, prepare your router for milling by installing the universal router adapter **5**. If using a variable speed router, start router on slowest speed and gradually increase speed until optimal milling results are achieved. Generally speaking, this will equate to speed “2” to speed “4” on most variable models with “1” to “10” speed adjustments. Do not insert or remove router while it is spinning. Move router smoothly in a clockwise manner, do not mill in straight lines for extended periods. Avoid abruptly pulling the end mill or exerting excessive force to move the end mill. Apply WD-40 liberally while milling to reduce excess heat. Remove chips whenever necessary.
(72) At block **1502**, and with reference to FIGS. **23**A-B, install #1 (short) guide pins **9** on router adapter **5** using the two smallest socket cap screws and 7/64″ Allen wrench. Open end of pins should be facing up. Make sure pin seats are clear of debris prior to installing. Check that guide pins are properly seated.
(73) At block **1504**, and with reference to FIG. **23**C, set end mill depth to the first hash mark using depth gauge #1 **1102**. Set depth by holding base of router adapter **5** against the edge of the guide plate **1**. Be sure guide pins **9** are not between adapter and guide plate. Make sure router depth adjustment is locked when complete.
(74) At block **1506**, and with reference to FIG. **23**D, orient lower receiver assembly so the buffer extension is closest to the user. Place router assembly atop guide plate **1**, with end mill entering the earlier drilled ⅜″ hole. The notched side of the router adapter should be facing the buffer extension as shown. The guide pins should be positioned inside the guide cavities on both sides. Turn router on slowest speed and increase to operating speed once ready to mill. Mill using consistent pressure and speed, moving in a clockwise manner.
(75) At block **1508**, and with reference to FIG. **23**E, make the first pass of milling allowing the guide pins to follow the entire area of the guide cavities. When milling corners, gently twist the router side to side to assist to complete the entire corner radius.
(76) At block **1510**, and with reference to FIG. **23**F, once the entire pass has been milled to depth, set end mill depth to the second hash mark. Mill second pass following the same method and process as shown in blocks **1506-1508**.
(77) At block **1512**, and with reference to FIGS. **23**G-I, continue milling in this manner, adjusting end mill depth by 1 hash mark until you reach the final hash mark of depth gauge #1. Do not attempt to mill more than 1 hash mark, as it may result in poor quality, longer time and broken end mills.
(78) At block **1514**, and with reference to FIGS. **23**J-K, complete the final pass to full depth of depth gauge #1 and stop. Before continuing to depth gauge #2, the #2 (medium) guide pins **9** should be installed.
(79) FIG. **16** depicts a method **1600** of milling with a jig assembly according to one or more aspects of the disclosure.
(80) At block **1602**, and with reference to FIGS. **24**A-B, remove #1 (short) guide pins **9** and install #2 (medium) guide pins **9** on router adapter **5** reusing the (2) screws and 7/64″ allen wrench. Make sure pin seats are clear of debris prior to installing. Check that guide pins are properly seated.
(81) At block **1604**, and with reference to FIG. **24**C, set end mill depth to the first hash mark using depth gauge #2. Set depth by holding base of router adapter **5** against the edge of the guide plate **1**. Be sure guide pins are not between adapter and guide plate. Make sure router depth adjustment is locked when complete.
(82) At block **1606**, and with reference to FIG. **24**D, place router assembly atop guide plate **1**, with end mill entering the earlier drilled ⅜″ hole. The guide pins **9** should be positioned inside the #2 guide cavities on both sides. Turn router on slowest speed and increase to operating speed once ready to mill. Mill using consistent pressure and speed, moving in a clockwise manner.
(83) At block **1608**, and with reference to FIG. **24**E, complete the first pass allowing the guide pins **9** to follow the #2 guide cavities. When milling corners, gently twist the router side to side to assist to complete the entire corner radius.

(84) At block **1610**, and with reference to FIG. **24**F, once the entire pass has been milled, set end mill depth to the second hash mark. Mill second pass following the same method and process as outlined in blocks **1606** and **1608**.
(85) At block **1612**, and with reference to FIGS. **24**G-I, continue milling in the same manner, adjusting milling depth by 1 hash mark until you reach the final hash mark of depth gauge #2. Do not attempt to mill more than 1 hash mark, as it may result in poor quality, longer time and broken end mills.
(86) At block **1614**, and with reference to FIGS. **24**J-K, complete the final pass to full depth of depth gauge #2. Start the end mill in the 5/16″ pilot hole. Start the router at slowest speed setting and mill the hole larger before increasing the router speed. Once complete, stop. Before continuing to depth gauge #3 **1106**, the #3 (long) guide pins **9** should be installed on the router adapter.
(87) FIG. **17** depicts a method **1700** of milling with a jig assembly according to one or more aspects of the disclosure.
(88) At block **1702**, and with reference to FIGS. **25**A-B, remove #2 (medium) guide pins **9** and install #3 (long) guide pins **9** on router adapter **5** reusing the (2) screws and 7/64″ Allen wrench. Open end of pins should be facing up. Make sure pin seats are clear of debris prior to installing. Check that guide pins are properly seated.
(89) At block **1704**, and with reference to FIG. **25**C, set end mill depth using depth gauge #3. Set depth by holding base of router adapter **5** against the edge of the guide plate **1**. Be sure guide pins are not between adapter and guide plate. Make sure router depth adjustment is locked before when complete.
(90) At block **1706**, and with reference to FIGS. **25**D-E, place router on guide plate **1**, with end mill entering the earlier drilled 5/16″ hole. The guide pins **9** should be positioned inside the #3 guide cavities on both sides. Start the router at slowest speed setting and mill the hole larger before increasing the router speed. Gently mill in a clockwise manner until the trigger slot is formed.
(91) FIG. **18** depicts a method **1800** of drilling with a jig assembly according to one or more aspects of the disclosure.
(92) At block **1802**, clamp jig assembly in the vise by the guide plate **1** so right side plate is facing up and ensure that the assembly is level. Use a rag or cardboard between the vise and guide plate to prevent damage to the top surface of the guide plate.
(93) At block **1804**, and with reference to FIG. **26**A, spray WD-40 into large hole. Insert ⅜″ drill bit into large guide hole (large left hole as shown). Do not start drill until bit is fully inserted in the guide hole. Apply moderate pressure and drill until the bit penetrates the right side wall. Do not drill through both sides.
(94) At block **1806**, and with reference to FIGS. **26**B-C, spray WD-40 into both small holes. Insert 19/64″ drill bit into either remaining guide holes. Do not start drill until bit is fully inserted in the guide hole. Apply moderate pressure and drill until the bit penetrates the right side wall. Do not drill through both sides. Repeat in last remaining hole.
(95) At block **1808**, unclamp jig assembly from vise and flip it over so the left side plate is facing up and re-clamp by the guide plate **1**. Ensure that assembly is level. Use a rag or cardboard between the vise and guide plate to prevent damage to the top surface of the guide plate.
(96) At block **1810**, and with reference to FIGS. **26**D-E, spray WD-40 into both small holes. Insert 19/64″ drill bit into either small guide hole. Do not start drill until bit is fully inserted in the guide hole. Apply moderate pressure and drill until the bit penetrates the left side wall. Continue drilling so the bit passes through the opposite side wall connecting the holes from either side. Repeat on remaining small hole.
(97) At block **1812**, and with reference to FIGS. **26**F-G, spray WD-40 into large hole. Insert ⅜″ drill bit into large guide hole. Do not start drill until bit is fully inserted in the guide hole. Apply moderate pressure and drill until the bit penetrates the right side wall. Continue drilling so the bit passes through the opposite side wall connecting the holes from either side.

(98) FIG. **19** depicts a method **1900** of lower receiver removal using a jig assembly according to one or more aspects of the disclosure.
(99) One advantage of the presently described jig assembly or assemblies is they do not require the user to completely disassemble the jig assembly to remove or mount an 80% lower receiver.
(100) At block **1902**, and with reference to FIG. **27**A, remove two #8-32 screws **15** from the buffer adapter **7**.
(101) At block **1904**, and with reference to FIG. **27**B, remove short quick release pin **11** from front takedown adapter.
(102) At block **1906**, and with reference to FIG. **27**C, remove ¼-20×2″ screw from left side plate **4** using 3/16″ Allen wrench.
(103) At block **1908**, and with reference to FIG. **27**D, the jig assembly and lower receiver should now be separable. For the AR-308 router jig, loosening or removing one of the side plates **3**, **4** may be employed to extract the lower receiver.
(104) At block **1910**, and with reference to FIG. **27**E, unthread the buffer adapter **7** from the lower receiver.
(105) FIG. **20** depicts various components of a jig assembly with reference to FIGS. **13-19** and **21-27**, as described below:
(106) 1. Guide Plate (e.g. guide plate **108** described above); 2. Drill Guide; 3. Right Side Plate (e.g., carriage **114** as described above); 4. Left Side Plate (e.g., carriage **302** as described above); 5. Router Adapter (e.g., power tool adapter **122**); 6. Router Adapter Side Block; 7. Buffer Adapter (e.g., rear support **110** as described above); 8. Front Takedown Adapter (e.g., front support **118**); 9. Guide Pin Set (e.g., **908** as described above); 10. Long Quick Release Pin (e.g., corresponding to locating pin **306**); 11. Short Quick Release Pin (e.g., corresponding to pin **704**); 12. (5) M4×10 Phillips Truss Screw (e.g., adapter screw **906** as described above); 13. (1) ¼″-20×2″ Socket Screw (e.g., carriage screw **304** as described above); 14. (6) ¼″-20×⅝″ Socket Screws (e.g., plate screws **106** as described above); 15. (8) #8-32×⅝″ Phillips Screws (e.g., plate screws **120** as described above).
(107) It should be clear that the above-described jig for manufacturing a firearm lower receiver is a universal fitment and facilitates in the guidance of the rotary tool without placing the rotary tool in direct contact with any of a plurality of guidance features for firearm lower receiver manufacturing. It is straightforward to use, resists wear and produces accurate and repeatable results in the hands of both skilled and unskilled users.
(108) The foregoing has been a detailed description of illustrative embodiments of the invention. Various modifications and additions can be made without departing from the spirit and scope if this invention. Each of the various embodiments described above may be combined with other described embodiments in order to provide multiple features. As used herein the directional terms, such as, but not limited to, “up” and “down”, “upward” and “downward”, “rear”, “rearward” and “forward”, “top” and “bottom”, “inside” and “outer”, “front” and “back”, “inner” and “outer”, “interior” and “exterior”, “downward” and “upward”, “horizontal” and “vertical” should be taken as relative conventions only, rather than absolute indications of orientation or direction with respect to a direction of the force of gravity. Furthermore, while the foregoing describes a number of separate embodiments of the apparatus and method of the present invention, what has been described herein is merely illustrative of the application of the principles of the present invention. For example, the foregoing jig can be adapted to machining and finishing other parts for a firearm, such as portions of an upper receiver that is being repaired, modified or fabricated. Moreover, the jig can be sold as part of a kit with additional right and left carriages and guide pins that are adapted for machining other firearms (for example, polishing the internal surfaces or repairing a restored firearm). This jig can be adapted for firearms of various sizes and shapes by interchanging the carriages, thereby providing a jig that can be useful to a person finishing a firearm, and repairing and/or restoring a firearm. Also, it is expressly contemplated that the size and shape of the

plates of the jig can vary. In general, they are sized in an embodiment proportionally to the depiction herein relative to the size of the lower receiver. Accordingly, this description is meant to be taken only by way of example, and not to otherwise limit the scope of this invention.

Claims

1. A method for forming a jig assembly, comprising: providing a jig including a guide plate configured to be disposed below a top surface of an unfinished lower receiver, a front takedown adapter configured to couple the guide plate with one or more front takedown holes of an unfinished lower receiver, a buffer adapter, a first side plate, and a second side plate, threading the buffer adapter into a buffer mount of the unfinished lower receiver; orienting the front takedown adapter between the front takedown holes on the unfinished lower receiver, the first side plate on a first side of the unfinished lower receiver, the second side plate on a second side of the unfinished lower receiver; threading the first side plate into the second side plate; placing the guide plate atop the first side plate and second side plate; and aligning holes in the guide plate with threaded holes in the front takedown adapter and threaded holes in the buffer adapter.
2. The method of claim 1, further comprising: an adapter configured to couple with a rotary power tool and engage with an upper support surface of the guide plate, the adapter including a window configured to receive the buffer adapter and the buffer mount during machining.
3. The method of claim 2, further comprising: a power tool mount configured to engage with the adapter and configured to receive the rotary power tool.
4. The method of claim 2, wherein in an assembled configuration, the buffer adapter and the buffer mount of the unfinished lower receiver protrude above the upper support surface.
5. The method of claim 2, wherein the adapter is configured to receive a guide pin, the guide pin being configured to engage with the adapter and align the adapter with respect to the guide plate.
6. The method of claim 2, wherein the adapter defines a through-hole for a rotary tool to pass therethrough.
7. The method of claim 1, wherein the guide plate has a thickness between ⅛ inch and ½ inch.
8. The method of claim 2, wherein the guide plate engages with the adapter.
9. The method of claim 1, wherein at least one of the first side plate and the second side plate includes guide holes that receive a drill bit to form holes in at least one of the first side or second side of a lower receiver.
10. The method of claim 1, further comprising at least one locating pin.
11. The method of claim 10, wherein the at least one locating pin is configured to couple the unfinished lower receiver with at least one support feature configured to engage with the guide plate.
12. The method of claim 1, wherein orienting the first side plate on a first side of the unfinished lower receiver and the second side plate on a second side of the unfinished lower receiver includes inserting quick release pins through the second side plate and out the first side plate.
13. The method of claim 1, wherein aligning holes in the guide plate includes inserting at least two fasteners through the holes in the guide plate and the threaded holes in the front takedown adapter.
14. The jig of claim 1, wherein the front takedown adapter includes at least one locating pin.
15. The jig of claim 1, wherein the jig is constructed and rearranged to be a universal fitment onto a rotary power tool for use in firearm lower receiver manufacturing.