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2,626,398

ARTIFICIAL ARM

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2 SHEETS—SHEET 1

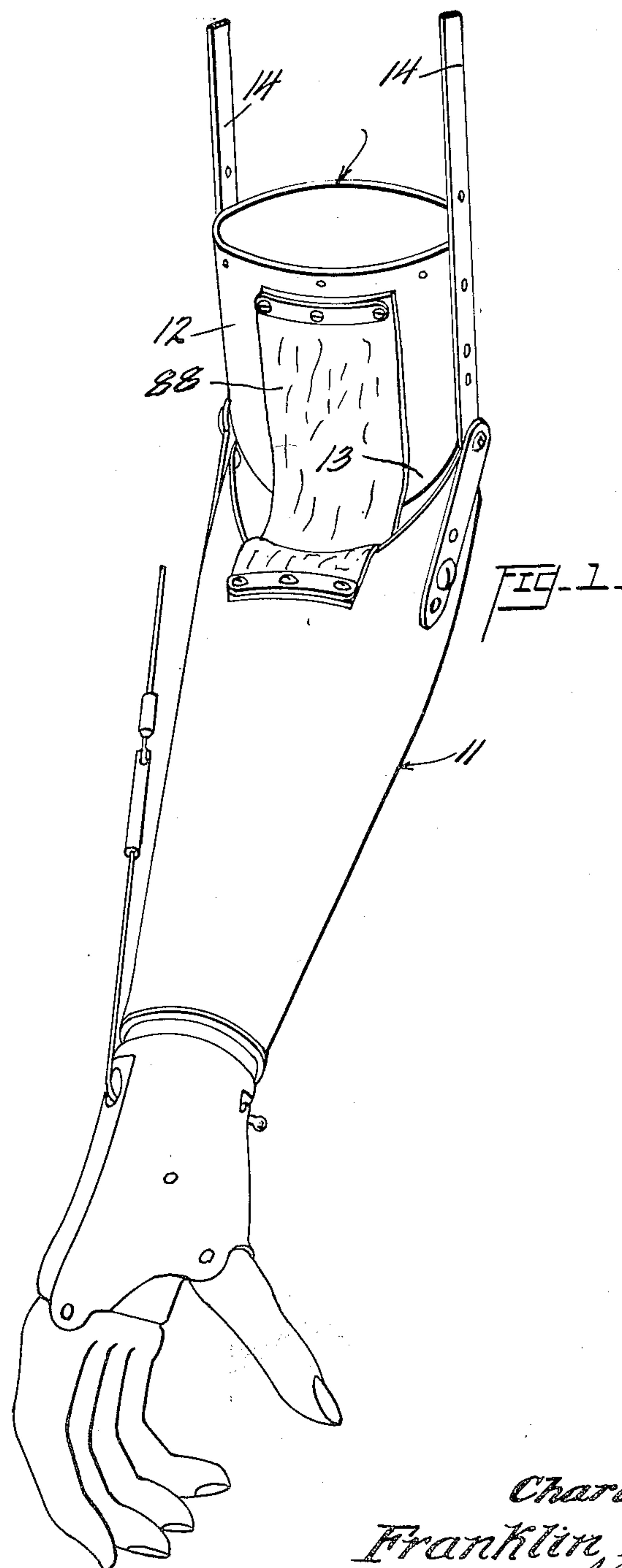


FIG. 1.

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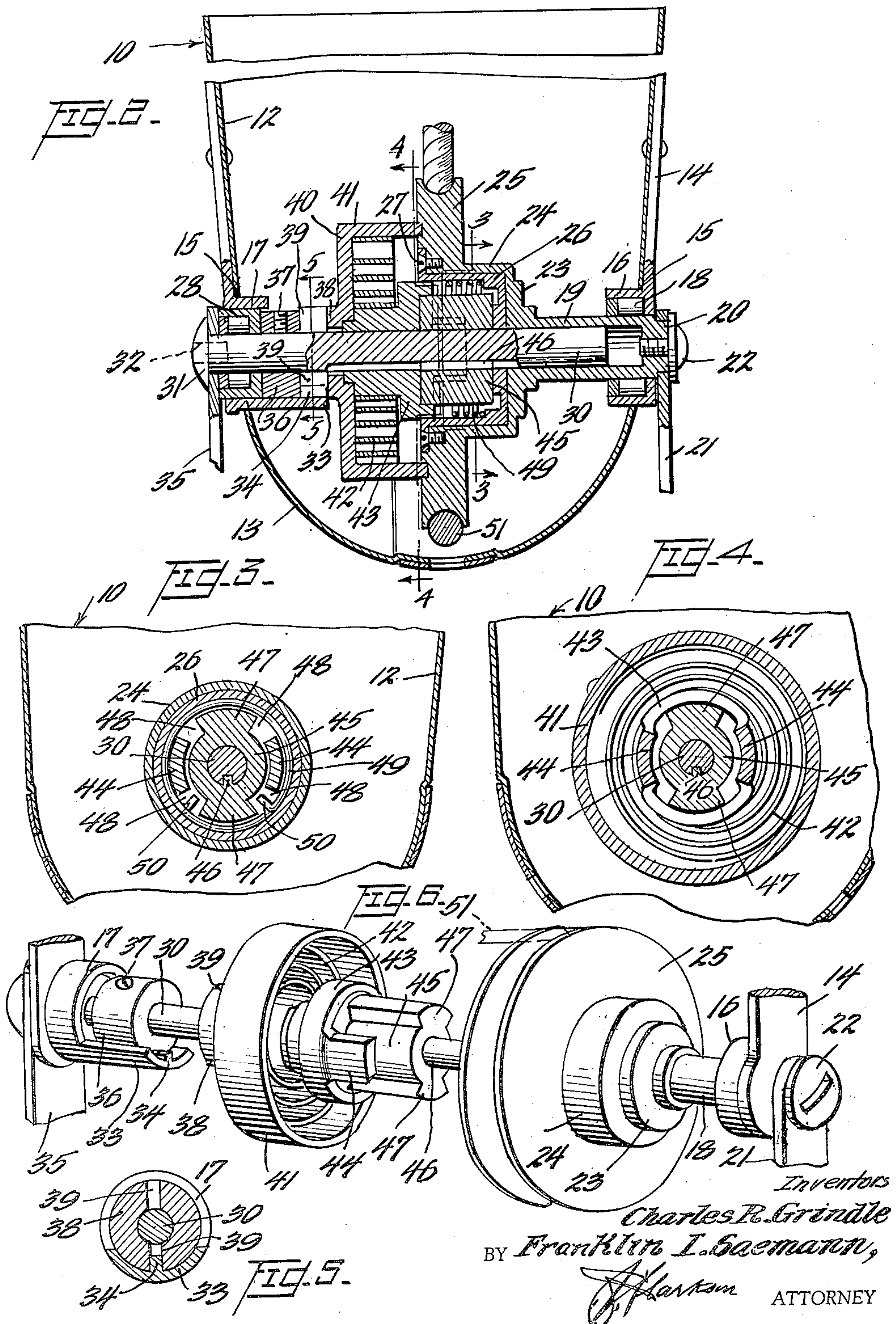
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2 SHEETS--SHEET 2



UNITED STATES PATENT OFFICE

2,626,398

ARTIFICIAL ARM

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10 Claims. (Cl. 3—12.2)

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This invention relates to artificial arms and has special reference to such arms as are adapted for use after upper arm amputations.

More particularly the invention relates to artificial arms having elbow joints.

In artificial arms for replacement of arms amputated above the elbow joint it is desirable that the arm have an upper section provided with a socket to receive the stump of the natural arm as left after amputation. It is common in such cases to provide a lower arm section of the artificial arm connected to the upper section in a pivoted manner so that the lower section may be moved to desired angular relation to the upper section.

One of the principal objects of this invention is to provide a novel means in such an arm whereby the angular relation between the upper and lower arm sections may be varied by exerting tension on an adjusting cord connected to the harness commonly used in holding artificial arms in position on a wearer.

Artificial arms are usually provided with an article-gripping device such as a hand or claw, a hook or the like. Such devices are often interchangeable on the arm proper and vary in weight. Such arms also are worn beneath the wearer's clothing and such clothing varies in weight and flexibility.

A second important object of this invention is to provide an elbow joint having spring means adjustable to compensate for variations in weight carried by the forearm section such as are caused by the particular weight of an artificial hand or other article-holding device and variations in the weights of clothing worn by the wearer of the arm forming this invention.

A third important object of this invention is to provide novel means, operable for adjusting the tension of the spring used herein.

A fourth important object of the invention is to provide, in a novel device of this character, means to releasably hold the arm in angularly adjusted position.

A fifth important object of the invention is to provide means operable from outside the clothing whereby such adjustment holding means may be released to permit the forearm portion of the artificial arm to swing freely.

With the above and other objects in view, as will be presently apparent, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings and particularly claimed.

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In the drawings like characters of reference indicate like parts in the several views, and

Fig. 1 is a perspective view of one form of the invention.

Fig. 2 is an enlarged fragmentary cross section taken on the axial plane of the preferred form of elbow joint in such an arm.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 is a section on the line 4—4 of Fig. 2.

Fig. 5 is a detail section on the line 5—5 of Fig. 2.

Fig. 6 is an exploded perspective disclosing the operating parts of the elbow joint.

As shown in the drawings the invention includes an upper arm section 10 and a lower arm section 11. The section 10 is formed of thin metal and is shaped to provide a cylindrical upper portion 12 and a substantially hemispherical lower end closure 13, the portion 12 being open at the top. Metallic straps 14 are riveted to opposite sides of the portion 12 and extend upwardly therefrom so that an arm-gripping portion may be secured thereto. This arm-gripping portion is not here shown as it may be of any desired structure, one example of which is shown in the patent to Mollenhour, No. 2,409,884 in Fig. 1 at 76.

At opposite points of the section 10 at the junction of the portions 12 and 13 there are provided openings 15. In the forms shown in Figs. 1 to 6 axially aligned bushings 16 and 17 are fitted in openings 15, being preferably of antifriction character.

The bushing 16 is integral with one of the straps 14 and this form is provided with an internal roller bearing 18. In this bearing is rotatably mounted a hollow shaft 19 which has an outer polygonal end 20 on which is fitted the upper end of a strap 21 which is fixedly secured to the lower arm section 11. The strap 21 is held on the end 20 by a cap screw 22. The inner end of the shaft 19 is provided with a head 23 having an inwardly extending peripheral flange 24 having a grooved belt pulley 25 formed integrally thereon. The head and flange 24 thus form a hollow cylinder in which is fitted a liner 26 secured by screws 27.

The other bushing 17 has an internal roller bearing 28, the bushing being integral with a strap 14 which is secured to the upper arm section 10. A shaft 30 is rotatably mounted in the bearing 28 and at its inner end is rotatably fitted in the hollow shaft 19. Projecting inwardly from the bushing 17 is an arcuate arm 33 concentric to the shaft 30. This arm 33 is pro-

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vided on its inner side with a rib 34 forming a key. The outer end of the shaft 30 extends rotatably through the upper end of a strap 35 which extends down along and is fixed to the lower arm section 11. Fitted on the shaft 30 to bear against the bushing 17 is a collar 36 held stationary by a set screw 37. Thus the head 31 and collar 36 serve to hold the straps 21 and 35 properly together and also to prevent longitudinal movement of the shaft 30. Rotatably mounted on the shaft 30 is a sleeve 38 having (Fig. 5) a pair of diametrically disposed slots 39. The sleeve is of such diameter as to fit within the arm 33 thus enabling the rib 34 to engage in a selected slot 39. On the inner end of the sleeve 38 is a head 40 of disc-like form from the periphery of which extends a flange 41, the head and flange forming a spring housing to which one end of a spirally wound leaf spring 42 is attached. The other end of this spring is attached to a spring anchor formed by a sleeve 43 revolvably mounted on the shaft 30. From the sleeve 43 extends a pair of segmental arms 44 which are diametrically opposite. Secured to the shaft 30 is a sleeve 45 which is held against rotation on the shaft by a key 46. The sleeve 45 is preferably termed a spring tension regulating sleeve. This sleeve 45 is provided with a pair of longitudinally segmental ribs 47. The arcuate extensions of the arms 44 and ribs 47 are equal but each has an extension of less than 90 degrees so that the location of the ribs between these arms provide spaces 48 arranged 90 degrees apart. Fitted within the liner 26 is a cylindrically coiled spring 49 the ends 50 of which are bent to extend radially inward at 90 degrees apart so as to fit in adjacent spaces 48 (Fig. 3).

Under this arrangement if the shaft 30 is turned by a key inserted in the key hole 32 the sleeve 45 is rotated with the shaft 30 and one side face of one of the ribs 47 will engage one of the spring ends 50 while the other spring end 50 will engage a side face of one of the arms 44. By rotating the shaft 30 in one direction the spring 49 is caused to expand and thus frictionally grip the liner 26. The extent of such rotation of the shaft section 30 determines the expansive stress exerted by the spring 49 on the liner. Obviously, rotation of the shaft 30 in the opposite direction will contract the spring 49 and thus diminish such expansive stress or even free the spring from contact with the liner. Furthermore, the rotation of the shaft 30 rotates the sleeve 45 and this effects rotation of the sleeve 43 through engagement of the arms 44 by the ribs 47. Now the sleeve 43 to which the inner end of the spring 42 is fixed is positioned rotatively on the shaft by the movement of the sleeve 45 in causing expansion or retraction of the spring 49. The spring 49 together with the arms 43 and ribs 47 thus constitutes a pawl and ratchet mechanism of the friction type. Thus the normal or idle torsional effect is varied in accordance with the expansion and contraction of the spring 49. The liner 26 being fixed to the head 23 of the hollow shaft 19 rotation of the shaft 30 with the spring 49 expanded a certain rotative stress is exerted on said shaft 19. This shaft 19 being connected to the lower arm section 11 by the strap 21 the lower arm section will tend to rise in a manner similar to a living fore-arm in flexure. Thus a certain compensation of the weight of the lower section and clothing thereon may be adjustably effected so that the necessary flexing pull on the cord 51 of the usual

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harness may be adjusted for substantial uniformity by proper adjustment of the effect of the spring 42 in the foregoing manner.

In order to prevent clothing being caught between the open upper end of the lower arm section 11 and the upper arm section a flexible strap 88 is used to connect the two sections.

It is to be observed that this invention may have the spring adjustment in such manner that the lower arm section will swing, when the wearer is walking in exactly the same manner that the natural lower arm swings. This is true whether the wearer is lightly clothed or is wearing a heavy coat or the like. All that is necessary to permit this natural swinging movement is to adjust the spring in accordance with the weight and stiffness of the clothing on the arm.

What is claimed is:

1. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, and a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section.

2. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a tension adjustable spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, and adjusting means for adjusting the tension of said spring.

3. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection be-

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tween one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a tension adjustable spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, and adjusting means for adjusting the tension of said spring, said adjusting means further acting to effect adjustment of the friction grip of said clutch.

4. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, and means controllable by the wearer and carried by the first mentioned shaft part for rotating said shaft part in like direction to which it is urged by said spring.

5. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, adjusting means for adjusting the tension of said spring, and means controllable by the wearer and carried by the first mentioned shaft part for rotating said shaft part in like direction to which it is urged by said spring.

6. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a tension adjustable spring having its ends engaging said parts and urging the second of said parts to rotate

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in the direction of the first part when biasing the lower arm section, adjusting means for adjusting the tension of said spring, said adjusting means further acting to effect adjustment of the friction grip of said clutch, and means controllable by the wearer and carried by the first mentioned shaft part for rotating said shaft part in like direction to which it is urged by said spring.

7. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch including a cup-shaped head on one of said parts, a spring cylindrically wound and fitted in said head, spring end engaging means carried by the other of said parts, said last part when rotated controlling the frictional engagement of the spring in the head, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, and a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section.

8. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch including a cup-shaped head on one of said parts, a spring cylindrically wound and fitted in said head, spring end engaging means carried by the other of said parts, said last part when rotated controlling the frictional engagement of the spring in the head, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last mentioned part, a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, and adjusting means for adjusting the tension of said spring.

9. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially aligned, clutch means including a friction clutch for connecting said parts, said clutch including a cup-shaped head on one of said parts, a spring cylindrically wound and fitted in said head, spring end engaging means carried by the other of said parts, said last part when rotated controlling the frictional engagement of the spring in the head, a connection between one of said parts and the lower arm section arranged to cause biasing of said lower arm section upon rotation of the last

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mentioned part, a spring having its ends engaging said parts and urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, and means controllable by the wearer and carried by the first mentioned shaft part for rotating said shaft part in like direction to which it is urged by said spring.

10. An artificial arm for use by persons having an upper arm amputation, said artificial arm including an upper arm section for support on the stump of the amputation and a lower arm section, pivot means carried by the lower end of the upper arm section and supporting the lower arm section, said pivot means connecting said sections, said pivot means including a two-part shaft having its parts axially alined, clutch means including a friction clutch for connecting said parts, said clutch means including clutch elements mounted in coacting relation on the respective shaft sections, said clutch including a cup-shaped head on one of said parts, a spring cylindrically wound and fitted in said head, spring end engaging means carried by the other of said parts, said last part when rotated controlling the frictional engagement of the spring in the head, a connection between one of said parts and the lower arm section arranged to cause

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biasing of said lower arm section upon rotation of the last mentioned part, a spring having its ends engaging said parts and such clutch means including clutch elements mounted in coacting relation on the respective shaft sections, urging the second of said parts to rotate in the direction of the first part when biasing the lower arm section, adjusting means for adjusting the tension of said spring, and means controllable by the wearer and carried by the first mentioned shaft part for rotating said shaft part in like direction to which it is urged by said spring.

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