REPLY TO
ATTN OF: GP

TO: KSI/Scientific & Technical Information Division
Attn: Miss Winnie M. Morgan

FROM: GP/Office of Assistant General Counsel for Patent Matters

SUBJECT: Announcement of NASA-Owned U.S. Patents in STAR

In accordance with the procedures agreed upon by Code GP and Code KSI, the attached NASA-owned U.S. Patent is being forwarded for abstracting and announcement in NASA STAR.

The following information is provided:

U.S. Patent No. : 4,064,642
Government or Corporate Employee : U.S. Government
Supplementary Corporate Source (if applicable) :
NASA Patent Case No. : ARC-11101-1

NOTE - If this patent covers an invention made by a corporate employee of a NASA Contractor, the following is applicable:

YES [ ] NO [X]

Pursuant to Section 305(a) of the National Aeronautics and Space Act, the name of the Administrator of NASA appears on the first page of the patent; however, the name of the actual inventor (author) appears at the heading of column No. 1 of the Specification, following the words "...with respect to an invention of ..."

Bonnie L. Henderson

Enclosure
A walking boot assembly particularly suited for use with a positively pressurized spacesuit, including a bootie adapted to be secured to the foot of a wearer, an hermetically sealed boot for receiving the bootie having a walking sole, an inner sole and an upper portion adapted to be attached to an ankle joint of a spacesuit, a protuberance projected from the bootie and received within a recess formed in the inner sole of the boot for positioning the bootie relative to the boot, and releasable latching means for latching the protuberance in a received relationship with the recess.

References Cited
U.S. PATENT DOCUMENTS
3,139,622 7/1964 Schueller 2/2.1 A
3,751,727 8/1973 Shepard et al. 2/2.1 A

References Cited
FOREIGN PATENT DOCUMENTS
20,610 11/1918 France 36/99

ABSTRACT
A walking boot assembly particularly suited for use with a positively pressurized spacesuit, including a bootie adapted to be secured to the foot of a wearer, an hermetically sealed boot for receiving the bootie having a walking sole, an inner sole and an upper portion adapted to be attached to an ankle joint of a spacesuit, a protuberance projected from the bootie and received within a recess formed in the inner sole of the boot for positioning the bootie relative to the boot, and releasable latching means for latching the protuberance in a received relationship with the recess.
WALKING BOOT ASSEMBLY

ORIGIN OF THE INVENTION

The invention described herein was made by employees of the United States Government and may be manufactured and used by or for the government for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates generally to footwear and more particularly to an improved walking boot assembly adapted for use with spacesuits and the like.

2. Description of the Prior Art

Spacesuits are generally expensive to fabricate and, generally, it is advantageous when a given spacesuit can be comfortably worn by different astronauts of varying sizes. In the past, boots for a spacesuit were often custom made for one particular wearer. In some cases the boots were made oversized and liners, sometimes referred to as “spacers,” were employed to take up the excess volume. Spacers, of course, tend to have many drawbacks and they are seldom comfortable to wear, even for short periods of use. Moreover, spacers tend to impair foot ventilation and cause excessive perspiration.

It is, therefore, the purpose of the instant invention to provide an improved boot assembly for a spacesuit which can be worn by a plurality of wearers having mutually differing foot sizes.

OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an improved boot assembly which overcomes the aforementioned difficulties and disadvantages.

It is another object to provide an improved boot assembly which accommodates feet of different sizes.

It is another object to provide for use in combination with a spacesuit an improved boot assembly adapted to fit the feet of wearers having different foot sizes.

It is another object to provide in combination with the spacesuit an improved boot assembly which includes a hermetically sealed boot attached to the ankle joint of a spacesuit, and a bootie adapted to be worn by a wearer, inserted into the boot and releasably latched to the inner sole of the boot for securing the bootie in fixed relation with the boot.

Another object is to provide an improved boot assembly which is particularly useful in combination with an hermetically sealed pressure suit, such as a spacesuit, although not necessarily restricted in use thereto, since the boot assembly may enjoy equal utility in terrestrial environments.

These and other objects and advantages are achieved through the use of a bootie comprising a truncated shoe, adapted to be worn by a wearer and characterized by a sole segment configured to be positioned between the ball and the heel of the foot of a wearer and having a raised protuberance configured to be received within a recess formed within an hermetically sealed walking boot, and a manually operable latching mechanism for releasably securing the protuberance in place within the recess, as will become more readily apparent in view of the following description and claims, in light of the accompanying drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings with more particularity wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 an improved boot assembly, generally designated 10, embodying the principles of the instant invention. While the boot assembly 10 is intended to be worn on a right foot, it should be apparent that a similar boot comprising a mirror image of the boot 10 may be worn on the left.

As illustrated in FIG. 1, the boot assembly 10 is connected with an ankle joint assembly, generally designated 12, of a pressure suit of the type frequently referred to as a spacesuit. Such an ankle joint assembly is more fully described in U.S. Letters Patent application No. 753,965, filed Dec. 23, 1976, incorporated herein by reference thereto.

The boot assembly 10 includes an hermetically sealed walking boot 14. The walking boot, in turn, includes a walking sole 16, formed of a commercially available synthetic resin, and a flexible upper portion 18, for the sake of convenience hereinafter referred to simply as an “upper,” fabricated from a suitable flexible, impervious material, connected with the ankle joint assembly 12 at an anulus 20 provided therefor.

As a practical matter, the upper 18 is fabricated from an impervious, laminated fabric, such as coated Nomex. Where desired, the upper 18 constitutes a continuation of the sleeve-like body employed as a flexible diaphragm for the ankle joint assembly 12.

Since the ankle joint assembly 12 is more fully described in the aforementioned U.S. Letters Patent application No. 753,965, a detailed description thereof is omitted in the interest of brevity. However, it is to be understood that, as shown, the upper 18 is affixed to and supported by the annulus 20.

The boot 14 also includes an inner sole subassembly, generally designated 22, formed of materials found to be satisfactory for this purpose. The configuration of the inner sole 22 is suitable for supporting the foot of a wearer. As a practical matter, the inner sole 22 includes a wedge-shaped segment 24 which serves to provide adequate support for the heel and longitudinal arch of the foot of a wearer.

The walking boot assembly 10 further includes a bootie, generally designated 26. The bootie 26, in practice, is a truncated shoe of an open-toe, open-heel configuration. Thus the bootie is configured to include a band 28 adapted to be disposed in circumscribing rela-
tion with the arch and instep of the foot of a wearer, while a heel strap is provided for maintaining the

in a desired positional relationship with the foot

of the wearer. Suitable lacing, generally designated, is provided for tightening the band about the foot of

the wearer in a manner which should readily be apparent.

It is important to note that the bootie further includes a segment of a hard sole, designated, disposed

beneath the arch of the foot of the wearer, to which is attached a protuberance, as best shown in FIG. 3.

This protuberance is configured to be received by a receptacle, generally designated, including a recess

provided in the inner sole of the boot. Therefore, it should be apparent that the configuration of the recess

constitutes a mirror image of the configuration of the protuberance.

In order to provide for a suitable mounting of the protuberance, there is provided a wedge-shaped base

disposed to the sole segment of the bootie. Preferably, the base is rigidly affixed to the sole segment of

the lacing utilizing suitable fasteners, including adhesives and the like. Projected from the plane of the base plate there is a latch housing having an axially related planar side surfaces. As a practical matter, the housing is of a truncated, pyramidal configuration and is formed of a suitable material such as metal or the like employing techniques fully understood by those familiar with the metal working arts. Of course, where so desired, the housing may be formed of suitable synthetic resins.

Within the housing there is disposed an axially displaceable latching bolt having a normally extended end including a cam face, defining an axially extended pawl. The bolt is seated for reciprocatory motion within a suitable bore and is retained within the bore by a pin-and-slot coupling. This coupling includes a pin extended through an elongated slot formed in the bolt, the length of which determines the throw of the bolt. The pin, of course, is secured within the latch housing employing any suitable means.

Within the bore there is disposed a compression spring. This spring is interfaced between the bolt and the housing and serves to continuously urge the latching bolt in axial displacement toward an extended relationship with the bore. It should, therefore, be apparent that the face of the latching bolt normally is resiliently supported in an extended relationship with the latch housing.

It is important to note that within the receptacle there is provided a detent adapted to cooperate with the latching bolt. The detent is, as a practical matter, comprises an open end of a bore disposed in communication with the recess and receives the extended end portion of the latching bolt. Thus a releasable coupling of the protuberance within the receptacle is achievable.

In order to more firmly couple the protuberance with the receptacle, it has been found desirable to provide another latching bolt in spaced relation with the bolt. The bolt is disposed within the inner sole of the boot and is seated in a tubular bore coaxially aligned with the detent and communicating with the recess. Like the latching bolt, the latching bolt includes a normally projected end having a cam face defining an axially extended pawl. The bolt is resiliently supported for axial reciprocation. This is achieved through a use of a compression spring seated within the bore and disposed in an abutting relationship with one end of the latching bolt for purposes of urging the bolt in axial extension into the recess of the receptacle. A pin-and-slot coupling is provided for limiting the throw of the bolt. The coupling includes a slot formed in the latching bolt and a rigid pin extended therethrough. Thus the latching bolt is retained within the bore while axial displacement thereof is accommodated.

In order to receive the extended end portion of the latching bolt, there is provided within the latch housing a detent. This detent is arranged in coaxial alignment with the latching bolt and serves to receive the adjacent end portion of the latching bolt.

As a practical matter, a mated relationship between the protuberance and the receptacle is achieved by aligning the latch housing with the recess and then inserting the housing into the recess. Therefore, it is to be understood that the cam faces of the extended end portions of the latching bolts and, respectively, engage the adjacent surfaces of the recess and housing, respectively, so that the latching bolts are cammed in retracting displacement against the applied forces of the supporting springs until such time as the latching bolts become aligned with their respective detents. Upon becoming aligned, the bolts are forced by their supporting springs and into seated relation with the detents.

In order to accommodate a release of the protuberance from its mated relationship with the receptacle, there is provided in the boot a manually operable release mechanism, generally designated, FIGS. 1 and 5.

The release mechanism includes a tubular shell of a generally cylindrical configuration. The shell is embedded in the inner sole of the walking boot in coaxial communication with the detent and bore and communicates with the surface of the heel portion of the boot. Seated within the shell there is an axially displaceable plunger. The plunger comprises a cylindrical body having a first end portion disposed axially from the shell and the heel portion of the boot. The end portion of the plunger is positioned to serve as a manually operable button, and is disposed within a protective housing provided therewith. The shell is hermetically sealed by a suitable seal disposed in concentric relation with the end portion of the plunger and supported by a seal.

Near the end of the plunger, opposite its end, there is provided a latching bolt actuator, generally designated. The actuator includes an end portion of the plunger, the diameter of which is substantially reduced with respect to the diameter of the body of the plunger. As a practical matter, the shell is further hermetically sealed by an O-ring supported in place by an annular retainer disposed in concentric relation with the end portion of the plunger. As shown, the O-ring is interposed between the retainer and a shoulder, not designated, defined about the periphery of the plunger.

Also included in the actuator is a retractor pin. This pin is extended in coaxial relation with the end portion of the plunger. The retractor pin, where so desired, is formed simply by machining the end por-
In order to effect a release of the protuberance 36 from the receptacle 38, the end portion 70 of the plunger 69 is depressed thus causing the plunger 69 to advance axially along the shell 68. This advancement of the plunger causes the retractor pin 84 to enter the detent 54 and engage the end portion of the latching bolt 44 for retracting the latching bolt from the detent against the applied force of the spring 52. Of course, the extended end portion 90 of the latching bolt 44 engages the adjacent end surface of the latching bolt 56. Continued displacement of the plunger 69 now causes the latching bolt 56 to be forced in retracting displacement against the applied forces of the spring 60, for thus causing the latching bolt 56 to be retracted from the detent 65. Once the latching bolts 44 and 56 are retracted from their respective detents, the protuberance 36 is released for extraction from the receptacle 38. The bootie 26, and hence the foot of the wearer, is thus released for extraction from the walking boot 14.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the illustrative details disclosed.

What is claimed is:

1. In a walking boot assembly, the combination comprising:
   a. a bootie having a sole and an upper portion adapted to be attached to a foot of a wearer;
   b. a walking boot having an inner sole and an upper portion for receiving said bootie; and
   c. coupling means for releasably attaching said bootie to the walking boot, said coupling means including a protuberance affixed to the sole of said bootie, a recess defined in the inner sole of said boot for receiving said protuberance in mated relation, and means for securing said protuberance in mated relation with said recess.

2. The combination of claim 1 wherein said coupling means includes a spring biased latching pawl and a detent for receiving said pawl.

3. The combination of claim 1 wherein said bootie comprises a truncated shoe having a sole adapted to be received beneath the longitudinal arch of the foot of a wearer, and means including a band adapted to be passed about the foot for securing said sole in place relative to said arch.

4. The combination of claim 3 wherein said coupling means further includes:
   a. a retractable pawl mounted in said protuberance and extended therefrom;
   b. means defining in said recess a detent for receiving said pawl; and
   c. means for continuously urging said pawl into an extended relationship with said protuberance.

5. The combination of claim 4 wherein said coupling means further includes:
   a. a retractable pawl extended into said recess; and
   b. means defining in said protuberance a detent for receiving said pawl; and
   c. means for continuously urging said pawl into an extended relationship with said recess; and
   d. manually operable means mounted on said boot for simultaneously retracting said pawls.

6. The combination of claim 5 wherein each of said pawls includes a spring biased bolt resiliently supported for axial displacement and said means for simulta-

In order to effect a release of the protuberance 36 from the receptacle 38, the end portion 70 of the plunger 69 is depressed for thus causing the plunger 69 to advance axially along the shell 68. This advancement of the plunger causes the retractor pin 84 to enter the detent 54 and engage the end portion of the latching bolt 44 for retracting the latching bolt from the detent against the applied force of the spring 52. Of course, the extended end portion 90 of the latching bolt 44 engages the adjacent end surface of the latching bolt 56. Continued displacement of the plunger 69 now causes the latching bolt 56 to be forced in retracting displacement against the applied forces of the spring 60, for thus causing the latching bolt 56 to be retracted from the detent 65. Once the latching bolts 44 and 56 are retracted from their respective detents, the protuberance 36 is released for extraction from the receptacle 38. The bootie 26, and hence the foot of the wearer, is thus released for extraction from the walking boot 14.

Although the invention has been herein shown and described in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of the invention, which is not to be limited to the illustrative details disclosed.

What is claimed is:

1. In a walking boot assembly, the combination comprising:
   a. a bootie having a sole and an upper portion adapted to be attached to a foot of a wearer;
   b. a walking boot having an inner sole and an upper portion for receiving said bootie; and
   c. coupling means for releasably attaching said bootie to the walking boot, said coupling means including a protuberance affixed to the sole of said bootie, a recess defined in the inner sole of said boot for receiving said protuberance in mated relation, and means for securing said protuberance in mated relation with said recess.

2. The combination of claim 1 wherein said coupling means includes a spring biased latching pawl and a detent for receiving said pawl.

3. The combination of claim 1 wherein said bootie comprises a truncated shoe having a sole adapted to be received beneath the longitudinal arch of the foot of a wearer, and means including a band adapted to be passed about the foot for securing said sole in place relative to said arch.

4. The combination of claim 3 wherein said coupling means further includes:
   a. a retractable pawl mounted in said protuberance and extended therefrom;
   b. means defining in said recess a detent for receiving said pawl; and
   c. means for continuously urging said pawl into an extended relationship with said protuberance.

5. The combination of claim 4 wherein said coupling means further includes:
   a. a retractable pawl extended into said recess; and
   b. means defining in said protuberance a detent for receiving said pawl; and
   c. means for continuously urging said pawl into an extended relationship with said recess; and
   d. manually operable means mounted on said boot for simultaneously retracting said pawls.

6. The combination of claim 5 wherein each of said pawls includes a spring biased bolt resiliently supported for axial displacement and said means for simulta-
neously retracting said pawls comprises an axially displaceable rod mounted in said boot and projected therefrom in coaxial alignment with the pawls and disposed in abutting engagement with at least one of the pawls.

7. The combination of claim 6 wherein the upper portion of said boot is connected to one leg of a spacesuit and the boot comprises an hermetically sealed boot.

8. In combination with a spacesuit an improved boot assembly comprising:

A. a bootie adapted to be donned by a wearer of the spacesuit including a segment of sole adapted to be positioned between the ball and the heel of the foot of the wearer and an adjustable band for securing the segment of the sole to the foot;

B. an hermetically sealed boot including a walking sole, an inner sole and an upper portion formed of a flexible, impermeable material connected to one leg of said suit;

C. foot positioning means for positioning the foot in fixed relation with said boot including a protuberance projected from the segment of the sole and means defining a recess in the inner sole of said boot for receiving said protuberance;

D. latching means for securing said protuberance in said recess including a first and a second pawl, means defining a first and second detent for receiving each of said pawls and a first spring biased pawl mounted in said protuberance and resiliently projected therefrom, means defining in said recess a detent for receiving said pawl in mated relation, a second spring biased pawl mounted in the inner sole of said boot and resiliently projected into said recess, and means defining in said protuberance a detent for receiving said second pawl; and

E. manually operable means mounted on said boot for simultaneously retracting said first and second pawls including an axially extensible rod disposed in coaxial alignment with said pawls when said protuberance is received in said recess engageable with at least one of said pawls for retracting the pawls as axial displacement is manually imparted thereto.