

C. ANDERSON & M. SILVER.
 DIVING SUIT.
 APPLICATION FILED JAN. 13, 1911.

1,022,997.

Patented Apr. 9, 1912.

2 SHEETS—SHEET 1.

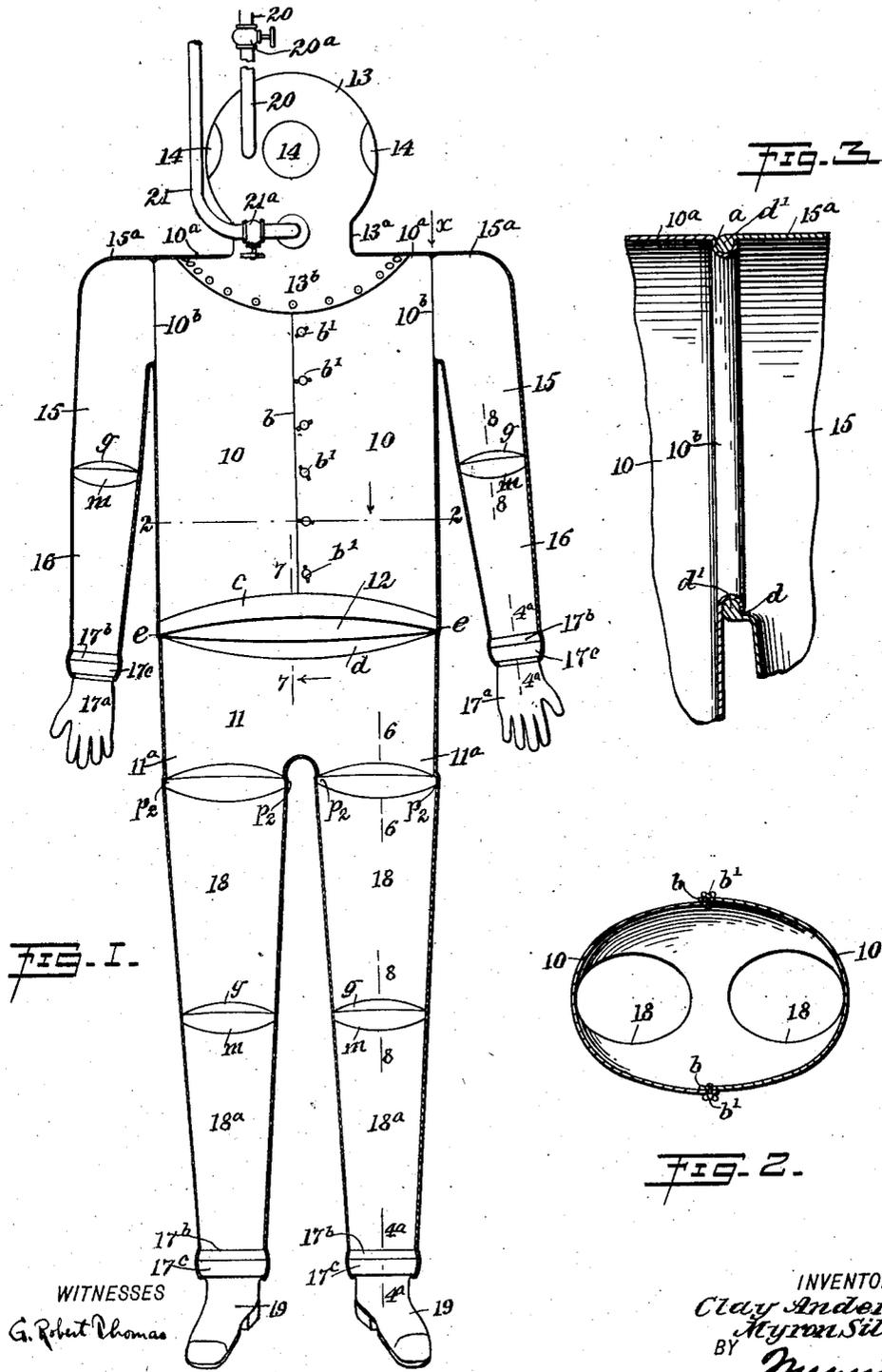


FIG. I.

FIG. 2.

FIG. 3.

WITNESSES
 G. Robert Thomas
 J. P. Patton

INVENTORS
 Clay Anderson
 Myron Silver
 BY
 Mumford
 ATTORNEYS

C. ANDERSON & M. SILVER.

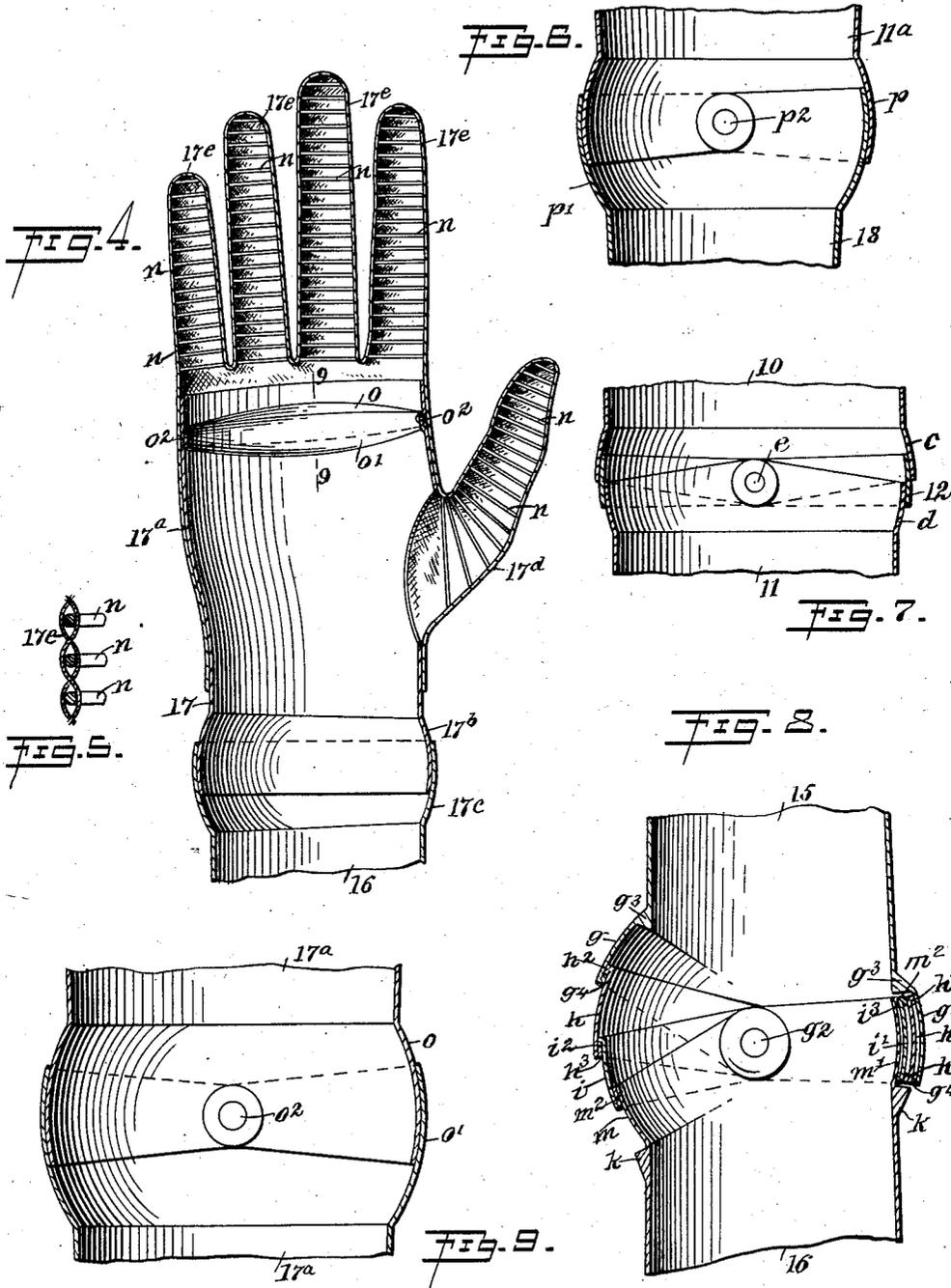
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ATTORNEYS

UNITED STATES PATENT OFFICE.

CLAY ANDERSON AND MYRON SILVER, OF PASSI, PHILIPPINE ISLANDS.

DIVING-SUIT.

1,022,997.

Specification of Letters Patent.

Patented Apr. 9, 1912.

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To all whom it may concern:

Be it known that we, CLAY ANDERSON and MYRON SILVER, both citizens of the United States, and residents of Passi, in the Province of Iloilo, Philippine Islands, have invented a new and Improved Diving-Suit, of which the following is a full, clear, and exact description.

This invention relates to a suit of apparel, particularly designed for the protection of a diver, and has for its object to provide a diving suit of novel construction, that may be comfortably worn by a person, be capable of yielding at all the joints of the wearer's body, be waterproof and airtight, be attachable to a source of air supply under graduated pressure, be light, strong and durable, afford means for the descent of a diver in various depths of water, without being subjected to excessive pressure, and enable the diver to hold conversation with a person who is located on the body of water over the diver.

The invention consists in the novel construction and combination of parts, as is hereinafter described, and defined in the appended claims.

Reference is to be had to the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a front view of the improved diving suit, partly in section; Fig. 2 is a transverse sectional view of the waist portion of the diving suit, taken substantially on the line 2—2 in Fig. 1, seen in the direction of the arrow thereat; Fig. 3 is an enlarged fragmentary sectional side elevation of a shoulder and arm connection for the suit, taken below the arrow *x* in Fig. 1; Fig. 4 is an enlarged sectional front view of the novel hand covering, that is a detail of the invention, said view also showing the universal joint connection between the hand protector and the fore-arm sleeve, taken substantially on the line 4^a—4^a in Fig. 1; Fig. 5 is an enlarged fragmentary sectional view of the material of which the hand protectors are formed; Fig. 6 is an enlarged vertical transverse sectional view of joint connections for the thigh casing sections with the lower portion of the body casing, taken substantially on the line 6—6 in Fig. 1; Fig. 7 is a vertical transverse sectional view of details, substantially on

the line 7—7 in Fig. 1, showing an air and water-tight joint connection between the upper and lower portions of the body casing; Fig. 8 is an enlarged vertical transverse sectional view, taken substantially on the separate lines 8—8 in Fig. 1, showing similar joint connections between sections of the leg casings and also between sections of the arm casings, and Fig. 9 is an enlarged vertical transverse sectional view of a joint connection on the hand protector located at the joints between the fingers and palm, and taken substantially on the line 9—9 in Fig. 4.

Briefly stated, our aim in the construction of the improved diving suit, is to render it safe for use at different depths in water, and afford freedom for the use of the diver's limbs; also, to facilitate communication between the diver and his assistant at the surface of the water, and to apply such a moderate pressure of pure air within the incasing suit as will neutralize the external pressure on it due to the depth of submersion.

In the drawings that show the construction and relative arrangement of parts of the improvement, an incasing body portion for the armor is provided, consisting of two equal and similar sections 10, 10, that are formed of sheet metal or other suitable material, said sections extending from the neck portion down to a lower body section 11. As shown in Figs. 1, 2 and 3, the casing sections 10, 10 are semi-elliptical in cross section, extending over the shoulder, as at 10^a, and each section is formed with an arm-hole, which is circular and is defined by a circumferential flange 10^b, said flange being exteriorly grooved, as shown at *a* in Fig. 3. The casing sections 10, 10 have parallel vertical side edges, that when assembled are lapped together, as shown at *b*, and are secured together air and water tight by thumb screws *b'*. The upper edge of the lower section 11 for the body casing is jointed upon the lower edge of the sections 10, 10 by means of a central coupling band 12, that is rendered concavo-convex in cross section, the convex surface being external (see Fig. 7).

On the lower edge portion of the connected body sections 10, 10 a flange *c* is formed, which is concave on the inner surface, into which is introduced the convex outer surface of the band 12, said flange having an air and water tight contact with the outer

surface of the band, as is indicated in Fig. 7. A peripheral flange d is formed on the upper edge portion of the lower body section 11, which is concavo-convex in cross section and fits air and water tight within the concave inner surface of the coupling band 12.

Directly below the center of each arm-hole the coupling ring or band 12 is pivoted between the oppositely-lapped portions of the sections 10 and 11, which jointed connection e, e permits the body sections 10, 10 to receive rocking adjustment forward and rearward on the section 11 but prevents a lateral flexure thereof.

A helmet 13 for the reception of the head of the diver is formed of plate metal or other suitable material, and preferably is globular in form, having a depending neck 13^a and a radial flange 13^b on the lower end of the neck. This flange 13^b is curved so as to fit closely the upper portions 10^a of the complete body section 10, 10, and is thereon removably secured by screws or other means, the joint between said parts being air and water tight. The dimensions of the helmet 13 and neck 13^a are such as will permit the free insertion of the head of the diver and allow an air space around the head. In the front face of the helmet, at a suitable point, a preferably circular heavy transparent disk 14 is secured in an opening, air and water tight, and over each shoulder a similar disk 14 is secured in an aperture in the helmet, in the same horizontal plane with the front disk, the positions of the laterally-disposed disks being such that the diver, in service, may turn his head and view objects at either side of him without turning his body. Two similar arm casings are provided, that are formed of plate metal, these casings each consisting of two sections 15, 16, that correspond in length with that of the upper and lower members of the diver's arm, said sections being cylindrical in form. The upper section 15 of each arm casing is closed on the upper and outer sides, to cover the shoulder and upper joint thereat, as indicated at 15^a , said portion of the casing having a lateral opening in the inner wall thereof, that is encircled by a bead or rib d' , which is clearly fitted into a corresponding peripheral groove a in the adjacent flange 10^b , as is clearly shown in Fig. 3.

It will be seen that the means for connecting the upper section 15 of each arm casing permits said sections to receive swinging movement forward and rearward, but prevents lateral movement thereof, and, as shown in Fig. 1, the arm casings are so disposed that their lower portions have sufficient clearance from the body sections 10. The sections 15, 16 of each arm casing are flexibly connected together by a joint, pref-

erably formed as shown in Fig. 8, constructed as follows: Upon the end of the section 15 that is to be jointed to a corresponding end of the section 16, two oppositely-disposed flaring flanges g, g' are formed integrally, these flanges, that are segments of a hollow sphere of a suitable diameter, terminating in a common center g^2 , that is at the center of the casing section 15, and it will be noted that the flange g , which is at the front side of the casing section, is located above the center g^2 , while the flange g' is positioned substantially in the same horizontal plane therewith. The flanges g, g' which trend outward and downward project from the outer sides of offset shoulders g^3 , and at their free depending edges g^4 a rib is formed on the inner or concave side of a respective flange. Two similar joint members h, h' are disposed in contact with the flanges g, g' , said members, of similar form, each consisting of a semi-circular band, that is concavo-convex in cross section. The bands h, h' are fitted air and water tight upon the true cylindrical body of the casing section 15, and at their ends lap upon each other and over the opposite center points g^2 . The bands h, h' at their outer convex sides and upper edges thereof, each have a flat rib h^2 , formed or secured thereon, that has air and water tight engagement with the concave inner surface of a respective depending flared flange g, g' , and it will be noted at the left in Fig. 8 that when the joint members or bands h, h' are rocked downward, the contact of the ribs h^2 upon the respective ribs g^4 will limit said downward movement of the bands named.

Two semi-circular bands i, i' , that are essentially similar to the bands h, h' are members of the compound joint shown in Fig. 8, and, as represented, the end portions of said bands i, i' lap upon each other and upon the end portions of the bands h, h' over the centers g^2 . The bands h, h' at their lower edges and on their inner sides are provided with flat ribs h^3 , and upon the outer sides and upper edges of the bands i, i' similar ribs i^2, i^3 , are formed, that engage the inner surfaces of the bands h, h' respectively, having air and water tight engagement therewith.

Upon the upper edge portion of the arm casing section 16 and the outer side thereof, a circumferential rib k is formed, that produces an annular shoulder, the use of which will hereinafter appear, and at the base of said rib, on the upper side thereof, two upwardly and outwardly flared flanges m and m' are integrally formed on the said section 16 at opposite points. The flanges m and m' are concave on their inner surfaces and convex externally. The flange m has on its outer side and upper edge a flat rib m^2 , that has air and water tight engage-

ment with the concave inner surface of the adjacent band i , and upon the upper edge of the latter an abutment rib i^2 is formed, which will limit the downward sliding movement of the joint section or band i . The flange m' has at its upper edge a flat rib m^2 which makes an air-tight and water-tight fit against the section or band i' . The lapped end portions of the bands h , h' and i , i' are pivoted together and upon the opposite sides of the central lapped portions of the casing sections 15, 16, as at g^2 in Fig. 8, and it will be noted that if said sections are extended in alinement with each other, the joint members at the left side in Fig. 8, and that may be at the front of the arm casing, will be opened out the full extent permitted by the engagement of the ribs on said joint members, while the corresponding set of joint members, that are directly opposite the front set, are closed, the shoulders g^2 and h limiting said closure, as indicated at the right in Fig. 8. A casing for each hand is provided, these similar casings each consisting of a glove-like envelop, formed to loosely receive the hands of the diver. Preferably the body of each casing is formed in two main sections 17, 17^a, one closely fitted within the other, the section 17 that is innermost being hinge-jointed upon the outer section 17^a, as indicated in Figs. 1 and 9.

A waterproof pliable fabric constitutes the material preferably employed for the production of the hand coverings, but upon the lower portion of the main section 17 a spherically-shaped flange 17^b, of rigid material, is formed or secured, as shown in Fig. 4, the section of which is defined by the line 4^a, 4^a in Fig. 1. On the fore-arm section 16 of an arm casing, at its lower end, a flange 17^c is formed, having a shape corresponding with that of the flange 17^b, whereon said flange 17^c is fitted air and water tight, this engagement of the flanges permitting a universal rocking movement of the hand covering upon the fore-arm casing section 16. The outer casing section 17^a of the hand covering fits closely upon the section 17, and upon said outer section the thumb-casing 17^d and finger-casings 17^e are formed or secured.

The thumb and finger coverings 17^d, 17^e are shaped to loosely receive those members of a wearer's hand. Preferably the finger and thumb casings are formed of pliable fabric, that is durable and waterproof, and to reinforce the material flexible metal rings n are embedded therein, as is indicated in Figs. 4 and 5. The portion of each hand covering that lies near the finger casings 17^e is bi-sectioned and connected together by a rockable joint, the form of which is clearly shown in Fig. 9. It will be seen in said view that the portion of the outer section

17^a that is adjacent to the finger casings 17^e terminates in a depending spherically-shaped flange o , whereon is fitted, air and water tight, the similarly shaped flange o' . At diametrically opposite points the lapped flanges o , o' are pivoted together, said pivotal connections o^2 being disposed respectively below the outer surfaces of the fore-finger and fourth finger casings, as indicated in Fig. 4. It will be seen that the points of pivotal connection between the flanges o , o' adapt the hand coverings to respectively yield, so that the finger casings 17^e may be folded over the palm portion thereof, and be extended at the will of the wearer of the protecting suit.

The lower portion 11 of the body casing hereinbefore described is bifurcated, affording two hip sections 11^a, these sections each having a circular contour. Two leg casings are provided, that are alike in form and dimensions, each consisting of an upper or thigh covering section 18, and a lower or calf covering section 18^a. The section 18 of each leg casing is jointed upon a respective hip section 11^a, as is indicated in Fig. 1, said joint connections of similar construction being preferably formed as is shown in Fig. 6, comprising the following details: A depending flange p , that is a segment of a sphere of proper diameter, is fitted air and water tight into a similar flange p' , which is formed upon the upper end of a respective leg casing section 18, these overlapped flanges being pivoted together at opposite points p^2 respectively at the inner and outer sides of the hip and thigh sections, as indicated in Fig. 1.

It will be seen that the character of the jointed connections just described permits the flexure of the upper sections of the leg casings to be effected forwardly and rearwardly a suitable distance, to enable the diver to walk forward freely or move rearward, if this is desired.

The upper section 18 and the lower section 18^a of each leg casing are preferably connected together by a duplex joint, such as is shown in Fig. 8, and that has been already described as forming the connection between the sections 15, 16 of a respective arm casing. It will be seen that if such a joint connection is employed for each leg casing, the flanges g , g' will extend down from the upper casing section 18 and the flanges m , m' will be projected upwardly from the lower casing section 18^a. The half-circular bands h , h' and i , i' that are located between the flanges g , g' and m , m' and that are arranged similarly to the like bands that are portions of the joints between the upper and lower sections of each arm casing, are pivoted together, as has been described for said bands for the arm casing joints, and cooperate with the concavo-con-

vex flanges *g* and *m* on the upper and lower leg sections for their flexure forwardly and rearwardly.

A foot covering 19 is a completing member, for the lower extremities of each leg casing, for the lower extremities of each leg casing that has been described, and, as shown in Fig. 1, is in the form of a boot, that is shaped to loosely fit upon the foot of the diver, and at the ankle portion of the boot a joint connection is provided, that is similar in construction to the joint connection between each hand covering and the lower portion of the respective arm casing section 16, and that is clearly indicated in Fig. 4, the line of section being indicated at 4^a in Fig. 1.

It is to be understood that while we prefer to construct the several portions of the incasing armor of rigid material, such as plate metal or fiber board, we may also use a waterproof, strong and durable fibrous material, or a composite material, such as vulcanized rubber cloth. In case the armor is made of other material than plate metal, it is necessary that the flanges and bands at the joints for the same be of rigid material, such as hard rubber or the like, to adapt them to retain their form and slide one upon the other freely.

It will be noted that the armor or casing affords a waterproof jacket, that loosely covers the diver, and by the provision of the joints which correspond with the joints of the wearer, freedom of action and bodily movement in any necessary direction is permitted.

An important cooperative feature of the improvement consists in the provision of adequate means for supplying fresh air to the diver, and means for oral communication between the diver and his attendant at the surface of the water wherein the diver is submerged. To these ends a tubular section 20 is connected at one end with the helmet 13, and thence extends upwardly, this pipe section near the helmet being preferably of metal and in open communication therewith, a valve 20^a being introduced therein, which may be conveniently manipulated by the diver, and from above the valve the pipe may be connected with a strong, non-collapsible hose, of sufficient length to extend upwardly to an attendant in a boat or other float (not shown) above the diver.

The tubular section 20 and its upward extension are designed for the supply of air to the interior of the diver's armor or suit, and should be attached at the upper end to an air pump of suitable form and capacity (not shown). Another tubular section 21 is attached at the lower end thereof upon the helmet 13, at a point opposite the mouth of the diver, so that when occasion requires, the wearer of the helmet may speak into the tube. From the pipe section 21 a flexible

extension is upwardly carried and supported on a float at the surface of the water, this pipe and its extension serving the twofold purpose of an escape for vitiated air and a speaking tube. A valve 21^a is introduced within the pipe section 21, which is normally left open, but may be partly or completely closed if it is desired to increase air pressure within the armor. It will be evident that by a proper adjustment of the valve 20^a, the pressure of pure air in the entire space afforded between the armor and person of the diver may be controlled, so that there can be no abrasive contact of any portion of the armor with the wearer of the same, and freedom of action is insured. At any time it is desired the valve 21^a may be fully opened, and the diver may orally communicate with his attendant, the sound being conveyed through the tube 21 and its extension.

Having thus described our invention, we claim as new and desire to secure by Letters Patent:

1. In a diver's suit, the combination with a body casing having a lateral opening at each shoulder, and a circularly-grooved flange at each of said lateral openings, of two arms casings, each having a lateral opening at the upper end thereof, and a circular rib defining said opening, each of said ribs engaging a corresponding grooved flange.

2. In a diver's suit, a hand covering, comprising two airtight and waterproof sections, one mounted on the other, in combination with an arm casing, and a universal joint connection between the arm casing and the hand covering.

3. In a diver's suit, a hand covering formed of airtight and waterproof material formed in two sections, one mounted upon the other, the outer section having finger and thumb coverings thereon.

4. In a diver's suit the combination with an arm casing section, and a concavo-convex flange thereon, of a hand covering in two sections, one mounted on the other, the outer section having finger and thumb coverings thereon, and the other section having a concavo-convex flange depending therefrom, which has air and water tight engagement with the similar flange on the other section.

5. In a diver's suit, the combination of two tubular limb members pivoted together and each having at the front and rear flaring and curved flanges provided with ribs on their inner faces, one section having internal shoulders at the base of the flanges and the other external shoulders at the base of the flanges, two semi-circular bands mounted on the pivot of the sections and having ribs on their inner and outer faces adjacent to their edges, said bands sliding

on the flanges of one limb member, and two other semi-circular bands mounted on the pivot of the members and provided with ribs on their inner and outer faces adjacent to the edges thereof, said bands sliding on the first mentioned bands and the flanges of the other limb member.

6. In a diver's suit, the combination of two tubular limb members pivoted together, one member having internal shoulders at the front and rear and flaring and curved flanges projecting from the shoulders and the other curved and flaring flanges at the front and rear and external shoulders at the junction of the flanges with the section, the shoulders at the front being above and below the pivot and the shoulders at the rear being in substantially the same horizontal plane with the said pivot, two semi-

circular bands mounted on the pivot of the sections and having air and water tight sliding connections with the flanges of one section, and two other semi-circular bands mounted on the pivot of the sections and having air and water tight sliding connections with the first bands and the flanges of the other section.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CLAY ANDERSON.
MYRON SILVER.

Witnesses as to Clay Anderson:

EDMOND BLARD,
MARCOS ALFARAS.

Signature of Myron Silver:

CHAS. W. DOWNWARD,
CHAS. STATLER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."