United States Patent	12385718
Kind Code	B1
Date of Patent	August 12, 2025
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Locking pin for use in an adjustable buttstock

Abstract

A locking pin assembly for use with an adjustable buttstock of a firearm. The locking pin assembly, in cooperation with an adjustable buttstock, may be used to permit a buttstock to be collapsed or extended in relation to a firearm's receiver. The locking pin assembly engages with the body and release lever of the buttstock to provide for their operative connection. The locking pin assembly is easily fabricated and used.

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Appl. No.: **18/776960**

Filed: **July 18, 2024**

Related U.S. Application Data

us-provisional-application US 63527682 20230719

Publication Classification

Int. Cl.: **F41C23/14** (20060101); **F16B39/28** (20060101)

U.S. Cl.:

CPC **F41C23/14** (20130101); **F16B39/28** (20130101);

Field of Classification Search

CPC: F41C (23/14); F16B (39/28); F16B (39/24)

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Patent No.	Issued Date	Patentee Name	U.S. Cl.	CPC
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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application claims the benefit of the filing of U.S. Provisional Patent Application Ser. No. 63/527,682 titled “Locking Pin for Use in an Adjustable Buttstock,” filed on Jul. 19, 2023, which application is incorporated fully herein by reference.

BACKGROUND OF THE INVENTION
Field of the Invention
(1) This invention relates generally to adjustable buttstocks for firearms, and specifically to a locking pin assembly usable with a collapsible/adjustable buttstock.
Background of the Invention
(2) Firearms, particularly but not limited to long rifles, may feature, or be adapted to include, adjustable buttstocks. An adjustable buttstock permits the length of a rifle (more specifically the distance from the trigger to the rifle butt) to be selectively changed to accommodate the size of the individual user, or to suit the circumstance in which the firearm is being used.
(3) Strictly speaking, there is a difference between a “collapsible” buttstock and a buttstock that is “adjustable.” In firearms usage, the “length of pull” is the distance from the trigger to the buttplate at the end of a long gun's stock; it is the space the user's arm must wrap around the gun to place the trigger hand in a firing position on the gun. “Collapsible” buttstocks can only adjust the length of pull. The user can collapse or extend the stock for a more comfortable firing stance, because of arm length, or other reasons. “Adjustable” buttstocks adjust in ways other than merely length of pull, and may have, for instance, a cheek riser or adjustable butt padding. Thus, adjustable stocks are meant to be adjusted in several ways including but not limited to length of pull and cheek risers. Nevertheless, many people use terms like adjustable, collapsible, and telescoping interchangeably when speaking of buttstocks. For purposes of this disclosure and the claims, “adjustable buttstock” is assigned a broad meaning to include both truly adjustable buttstocks as well as those that are

merely collapsible.
(4) Thus, for example, an adjustable buttstock may be controllably shortened to promote comfortable/proper use by a person of a smaller stature, and may be extended for use by a larger person. Also, an adjustable buttstock permits the firearm's length of pull to be modified by a single user as he or she alters shooting position or posture (e.g., shooting from a standing position versus while kneeling or sitting). Changing shooting positions often affects eye relief, that is, the need for the user's aiming eye to be in the “right spot” relative to the firearm's scope or other gunsight(s) when he shoulders the rifle-which can be accommodated by adjusting a buttstock. Thus, most adjustable buttstocks feature assemblies permitting the stock position to be selectively and temporarily secured in any of several positions, and releasably locked in a desired position while the firearm is in use, and collapsed to a minimum length when the firearm is transported or stored.
(5) Adjustable buttstocks have been known for at least fifty years, and many of their general forms and functions have changed only modestly over that time. Many innovations have involved exploiting improved material compositions, such as enhanced polymers, metal alloys, and composites, used in the stock itself. An early adjustable buttstock disclosure providing useful background for the present invention is U.S. Pat. No. 3,348,328 to Roy, which is incorporated herein by reference. Most adjustable buttstock assemblies include, as seen in the patent to Roy, a handle or release lever attached to a sliding buttstock using an axially movable locking pin assembly having a locking pin spring, and some means for securing the locking pin assembly for reciprocal movement (under the influence of the release lever and the locking pin spring) within the overall buttstock assembly in use. In U.S. Pat. No. 3,348,328, the means for securing the lock pin assembly include a nut having a threaded engagement with the lock pin, accompanied by a roll pin for securing the nut against rotation relative to the lock pin. Further developments in adjustable buttock assemblies have tended mostly to be improvements upon the fundamentals disclosed in this patent to Roy.
(6) An example of the current state of the art of adjustable buttstock assemblies is U.S. Pat. No. 10,830,558 to Underwood et al. All teachings of U.S. Pat. No. 10,830,558 are incorporated herein by reference. Underwood purports to improve upon the prior art by providing a locking pin assembly that is simplified by, among other things, eliminating the use of a roll pin (such as the roll pin featured in the patent to Roy). Underwood nevertheless teaches a locking pin assembly that requires complex machining techniques (particularly features defined in the interior of the axial aperture through its lock pin nut) and relatively expensive (e.g., all-metal) component materials.
(7) There remains an unmet need for a locking pin assembly that is affordably fabricated, including the potential use of non-metal parts, and yet is durable while also being easy to use.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The attached drawings, which form part of this disclosure, are as follows:
(2) FIG. **1** is a perspective side view, from the rear, of an adjustable buttstock assembly useable according to the present invention;
(3) FIG. **2** is a left side view of the buttstock assembly seen in FIG. **1**, with selected interior features depicted with phantom lines, and the rear of the buttstock is to the right in the figure;
(4) FIG. **3** is a front end view of the buttstock assembly seen in FIGS. **1** and **2**;
(5) FIG. **4** is a right side sectional view of the buttstock assembly, taken along section line A-A of FIG. **3**;
(6) FIG. **5** is a bottom perspective view of an embodiment of a locking pin assembly according to the present invention, with a spring component omitted from the view for clarity;
(7) FIG. **6** is a top perspective view of the locking pin assembly seen in FIG. **5**;

(8) FIG. **7** is a perspective exploded view, from below, of a preferred embodiment of the locking pin assembly, including a compression spring component, according to the present invention;
(9) FIG. **8** is a bottom view of a C-clip component of a preferred embodiment of the locking pin assembly;
(10) FIG. **9** is a side view of the C-clip component seen in FIG. **8**;
(11) FIG. **10** is a perspective bottom view of the C-clip component;
(12) FIG. **11** is a bottom view of a ferrule component of a preferred embodiment of the locking pin assembly;
(13) FIG. **12** is a side view of the ferrule component seen in FIG. **11**, with phantom lines showing interior features;
(14) FIG. **13** is a perspective view of the top of the ferrule component;
(15) FIG. **14** is an enlarged side sectional view of the ferrule component, taken along section line A-A in FIG. **11**;
(16) FIG. **15** is a bottom view of the ferrule component with the C-clip component seated therein, but omitting the locking pin;
(17) FIG. **16** is a perspective view of the bottom of the ferrule component with the C-clip component seated therein, but omitting the locking pin;
(18) FIG. **17** is a perspective bottom view of the locking pin assembly shown in a first condition prior to complete assembly;
(19) FIG. **18** is a perspective bottom view of the locking pin assembly according to FIG. **17**, in a second condition of assembly; and
(20) FIG. **19** is a perspective view of the locking pin assembly according to FIG. **18**, in a third condition of assembly.
(21) Like reference numerals identify like elements in the several views. The drawings are not necessarily to scale, either within a view or between views.

DESCRIPTION OF THE INVENTION

(22) There is disclosed hereby a locking pin assembly for cooperative use in an adjustable buttstock of a firearm, for example a rifle or carbine. Adjustable buttstocks are popularly deployed on the AR-15 types of rifles, for instance. The presently disclosed locking pin assembly is manufactured more affordably than assemblies known in the art. Further, the assembly of the locking pin assembly itself, and its installation in a buttstock, is simplified relative to the prior art.
(23) As explained in, for example, U.S. Pat. No. 10,830,558, adjustable buttstocks are controllably slidable or shiftable to-and-fro relative to the body of the firearm's receiver. The use position of the buttstock can be regulated and temporarily set by a means for releasably locking the buttstock in different positions—typically a range of at least several incrementally different positions. The means for releasably locking often includes a handle or release lever or pivotal grip attached to the shiftable buttstock using a locking pin assembly. By manually depressing the release lever, the user can disengage a locking pin from any of a series of apertures or notches in a receiver extension (a rigid tube, sometimes called a “buffer tube,” extending rearwardly from the rifle receiver) to free the buttstock for adjustable movement along the tube. The user then can slidably re-position the buttstock as desired (and to align the locking pin with a corresponding recess (e.g., aperture or notch) in the receiver extension tube). Upon the user's manually releasing the lever, the action of the locking pin spring pushes the locking pin into an extension tube recess or groove to re-lock temporarily the buttstock against sliding motion along the receiver extension.
(24) The present invention is of an improved locking pin assembly. The apparatus of the assembly is suitable for use, or can be adapted for use, in many types and kinds of known and future adjustable buttstock assemblies. The locking pin assembly described hereinafter is an improved alternative to the locking pin assemblies known in the art and as generally explained hereinabove. Among other things, the present invention fills a problem or unmet need for a locking pin assembly that is affordably manufactured, including the need to minimize complex machining of metal

components, as well as the need to advantageously fashion or mold selected parts of the assembly from plastic polymers or composite materials. In the present invention, the main locking pin preferably is made of metal, but it does not require sophisticated or complicated milling or shaping. Components with any relative complexity of shape may be fabricated from non-metals.

(25) Reference is initially made to FIGS. **1-4** illustrating a typical adjustable buttstock assembly **80**. The buttstock assembly **80** has two principal components, the body **82** and a handle-like release lever **84**. Most modern buttstocks, including both the main body **82** and the release lever **84**, are fashioned from polymers, aluminum, composite materials (such as fiberglass, carbon fiber, or Kevlar), or combinations thereof.

(26) The overall configuration of a buttstock body **82** for use with the instant invention is generally according to the known art. As seen in FIGS. **1-4**, the main body **82** includes an upper portion **88** and a lower portion **89** (the two portions ordinarily integrally molded, machined, or otherwise fabricated as a unit). The upper portion **88** defines therein, along most or all its axial length, a tube-like extension tunnel **90** for slidably receiving coaxially therein the rifle's receiver extension (not shown) as well-known in the art. The tunnel **90** ordinarily defines a mostly cylindrical inner wall. The tunnel **90** preferably has a bottom channel or groove **92** along its bottom wall, which groove may be incrementally interrupted along its length by spaced detents or recesses. The buttstock body **82** also defines buttstock top hole **94** that penetrates the body from its upper surface **95** to and into the interior of tunnel **90**. The buttstock top hole **94** facilitates the installation of the inventive locking pin assembly **10** in the overall buttstock assembly **80**, as shall be further described. A complete locking pin assembly **10**, including its locking pin spring, is seen in FIGS. **1-4** functionally installed within the full buttstock assembly **80**.

(27) The release lever **84** in a side view is typically shaped generally in the form of a broadly flattened, inverted “V.” It contacts a lower surface **96** of the body **82**, and is pivotal or rockable in relation thereto. A buttstock locking pin assembly **10** (FIGS. **5-19**) according to the present invention is used to attach the release lever **84** to the buttstock body **82**. More specifically, the locking pin **20** engages operatively with a release lever arm **86** of the release lever **84**. When the release lever **84** is attached beneath the body **82** by means of the locking pin assembly **10**, upward pressure against the release lever handle **85** causes the lever **84** to pivot about its apex **87**. This pivotal movement draws the release lever arm **86** downward (in FIGS. **1-4**) away from the lower surface **96** of the body **82**, and against the action of a spring **40** of the locking pin assembly in a manner further to be described. The release lever **84** thus acts as a sort of cam mechanism which converts pivotal motion of the release lever **84** (with its apex **87** rocking against a lower surface of the body **82**) to a translation (and reciprocating) motion of the locking pin **20** of the locking pin assembly **10**.

(28) Combined reference is made to FIGS. **5-7**, showing components of a preferred embodiment of a locking pin assembly according to the invention. The adjustable buttstock locking pin assembly **10** includes, in one embodiment, a locking pin **20**, a spring **40** (FIG. **7**) a ferrule **50**, and a C-clip **70**. The locking pin **20** preferably but not necessarily is composed of a suitable steel alloy. It is observed from FIG. **7** that a steel pin **20** has comparatively simple exterior contours and features which are readily machined. The spring **40** preferably is a helical compression spring, which also may be fabricated from a metal alloy, locatable coaxially around the pin **20**. In the preferred embodiment of the locking pin assembly **10**, the ferrule **50** and C-clip **70** are fabricated from a polymer, such as a high-impact Nylon, also known as toughened Nylon, made of Nylon 66 or Nylon 6. In one preferred embodiment, the ferrule **50** and/or the C-clip are composed of a 33% glass-filled Nylon composition. Other compositions, including other suitably durable amide polymers, may be adapted. FIGS. **5** and **6** show the locking pin assembly **10** when fully assembled, except that the spring **40** is omitted from these views to simplify the illustration. FIGS. **5** and **6** also show that when the locking pin assembly **10** is fully assembled for use, the C-clip **70** partially surrounds circumferentially one end of the locking pin **20** while the ferrule **50** encloses

circumferentially the C-clip **70**, all in a manner to be further explained. Reference also to FIGS. **17**-**19** suggests that when the locking pin assembly **10** is assembled, the ferrule **50** can hold the spring **40** in place on and around the stem of the locking pin **20**, while the C-clip **70** maintains the ferrule **50** in place upon the locking pin.

(29) The adjustable buttstock locking pin **20** is plainly depicted in FIGS. **5**-**7**. Locking pin **20** preferably is an integral unit machined from a single piece of metal alloy, and may be, for example, approximately 4.5 cm long. The pin **20** has a first end **22** and a second end **23**. On the first end **22** is a solid head **24**, preferably discoid in shape having a diameter of about 6 mm and (for example) about 2 mm thick axially. “Discoid” means having the form of a flat and circular discus having a diameter exceeding its axial thickness or length. On the second end **23** is a cap **25** which preferably is cylindrical and may be, by way of example only, about 1.0 cm in axial length with a diameter (for example, not by limitation) of about 8 mm. Extending between and joining the discoid head **24** and cap **25** is a stem preferably including a cylindrical major shaft **26** coaxially integral with a cylindrical minor shaft **28**. In a preferred embodiment, the stem of the locking pin **20** features the major shaft **26** having a diameter (e.g., approximately 6.0 mm) that is greater than the diameter (e.g., approximately 4.0 mm) of the stem's minor shaft **28**. The diametrical transition between the two shafts **26**, **28** defines a step **29**. The minor shaft **28**, the step **29**, and the upper or inside surface of the discoid head **24** thus define a circumferential clip channel **30**. The diametrical transition between the major shaft **26** and the cap **25** defines an annular seat **32** upon which an end of the spring **40** may be received. For ease of machine fabrication, the major shaft **26** and the head **24** preferably have approximately the same diameter. The outside diameter of the helix of the spring **40** typically is equal to or slightly less than the outside diameter of the cap **25**. On the major shaft **26** is a planar surface defining a keyway **34** extending a distance (e.g., approximately 9 mm) from the step **29** toward the seat **32**. The keyway **34** is operatively engageable with the ferrule **50** in a manner to be further described. Optionally but preferably there is in the first end **22**, such as in the center of the cap **25**, a tool aperture **36** for facilitating manipulation of the pin **20** with a thinly tipped tool (not shown).

(30) Attention is advanced to FIGS. **8**-**10**, showing details of the C-clip **70**. The bottom view of the C-clip **70** in FIG. **8** shows that, viewed axially, the clip has a generally “C” shape defining a mouth **72** that opens radially in the side of the clip. As shall be explained, the mouth **72** permits the C-clip **70** to be inserted into the clip channel **30** in the locking pin **20**, and around the minor shaft **28**. The top **74** and the bottom **75** of the C-clip **70** preferably are planar and mutually parallel. A downward-facing ledge **73** surrounding the circumferential extent of the mouth **72** is defined in/on the interior wall of the C-clip **70**, a modest distance (e.g., about 2.0 mm) above the bottom **75** of the clip. This ledge **73** receives the upper or inside surface of the head **24** of the locking pin **20** when the assembly **10** is fully assembled and at rest. As seen in FIGS. **9** and **10**, the overall exterior contours of the C-clip **70** (apart from the void of the mouth **72**) define a generally frustoconical shape. As suggested by FIG. **9**, the exterior contours of the frustoconical C-clip **70** preferably but not necessarily define a mildly oblique frustum; in the oblique frustum, the vertex of the truncated cone is not directly opposite the center of a circle defined by the periphery of the C-clip's bottom **75**. (Stated differently, an imaginary line representing the height of the (truncated) cone does not pass through the precise center of the base **75**, but is slightly offset radially therefrom.) Nevertheless, all versions of the C-clip **70** feature an exterior wall that tapers inwardly upward from the bottom **75** of the clip towards its top **74**. The exterior size and shape of the C-clip **70** correspond to the size and shape of the interior void defined by the clip bore **52** of the ferrule **50**. As explained further hereinafter, the C-clip **70** thus is adapted for wedged insertion into the ferrule's C-clip bore **52**.

(31) Collective reference is made to FIGS. **11**-**14** illustrating the details of the ferrule **50**, which may be formed from high-impact nylon or suitable alternative composition. The ferrule **50** is generally cylindrical with a planar top **54** and planar bottom **55**. It is about 8.0 mm in axial length, for example, and may have an outside diameter, by way of example and not limitation, of

approximately 12 mm. The ferrule **50** is completely penetrated axially by a clip bore **52**. Notably, and referring particularly to the views of FIGS. **12** and **14**, the clip bore **52** is not cylindrical. Rather, the bore **52** is a void having a generally frustoconical shape defined by the ferrule's interior wall **53**. The top aperture or opening **56** of the bore **52** has a diameter modestly less than the diameter of the bore's bottom aperture or opening **57**. For example only, the maximum diameter of the bore **52** at the bottom opening **57** may be about 9.0 mm, while the minimum diameter defined at the top opening **56** may be about 7.0 mm. It is seen therefore that the interior wall **53** tapers inwardly from the bottom **55** of the ferrule **50** toward the top **54**. As previously mentioned, the frustoconical shape of the void of the bore **52**, including that the frustum is mildly oblique, corresponds to the exterior contours and dimensions of the C-clip **70**.

(32) A longitudinal key **60** extends slightly (e.g., about 1.0 mm) radially into the bore **52** from the interior wall **53** of the ferrule **50**. The key **60** occupies, for example between about 40 degrees and about 60 degrees of the 360-degree circumference of the clip bore **52**. Its interior face (facing radially toward the bore axis) may be approximately planar, but preferably has a minor concave curvature complementary to the circumferential convex curvature of the major shaft **26**. In one embodiment, the key **60** is about 3.0 mm in lateral extent. The key **60** runs axially along the interior wall **53** of the ferrule **50**, extending from the top opening **56** downward, but stops about, for example, 2.0 mm short of the bottom opening **57**. Thus, the key top **62** defines a small shelf within the clip bore **52** about, for example, 2.0 mm above the bottom **55** of the ferrule **50**.

(33) A mode for installing the locking pin assembly **10** in an adjustable buttstock assembly (as such buttstock assemblies are generally known), and its assembly for use, are now described. As is known in the art, there is a vertical hole **94** in the top **95** of an adjustable buttstock **80**, used to place a locking pin assembly **10** into the stock. The buttstock top hole **94** has a diameter (e.g., approximately 9 mm) greater than the diameter of the cap **25** of the locking pin **20**, such that the entire pin **20** can pass through the top hole. Vertically aligned with the top hole **94** in the buttstock **80** is a buttstock bottom hole **97** with a diameter (e.g., about 6 mm) that is less than the diameter of the buttstock's top hole **94**, and in any event less than the diameter of the spring **40** (and the cap **25**). Also at the bottom of the buttstock body is the release lever **84**, which lever is penetrated by a pin aperture **98** having a diameter exceeding the diameter of the locking pin's major shaft **26**, but which is less than the diameter of the ferrule **50**; for example, the release lever's pin aperture **98** may have a diameter of about 7 mm. The buttstock top hole **94**, buttstock bottom hole **97**, and the pin aperture **98** in the release lever are coaxially aligned, as indicated in FIGS. **2-4**.

(34) Prior to installation, the locking pin assembly **10** appears generally as seen in FIG. **17**; that is, the uncompressed spring **40** is disposed around the locking pin's stem, usually the major shaft **26** of the locking pin **20**, with the spring on or near the annular seat **32**. At this outset, the ferrule **50** and C-clip **70** are not engaged with the locking pin **20**, but are separately situated and held for use. In one possible mode of installing the locking pin assembly **10** into an adjustable buttstock assembly, the adjustable buttstock **80** is inverted, and the locking pin **20** (with compression spring **40** thereon) is inverted (i.e., with the pin's second end **23** downward) and inserted upwardly through the top hole **94** of the buttstock **80**. (The inversion of the locking pin **20** causes the spring **40** to remain by gravity upon the locking pin.) This insertion may be facilitated by the use of a thin tool, such the tip of an awl or rigid wire, releasably engaged into the tool aperture **36** in the cap **25** of the locking pin assembly. The insertion of the locking pin **20** and spring **40** is continued until the bottom end of the spring **40** (which at this junction is actually upward within the tube of the buttstock **80**) contacts an interior wall of the buttstock (e.g., the narrowed diameter of the buttstock's bottom hole **97**). Pin insertion is continued as the head **24**, minor shaft **28**, and major shaft **26** are controllably passed through the buttstock's bottom hole **97** and the release lever's pin aperture **98**. The ongoing insertion of the locking pin **20** occurs against the action of the spring **40**, as the spring is now compressed between the interior wall of the buttstock's extension tunnel **90** and the annular seat **32** of the pin **20**, whose cap **25** moves toward the buttstock's interior wall. This forced translation of

the locking pin **20** continues (against the continued compression of the spring **40**) while the first end **22** of the pin (with the head **24**) passes through the pin aperture **98** in the release lever **84**.
(35) The inserting movement is still continued until the keyway **34** on the pin **20** has emerged and is fully exposed out of (at this time, above) the release lever's pin aperture **98**. At this point, the cap **25** on the second end **23** of the locking pin **20** may be received mostly or fully within a cylindrical well or cavity defined in the bottom groove **92** of the buttstock tunnel **90**. The locking pin **20** and the spring **40** (the latter held in compression) are maintained in this position on the buttstock **80** pending complete assembly of the locking pin assembly **10**. (The use of auxiliary jigs or clips to temporarily maintain the compression of the spring **40** and the extended condition of the locking pin **20** may permit the buttstock **80** to be inverted again (i.e., turned right-side up) while the locking pin assembly **10** is completed.)
(36) This disclosure is continued with the understanding that the top **95** of the buttstock **80** now is upward, and with the first end **22** (and head **24**) of the locking pin **20** projecting downward, oriented as seen in FIGS. **17**-**19**. The buttstock **80** and release lever **84** are omitted from FIGS. **17**-**19** for the sake of clarity of illustration; it is understood that the bottom wall of the buttstock body **82** and the release lever **84** (which are in adjacent contact) will be disposed between the top **54** of the ferrule **50** and the bottom of the spring **40** in FIGS. **17**-**19**. Again, FIGS. **1**-**4** show the locking pin assembly **10** installed for use within the buttstock assembly **80** configured and assembled for use.
(37) Referring to FIGS. **7** and **18**, with the spring **40** compressed and the keyway **34** exposed below the release lever **84**, the ferrule **50** is placed on the first end **22** of the locking pin **20**. As seen in FIG. **1**, the ferrule's key **60** is aligned with the locking pin's keyway **34**. As also seen in FIG. **18**, the ferrule **50** is slipped over and past the head **24** of the locking pin **20**, with the first end **22** of the pin being inserted through the ferrule's clip bore **52**, the ferrule key **60** in aligned registration with the locking pin keyway **34**, and the ferrule **50** arranged circumferentially around the pin's major shaft **26**. The ferrule **50** is moved upward (referring also to FIG. **7**) to place its top **54** near or into contact with the lower end of the spring **40**.
(38) With the locking pin **20** and ferrule **50** arranged as seen in FIG. **18**, the C-clip **70** is clipped into place upon the minor shaft **28** of the locking pin. The C-clip **20**, when installed, functions to secure the ferrule **50** against axial separation from the first end **22** of the locking pin **20**. FIG. **19** indicates that installation of the C-clip **70** upon the locking pin **20** is accomplished by pushing the locking pin's minor shaft **28** into the mouth **72** of the C-clip **70**. (Or, perhaps more particularly, the C-clip **70** is engaged around the minor shaft **28**.)
(39) FIGS. **18**-**19** show that, properly positioned for engagement with the minor shaft **28**, the C-clip's open mouth **72** is disposed diametrically opposite the ferrule's key **60**, such that the distal lips of the C-clip are arranged on opposite (circumferential) sides of the key **60**. Because the outside diameter of the minor shaft **28** exceeds the distance between the distal lips of the mouth **72** of the elastically resilient C-clip **72**, the C-clip “snaps” into releasable but reliable engagement in the pin's clip channel **30**, with the C-clip snuggly surrounding most of the circumference of the minor shaft **28**. When the locking pin assembly **10** is completely assembled, each of the two lips of the C-clip **70** preferably is drawn adjacent to a lateral side of the key **60**.
(40) When the C-clip **70** is fully installed upon the locking pin **20**, the annular upper surface of the locking pin head **24** contacts against the C-clip's circumferential interior ledge **73**. This engagement of the head **24** with the ledge **73** assists in securing the C-clip **70** against being inadvertently pushed or pulled axially off the first end of the locking pin **20**. Moreover, in a finished assembly of the locking pin assembly **10**, the upper surface of the locking pin head **24** contacts against the top **62** of the key **60** inside the ferrule **50**.
(41) With the C-clip **70** disposed in the locking pin's clip channel **30**, the potential energy of the compressed spring **40** is deliberately released by a user. The action of the spring **40**, which is compressed between the locking pin's annular seat **32** and an inside bottom wall of the buttstock

body **82**, pulls the entire locking pin assembly **10** (upward) toward the buttstock assembly **80**, and more particularly draws the ferrule **50** toward the outer bottom surface of the release lever **84**. This pulling action, particularly after the top **54** of the ferrule **50** contacts the bottom of the release lever **84**, also urges the C-clip **70** into the ferrule's clip bore **52**. The potential energy of the compressed spring **40** thereafter maintains the locking pin assembly **10** in a use configuration upon the buttstock assembly **80**.

(42) The foregoing essentially completes the installation of the locking pin assembly **10** on the adjustable buttstock. The assembly **10** (minus the spring **40**) is arranged as seen in FIG. **5**, with the cap **25** situated within the groove **92**, well or cavity defined in the bottom wall of the tunnel **90** of buttstock body **82**. Most of the axial length of the locking pin **20** is within the interior of the buttstock body **82** and release lever **84**, with only its first end **22** extending below the bottom of the release lever. The top **54** of the ferrule **50** abuts the bottom of the release lever **84**, and is held in such abutting contact by the ongoing compressive action of the spring **40** (which is inside the buttstock). Locking pin assembly **10** is thus configured for use in cooperation with the buttstock assembly **80**, including the release lever **84**.

(43) An advantage of the invention is the elimination from the locking pin assembly **10** of any threaded components with screwed engagement. Screw threading is a relatively expensive machining process. Threaded nuts and pins known in the art can be difficult to engage/disengage without damaging the components.

(44) When the locking pin assembly **10** is fully assembled and installed on a buttstock assembly, the C-clip **70** is inserted, wedge-like, into the ferrule **50** via the ferrule's bottom opening **57**. As explained previously, the overall exterior contours of the C-clip **70** complement the interior contours of the ferrule's clip bore **52**, so that the C-clip mates snugly within the bore **52**. Additional reference is made to FIGS. **15-16** in these regards, showing the inter-arrangement of the C-clip **70** within the ferrule **50** (the locking pin **20** omitted from FIGS. **15** and **17** for clarity of illustration). When the ferrule **50** and C-clip **70** are configured to releasably hold the locking pin **20** in place on the adjustable buttstock assembly **80**, the bottom surface **75** of the C-clip **70** preferably is substantially flush with the bottom **55** of the ferrule. The top **54** of the ferrule **50** is contactable with the release lever **84**, due to the action of the spring **40**, but the presence of the C-clip **70**—which is securely snapped within the clip channel **30** of the locking pin **20**—prevents the ferrule from being pushed off the second end **22** of the locking pin. The concurrent action of the spring **40** drawing upward the pin **20** toward the buttstock assembly, accordingly pulls the C-clip **70** axially upward for wedgeable insertion into the clip bore **52** from the ferrule's wider bottom opening **57** toward its narrower top opening **56**. But because the C-clip **70** cannot pass through the ferrule's top opening **56**, the C-clip **70** is retained reliably within the ferrule **50** in the positions seen in FIGS. **15** and **16**.

(45) Also seen in FIGS. **15** and **16** is the ledge **73** inside the C-clip **70** upon which the head **24** of the locking pin **20** abuts in the finished assembly configured for use in a buttstock. The contact between periphery of the head **24** and the ledge **23** permits spring force to be transmitted from the pin **20** to the C-clip **70**, and prevents the first end **22** of the locking pin from being pulled through the C-clip. FIG. **15** also reveals the ledge-like key top **62** of the ferrule **50**. When the C-clip **70** is fully seated within the bore **52** of the ferrule **50** as seen in FIGS. **15** and **16**, the key top **62** is at approximately the same axial position or elevation as the C-clip's ledge **73**. This alignment permits the top of the pin head **24** to abut the key top **62** concurrently with the contact between the head **24** and the ledge **73**. When the locking pin assembly **10** is in use, the periphery of the locking pin's head **24** thus is circumferentially abutted by the C-clip's ledge **23** and (for a comparatively minor arcuate length) the ferrule's key top **62**.

(46) Attention is returned to FIG. **5** (a bottom perspective view) and FIG. **6** (a top perspective view) showing the locking pin assembly **10** (minus the spring **40**) configured for use. It is noted that the operative engagement between the locking pin's keyway **34** and the ferrule's key **60** serves to limit rotary movement of the ferrule **50** around the locking pin **20**, while nevertheless fostering axial

placement of the ferrule upon the first end **22** of the locking pin. The releasable but reliable situation of the C-clip **70** in the locking pin's clip channel **30** (between the head **24** and the step **29**) prevents the C-clip from significant axial shifting along the locking pin **20**. Finally, the wedged insertion of the frustoconical C-clip **70** within the correspondingly shaped bore **52** of the ferrule **50** prevents the ferrule from separating axially from the first end of the locking pin **20**.

(47) If and when it may be desired to remove the locking pin assembly **10** from the buttstock assembly, the installation steps disclosed hereinabove are generally performed in reverse order. Removal of the locking pin assembly **10** may be indicated for purposes of cleaning the assemblies, removal/replacement of the release lever, or replacement of components of the locking pin assembly itself.

(48) To remove the locking pin assembly **10** from the buttstock assembly, a thin tool (again, a stiff wire is usually suitable) is inserted through the buttstock's top hole **94** and pressed against the top of the cap **25** (within the buttstock), e.g., engaged with the tool aperture **36**. With the buttstock **80** maintained in place, the locking pin **20** is then pushed downward to shift the ferrule **50** away from the bottom of the release lever **84** (which exposes a segment of the major shaft **26**). The ferrule **50** is then shifted (for instance, manually as grasped between the user's two fingers) upward axially along the exposed segment of the major shaft **26**. This movement of the ferrule **50**, with the locking pin **20** still held against movement, exposes the C-clip **70** from within the ferrule's clip bore **52**. The C-clip **70** is then disengaged from the locking pin's clip channel **30**, and is removed from the locking pin **20**. With the C-clip **70** removed entirely from the locking pin **20**, the ferrule **50** is removed from the first end of the locking pin **20** by slipping in it over and past the head **24**. Absent the ferrule **50**, the locking pin **20** and spring **40** are readily withdrawn from the interior of the buttstock assembly.

(49) Only some embodiments of the invention and but a few examples of its versatility are described in the present disclosure. In this disclosure, “approximately,” or “about,” when referring to a dimension, means plus or minus 10%, e.g., “approximately 10 mm” encompasses a range of 9.0 mm to 11 mm inclusive. It is understood that the invention is capable of use in various other combinations and is capable of changes or modifications within the scope of the inventive concepts expressed herein. Thus, although the invention has been described in detail with particular reference to these preferred embodiments, other embodiments can achieve the same results. Variations and modifications of the present invention will be obvious to those skilled in the art and it is intended to cover with the appended claims all such modifications and equivalents. The entire disclosures of the patents cited hereinabove are hereby incorporated by reference.

Claims

1. A locking pin assembly adapted for use with an adjustable buttstock assembly, the locking pin assembly comprising: a locking pin comprising: a first end having a discoid head; a second end having a cap; a stem extending between the head and cap, the stem comprising a major shaft adjoining the cap and a minor shaft adjoining the head, the major shaft being coaxially integral with the minor shaft, a diameter of the major shaft exceeding a diameter of the minor shaft, wherein the diametrical transition between the major and minor shafts defines a step; a circumferential clip channel defined between the head and the step; and a planar keyway on the major shaft extending from the step toward the cap.

2. The locking pin assembly according to claim 1 wherein the cap has a diameter greater than the diameter of the major shaft wherein a diametrical transition between the major shaft and the cap defines an annular seat.

3. The locking pin assembly according to claim 1, further comprising a C-clip defining a mouth opening radially in a side of the clip, whereby the C-clip is insertable into the clip channel and around the minor shaft.

4. The locking pin assembly according to claim 3 wherein the C-clip further comprises: a planar top; a planar bottom parallel to the top; and exterior contours defining a frustoconical shape.
5. The locking pin assembly according to claim 4 wherein the C-clip further comprises: an interior wall; and a downward-facing ledge, defined on the interior wall a distance above the clip bottom, for receiving an inside surface of the head.
6. The locking pin assembly according to claim 4 wherein the exterior contours of the C-clip define an oblique frustum.
7. The locking pin assembly according to claim 4, further comprising a cylindrical ferrule penetrated axially by a clip bore, wherein the ferrule comprises a ferrule interior wall defining a void of the clip bore having a frustoconical shape corresponding to the exterior contours of the C-clip.
8. The locking pin assembly according to claim 4 wherein the C-clip and the ferrule comprise a polymer.
9. The locking pin assembly according to claim 7, the ferrule further comprising: a planar top having a top opening therein; and a planar bottom having a bottom opening therein; wherein the ferrule interior wall tapers inwardly from the bottom of the ferrule toward the top.
10. The locking pin assembly according to claim 9, the ferrule further comprising a longitudinal key extending radially from the ferrule interior wall into the clip bore, running axially along the ferrule interior wall downward from the top of the ferrule, and alignable with the locking pin keyway.
11. A locking pin assembly adapted for use with an adjustable buttstock assembly, the locking pin assembly comprising: a locking pin comprising: a first end having a head; a second end having a cap; a stem extending between the head and cap; a circumferential clip channel defined in the stem; and a planar keyway on the stem; a ferrule penetrated axially by a clip bore, the ferrule disposable around the first end of the locking pin; a spring disposable around the stem; and a C-clip defining a mouth in a side of the clip, whereby the C-clip is insertable into the clip channel and around the stem, and wherein the C-clip is insertable into the clip bore.
12. The assembly according to claim 11 wherein: the locking pin stem comprises a major shaft adjoining the cap and a minor shaft adjoining the head, the major shaft being coaxially integral with the minor shaft, a diameter of the major shaft exceeding a diameter of the minor shaft, wherein the diametrical transition between the major and minor shafts defines a step; the circumferential clip channel is defined between the head and the step; and the planar keyway is on the major shaft extending from the step toward the cap.
13. The assembly according to claim 12 wherein the ferrule further comprises: a top having a top opening of the clip bore; a bottom having a bottom opening of the clip bore; and a ferrule interior wall around the clip bore and extending between the ferrule top and the ferrule bottom, wherein the ferrule interior wall tapers inwardly from the ferrule bottom toward the ferrule top to define a frustoconical shape of the clip bore.
14. The assembly according to claim 13, the ferrule further comprising a longitudinal key extending radially into the clip bore, running axially along the ferrule interior wall downward from the top of the ferrule, and alignable with the locking pin keyway.
15. The assembly according to claim 14 wherein the C-clip further comprises: a planar top; a planar bottom parallel to the top; and exterior contours defining a frustoconical shape corresponding to the frustoconical shape of the clip bore; wherein the C-clip is wedgeably insertable into the clip bore.
16. The assembly according to claim 15 wherein the C-clip further comprises a downward-facing ledge defined on the C-clip's interior wall a distance above the bottom of the clip, for receiving thereon an inside surface of the head when the assembly is configured for use.
17. The assembly according to claim 16 wherein the inside surface of the head contacts against a top of the key inside the ferrule when the assembly is configured for use.
18. The assembly according to claim 15 wherein the cap has a diameter greater than the diameter of

the major shaft, wherein a diametrical transition between the major shaft and the cap defines an annular seat upon which an end of the spring is received when the assembly is configured for use.

19. The assembly according to claim 15 wherein the C-clip is composed of nylon.

20. The assembly according to claim 15 wherein the ferrule is composed of nylon.