

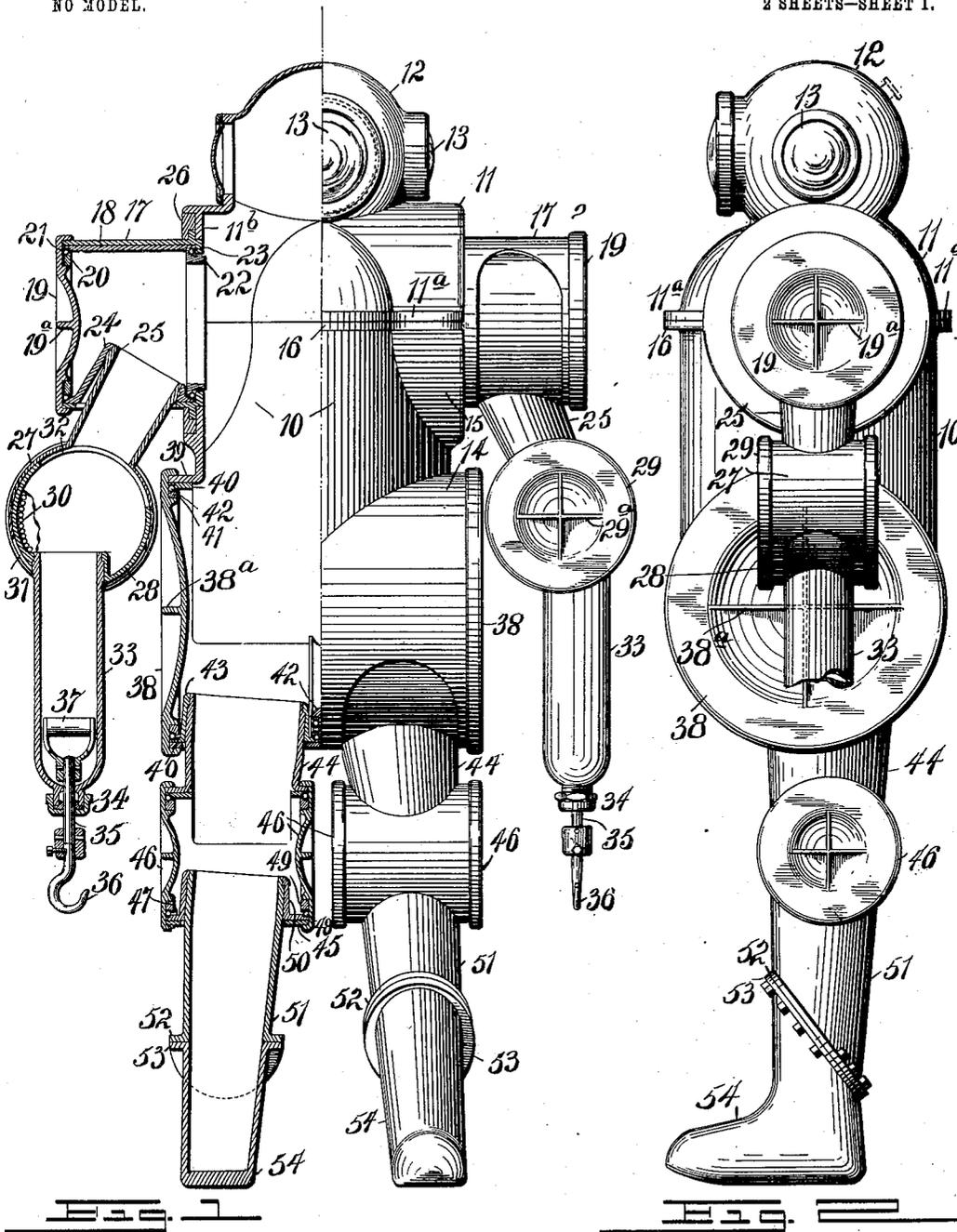
E. B. PETRIE & J. E. MARTIN.

DIVING APPARATUS.

APPLICATION FILED OCT. 1, 1902.

NO MODEL.

2 SHEETS—SHEET 1.



WITNESSES:

Wm. B. Campfield
J. G. Drubar

INVENTORS:

Emos B. Petrie
and Joseph E. Martin
 BY
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 ATTORNEY

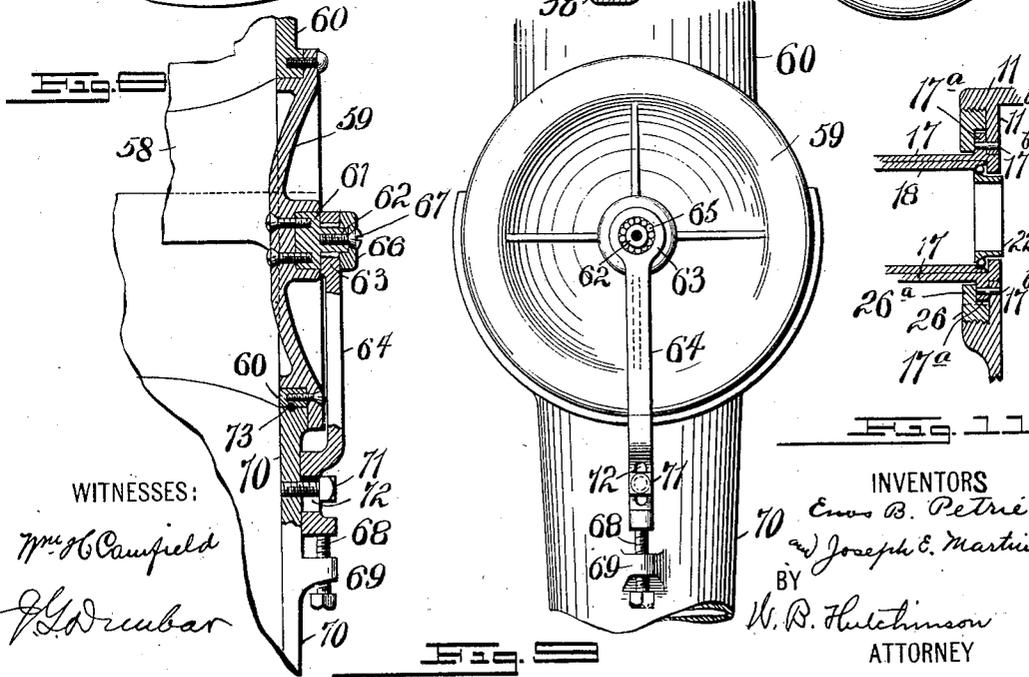
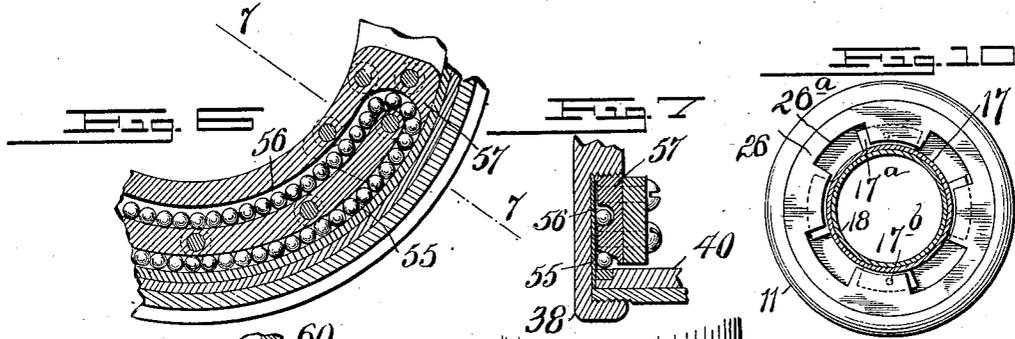
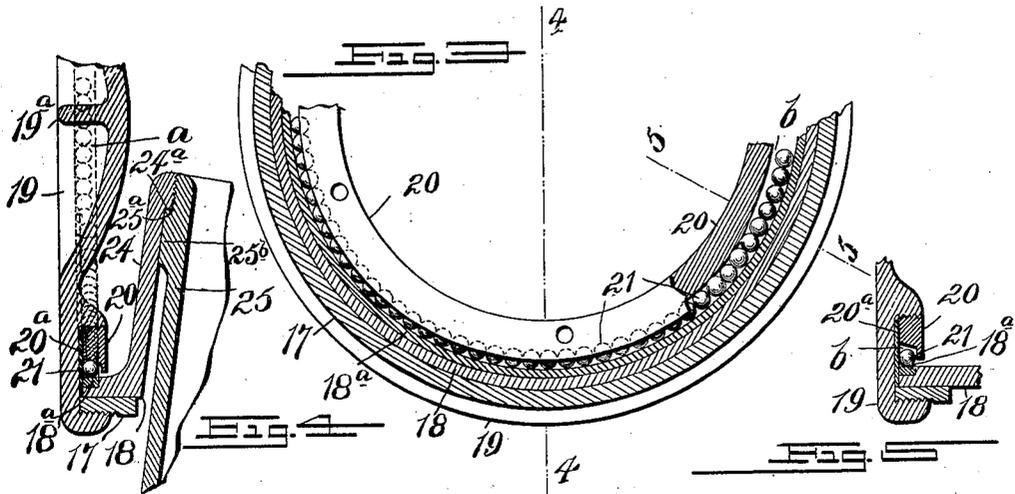
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UNITED STATES PATENT OFFICE.

ENOS B. PETRIE, OF NEW YORK, N. Y., AND JOSEPH E. MARTIN, OF NEWARK, NEW JERSEY, ASSIGNORS TO PETRIE DEEP SEA DIVING COMPANY, OF NEWARK, NEW JERSEY, A CORPORATION OF NEW JERSEY.

DIVING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 735,809, dated August 11, 1903.

Application filed October 1, 1902. Serial No. 125,514. (No model.)

To all whom it may concern:

Be it known that we, ENOS B. PETRIE, of New York, Kings county, New York, and JOSEPH E. MARTIN, of Newark, Essex county, New Jersey, have invented certain new and useful Improvements in Diving Apparatus, of which the following is a full, clear, and exact description.

Our apparatus embodies a device to be used as a diving-suit incasing a human body and conforming thereto in outline approximately and having at the places coinciding with the movable parts or joints of the body articulated junctures of the parts of the apparatus.

Our invention is also designed to present a diving-suit capable of withstanding severe pressure, at the same time allowing enough room for the free action of the body, which, coupled with the aforesaid articulated joints, allows great freedom of action to the diver, and therefore facilitates the working at depths not attained in the diving-suits as now constructed.

Another feature of our device that we desire to emphasize is the construction that embodies great strength and stability with a minimum amount of metal.

With these ends in view our invention consists of certain features of construction and combinations of parts, which will be hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming part of this specification, in which similar letters and figures of reference refer to similar parts throughout the several views.

Figure 1 is a half elevation and half central vertical section of the improved diving apparatus, and Fig. 2 is a side elevation of it. Fig. 3 is a sectional view of a portion of one of the articulated joints; and Figs. 4 and 5 are sections on lines 4 4 and 5 5, respectively, of the same. Fig. 6 is a section of a modified form of the bearings of a joint, and Fig. 7 is section on line 7 7 in Fig. 6. Fig. 8 is a central vertical section, and Fig. 9 an elevation, of still another modification of the construction of one of the joints. Figs. 10 and 11 are

a face view and a part vertical section of one form of spanner-ring and joint for securing a shoulder-joint to the body of the apparatus.

A cylindrical casing 10, formed to embrace, with the transverse cylindrical portion 14, the trunk of the body, has another transverse semicylinder 15, on the top of which is a flange 16, on which sets the part 11, having a flange 11^a, which can be clamped or secured in any usual or well-known manner to the flange 16. This part 11 is surrounded and integral with the head portion 12, having the lights 13 placed, as usual, on the fronts and sides thereof.

Fitting into the two semicylinders 15 and 11 on either side are two cylinders 17, forming shells for the reception of an inner cylinder 18, which forms on its ends bearings for the balls 21, which are further incased by the internal ring 20 and the cap 19, which has the strengthening-ribs 19^a and which screws on the end, screwing over the shells 17 and providing a water-tight joint. The inner ends of the cylinders 18 form, as stated before, bearings on one side of the balls 23, and an internal ring 22 on the other side likewise provides an opening for the shoulder of the diver. The cylinder 18 is formed on its lower side with an inwardly-projecting tubular portion 24, into which is screwed the tubular part 25, which terminates in the cylinder 27. This cylinder 27 receives in turn a cylinder 28, adapted to revolve therein. These cylinders have the cut-away portions 31 and 32, which allow their rotation without interfering with the arm of the occupant. On either side of the cylinders and screwing over the outside one are the end plates 29, which have the ribs 29^a for strengthening purposes. The balls 30 form the bearing for the easy rotation, and the construction is the same as the ends of the shoulder-joints as far as the bearings for the balls are concerned. Fitting into the inner cylinder 28 is the mitten-body 33 to receive the forearm and having a stuffing-box 34 on the end through which slides the shaft 35 of the hook 36, having on the end a handle 37 to manipulate it. On the ends of the transverse cylinder portion 14 of the trunk part

are the end plates 38, with the customary stiffening-ribs 38^a screwing thereon over the flange 39, holding between the flange and the plate the rings 40 and 41 to receive the balls 42, and in the part of the apparatus coinciding with the crotch a central rib 42 is placed, which acts to support the inner ends of the rings 40, which of course act independently of one another. These rings 40 have comparatively short circular projections 43, and the upper leg portions 44 each fit into one and then into the ring 45. Each ring 45 forms a support for the knee-joints and has on either end a cap-piece 46, and in this joint is a cylinder 47, the ends of which receive the balls 48, the internal ring 49 completing the bearing. In the projection 50 is secured a sleeve 51, projecting down and terminating in a flange 52, this being arranged, preferably, as shown, at an angle, the reason thereof being described hereinafter, and the flange coincides with the flange 53 of the part 54, the part 54 being adapted to receive the foot. The outer shells of all these articulated joints are of course cut away enough to allow of the free movement of the projections of the inner shell and are of such a length as to provide stops for the movement.

The bearings of the shoulder, elbow, hip, and knee joints are shown more especially in Figs. 3, 4, and 5; but we have lettered these views to coincide with the shoulder-joint, in which the cylinder and the cap 19 inclose the ball-bearings, which consist, as stated before, of the internal rings 20. The hard steel or similar strips 20^a and 18^a may be inserted to diminish the wear on the parts. Another novel feature of this construction is a relieving of the ball-race, where the friction or pressure is practically *nil*, by cutting away the strip 20^a, as in Fig. 4, to provide a clearance *a*, which of course allows the balls to move freely without any friction. Another way is to cut away or enlarge the opening in the direction toward the center of the outer edge of the ring 20, which relieves the balls, as at *b*. (See Figs. 3 and 5.)

A joint applicable to all the parts, but particularly adapted to that portion between the hip-joints, is shown in Figs. 6 and 7, where the balls work through a raceway 55 in the sector 57 when they are engaged in taking up the wear and are returned through a way 56, which is larger than the diameter of the balls, and consequently relieves the wear. As stated, this is to be used mostly in the crotch, where a complete circular construction is not possible. All the end plates of the articulated joints are made with a central concave portion and are all provided with any suitable number of diametrically arranged ribs, as 19^a in the plate 19 or as 29^a in the plate 29. This construction is designed to provide a stronger plate not apt to bend, and to withstand greater pressure than a perfectly flat plate would.

In Figs. 8 and 9 we illustrate a construc-

tion of joint that differs from the others in that the outer shell moves over the inner, and the inner shell 58 is integral with the end plate 59, which is screwed to one another, 60, of the joint and is provided in the center with a part 61, having a projecting boss 62. Over this boss fits a bearing 63 on the end of an arm 64, which incases the rollers 65, and a thimble 66 fits over the end of the boss 62 to inclose the rollers. A screw 67 can be used to secure the thimble on the boss 62. The lower end of the arm 64 rests on a screw 68, which is adjustable through an ear 69 on the other member of the joint 70. In this way a fine adjustment between the two cylinders is secured, and a screw 71, working in a slot 72, clamps the parts in their adjusted positions. A packing 73 can be inserted between the two shells to provide a tight joint.

In all the joints at the upper ends of the elements 25, 33, 44, and 51 we provide a water-tight fitting similar in all the cases to the construction shown in Fig. 4, where the portions 24 and 25 are fitted with shoulders 24^a and 25^a, respectively, and an abutment 25^b is formed to fit into the portion 24, which, with the screw-threaded portion and shoulders, forms a joint that is water-tight.

In Figs. 10 and 11 we show the preferred form of fastening the shoulder-joint to the main body portion. The outer cylinder 17 fits against the flange 11^b and is held from turning by the pins 17^b and is provided with the ears 17^a. The spanner-ring 26 has a number of cut-away portions 26^a, which when the spanner-ring is screwed up tight are so arranged to hold the cylinder 17 rigid. When it is desired to disengage the cylinder 17, the ring 26 is turned, and the pins hold the cylinder fast, and when the openings 26^a register with the ears 17^a the withdrawal is easy. The fastening of the same is accomplished with as much despatch, and an eighth-turn of the spanner-ring is all that is necessary to lock the parts.

Presuming the diver desires to enter the suit, the chest part 11, with its head-piece, the arm portions, and the foot parts are removed. It then becomes an easy matter for the diver to occupy the leg and trunk portions. Then a foot part 54 can be slid over each foot, this being made easier by the oblique or slanting arrangement in the opening of the top thereof, and the flanges 52 and 53, connecting these lower leg portions, can be bolted or suitably fastened together. The chest part 11 is now placed over the head, and the fastening of the flanges 16 and 11^a by any suitable means makes this part complete. The arms of the diver are now passed into their respective arm portions, and the sleeves 17 fit over and abut against the internal flanges 11^b of the chest portion 11, when thus seated a spanner-ring 26, preferably screw-threaded on its outer periphery, is screwed into the parts 11 and 15 to hold these arm portions solid and also provide an

absolutely tight joint. We have thus demonstrated the ease and facility with which this suit can be put on, and with the joints made as shown the utmost freedom of action is possible for the occupant and he is at the same time relieved of all outward pressure.

The usual air inlets and outlets may be provided as is customary in all diving-suits.

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

1. A diving apparatus, comprising an upright cylindrical body portion, a transverse cylindrical portion, leg portions depending from said transverse cylindrical portion and having knee-joints, a semicylindrical transverse portion on the upper end of the upright cylindrical part, a corresponding semicylindrical chest portion fitting thereon, and provided with a head portion, and cylindrical shoulder-casings fitting into said semicylindrical parts to form shoulder-joints, and having depending therefrom arm portions, said arm portions being provided with elbow-joints.

2. A diving apparatus, comprising an upright cylindrical body portion, a transverse cylindrical portion, leg portions depending from said transverse cylindrical portion and having knee-joints, foot portions adapted to be fitted to the end of the leg portions between the knee and the ankle, a semicylindrical transverse portion on the upper end of the upright cylindrical part, a corresponding semicylindrical chest portion fitting thereon, and provided with a head portion, and cylindrical shoulder-casings fitting into said semicylindrical parts to form shoulder-joints, and having depending therefrom arm portions, said arm portions being provided with elbow-joints.

3. A diving apparatus comprising an upright cylindrical portion, a transverse cylindrical portion providing bearings for the hip-joints, leg portions depending therefrom having knee-joints and provided on the end with foot portions detachably secured thereto, a transverse semicylindrical portion on the upper end of the upright cylindrical portion, a corresponding semicylindrical portion fitting thereon and provided with a head portion, cylindrical shoulder-casings fitting into said semicylindrical transverse portions, arm portions depending from the shoulder-casings, said arm portions being provided with elbow-joints; all the joints being cylindrical and having end plates thereon.

4. A diving apparatus comprising an upright cylindrical portion, a transverse cylindrical portion providing bearings for the hip-joints, leg portions depending therefrom having knee-joints and provided on the end with foot portions detachably secured thereto, a transverse semicylindrical portion on the upper end of the upright cylindrical portion, a corresponding semicylindrical portion fitting

thereon and provided with a head portion, cylindrical shoulder-casings fitting into said semicylindrical transverse portions, arm portions depending from the shoulder-casings, said arm portions being provided with elbow-joints, all the joints being cylindrical and having end plates thereon, said end plates having a concavity and provided with external strengthening-ribs.

5. A diving apparatus comprising an upright cylindrical portion having a lower transverse cylindrical portion and an upper transverse semicylindrical portion, the transverse cylindrical portion acting as a bearing for the leg portions, and a semicylindrical chest portion fitting over the semicylindrical portion of the main part, said semicylindrical portions receiving the shoulder parts with the arm portions.

6. A diving apparatus comprising an upright cylindrical portion having a lower transverse cylindrical portion providing bearings for the hip-joints of the apparatus, leg portions depending therefrom and having cylindrical knee-joints, foot portions detachably secured to the leg portions the foot and leg portions having oblique joints, semicylindrical transverse sections on the upper end of the upright cylindrical portion, a corresponding semicylindrical portion fitting thereon and adapted to be secured thereto and having a head portion, said semicylindrical portions receiving the cylindrical shoulder-joints, and the shoulder-joints supporting the arm portions, the arm portions in turn having cylindrical elbow-joints and mitten-sections thereon.

7. In a diving apparatus, the joint comprising outer and inner cylindrical shells turning in relation to each other, the outer shell being slotted, an end plate forming a closure for the ends of both shells, and projecting members attached to the shells, the member on the inner shell projecting through the slot in the outer shell.

8. In a diving apparatus, the joint comprising outer and inner cylindrical shells turning one within the other, the outer shell being slotted, an end plate forming the end closure for both shells, said plate having a central concave portion provided with strengthening-ribs and projecting members attached to the shells, the member on the inner shell extending through the slot of the outer shell.

9. In a diving apparatus, the joint comprising outer and inner cylindrical shells turning one within the other, the outer shell being slotted, end plates forming end closures for both shells, an internal ring fitted to the end plates and forming between itself and the inner shell a race for bearing-balls, and oppositely-projecting members on the two shells, the member on the inner shell extending through the slot in the outer shell.

10. In a diving apparatus, the joint com-

prising outer and inner cylindrical shells arranged one within the other and turning in relation to each other, the outer shell being slotted circumferentially, projecting members on the two shells, the member of the inner shell projecting through the slot in the outer shell, end plates forming the closures for both shells, and an internal ring fitted to the plates and forming a ball-race between itself and the inner shell, the ball-race being relieved during a portion of its course to provide a free movement for the bearing-balls.

11. In a diving apparatus, a joint comprising a fixed member, a movable member, an inner ring arranged between the two aforesaid elements, a ball-race between the inner ring and the movable portion, and a return-race of larger diameter than the diameter of the balls.

12. In a diving apparatus, a joint comprising an outer cylindrical shell, an inner cylindrical shell, end plates on the inner shell having a central boss, an arm extending from the outer shell having a ring on the end embracing the boss, rollers or balls between the boss and the ring, a screw in a lip bearing against the end of the arm to adjust it, and a clamping-screw to fasten the arm in its adjusted position, thereby adjusting the cylinders.

13. A diving apparatus, comprising a body portion, hip-joints with leg portions depending therefrom, a semicylindrical portion at the top of the body portion, a semicylindrical chest portion fitting over the semicylindrical part of the body portion, cylindrical shoulder-joints with arm portions depending therefrom, said shoulder-joints fitting against said semicylindrical portions, and spanner-rings

to detachably secure said shoulder-joints in position.

14. A diving apparatus, comprising a body portion, hip-joints with leg portions depending therefrom, a semicylindrical portion at the top of the body portion, a semicylindrical chest portion fitting over the semicylindrical part of the body portion, spanner-rings in said semicylindrical portions having central openings and cut-away portions on the inner edges, cylindrical shoulder-joints with arm portions depending therefrom, wings on said shoulder-joints adapted to register with the openings in the spanner-rings when the spanner-rings are partly rotated, to permit the removal of the shoulder-joints.

15. A diving apparatus, comprising a body portion, hip-joints with leg portions depending therefrom, a semicylindrical portion at the top of the body portion, a semicylindrical chest portion fitting over the semicylindrical portions having central openings and cut-away portions on the inner edges, cylindrical shoulder-joints with arm portions depending therefrom, wings on said shoulder-joints adapted to register with the openings in the spanner-rings when the spanner-rings are partly rotated, to permit the removal of the shoulder-joints, and means to prevent the rotation of the shoulder-joints in the semicylindrical portion.

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

ENOS B. PETRIE.
JOSEPH E. MARTIN.

Witnesses:

W. B. HUTCHINSON,
J. G. DUNBAR.