

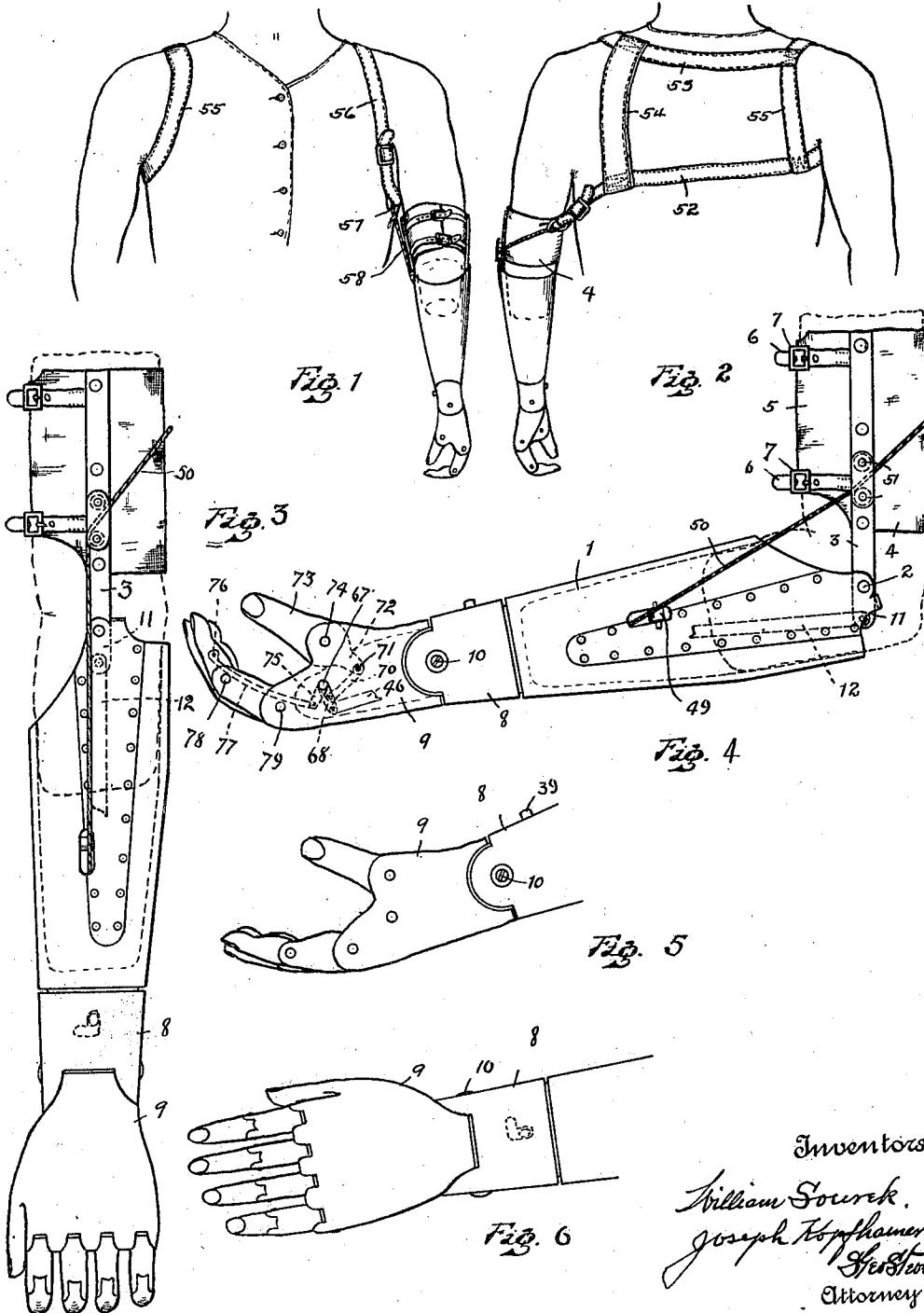
W. SOUREK AND J. KOPFHAMER.
ARTIFICIAL ARM.

APPLICATION FILED MAY 31, 1921.

1,399,031.

Patented Dec. 6, 1921.

2 SHEETS—SHEET 1.



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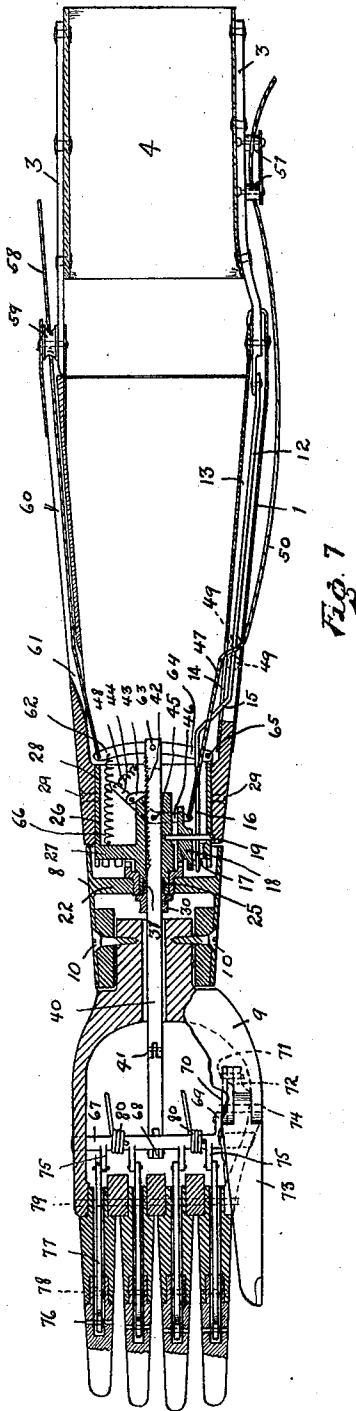


Fig. 7

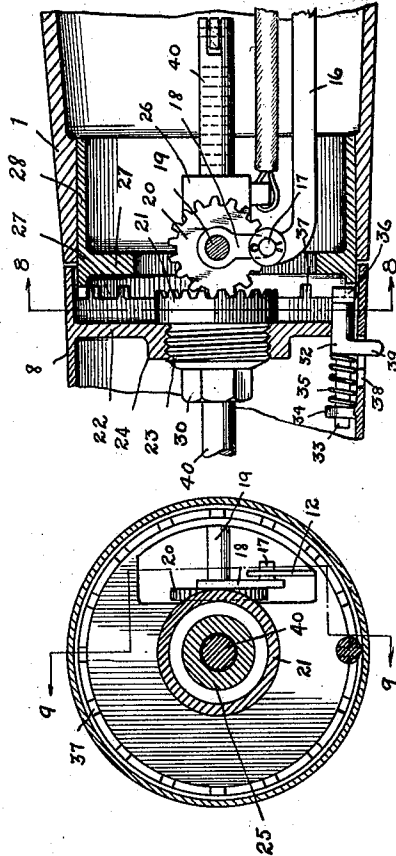


Fig. 8

Fig. 9

Fig. 10

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ARTIFICIAL ARM.

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Specification of Letters Patent.

Patented Dec. 6, 1921.

Application filed May 31, 1921. Serial No. 474,045.

To all whom it may concern:

Be it known that we, WILLIAM SOUREK and JOSEPH KOPFHAMER, a subject of Czechoslovakia and a citizen of the United States, respectively, the former residing at Elmer, in the county of St. Louis and State of Minnesota, and the latter residing at Cazenovia, in the county of Richland and State of Wisconsin, have invented certain new and useful Improvements in Artificial Arms, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to artificial limbs and has for its principal object to provide as practical and useful an arm of this type as possible.

Another object is to provide improved means in combination with such an arm whereby motion of the wearer's body will cause the hand of the arm to open and close.

Another object is to provide means whereby the hand of the arm when brought into closed or grasping position will become locked and thus remain until forcibly unlocked by the action of the user's body.

Another object is to provide improved means whereby the hand will automatically rotate by the bending of the elbow of the artificial arm.

Still another object is to provide improved means whereby the hand may be quickly adjusted to any desired axial position in relation to the remainder of the arm.

Other objects and advantages of the invention will appear in the further description of the invention.

Referring to the accompanying drawing forming part of this application in which like reference characters indicate like parts:

Figure 1 is a front elevation of one of our improved arms as applied to the body of a person,

Fig. 2 is a rear elevation of the same,

Fig. 3 is an enlarged side elevation of one of the detached arms showing a back view of the hand,

Fig. 4 is a similar view to Fig. 3 except that the arm is shown with the elbow bent and the hand shown in partly closed side elevation,

Fig. 5 is a side view of the hand opened,

Fig. 6 is a back view of Fig. 5,

Fig. 7 is a central transverse sectional view of the entire artificial arm and hand except the thumb and finger tips thereof, which are shown in plan view,

Fig. 8 is an enlarged transverse sectional view on the line 8—8, Fig. 9,

Fig. 9 is a longitudinal central section on the line 9—9, Fig. 8, and

Fig. 10 is an enlarged view of the spring actuated locking device of the wrist.

1 represents the artificial forearm which is hollow and made of light composition material used for such purposes or wood if preferred and to the upper end of which is pivotally attached upon the sides thereof, as at 2, the metal arm straps 3, they being sufficiently long to carry securely fixed thereto the cylindrically shaped flexible arm encircling member 4, the forward flaps 5 of which are applied around the wearer's stump and securely held thereupon by suitable smaller straps and buckles 6 and 7, such means of applying an artificial limb being common and forming no part of our present invention.

8 represents the wrist portion of the arm which is rotatably adjustably carried upon the lower extremity of the forearm and 9 represents the hand portion which is transversely pivotally carried as at 10 upon the wrist 8, this pivotal connection of the hand upon the wrist being principally for convenience in removing and applying the hand rather than its being pivoted to any considerable extent for convenience in the operation thereof, except that such pivotal joint is made slightly loose for convenient flexibility of the device.

The application and operating of this embodiment of the device will be described as applied to a person who has been deprived

of his arm below the elbow and has a portion of a stump below the elbow which is insertible within the hollow portion of the forearm 1, as clearly illustrated in Figs. 1, 2, 3 and 4 of the drawings, and by which mounting it becomes readily convenient for the user to bend his elbow and thus correspondingly operate the artificial arm.

One of the straps 3 extends somewhat below its pivotal connection 2 with the sides of the forearm and on such extension 11 is pivotally attached an operating strap 12 which is carried within a suitable channel 13 formed in the wall of the forearm 1 to an opening 14 into said channel just above the wrist portion of the arm where it extends inwardly as at 15 and thence straight downwardly as at 16 where it is pivotally connected as at 17 to the crank arm 18 on the transverse shaft 19 which carries in close juxtaposition thereto the gear wheel 20 which meshes with the annular ring gear 21 which is rigidly carried axially within the partition wall 22 of the wrist portion 8, said annular ring gear having an externally screw threaded hub portion 23 which is engaged within the hub portion 24 of said partition wall. The hub portion 23 of the ring gear 21 is bored out and rotatably carried upon the telescopic section 25 of the sleeved hub 26 of the large ring gear 27 which surrounds the smaller ring gear 21 and is concentric therewith. Upon the peripheral edge of the ring gear 21 is a sleeve like extension 28 which fits within the lower end of the forearm 1 and is held therein by any suitable means such as screw bolts 29 or the like. A nut 30, having an externally screw threaded hub extension 31, is attachable within the telescopic section 25 for holding the sleeve section 8 with its ring gear in operative relation to the larger ring gear 27 and its associated parts, so that the wrist portion 8 may be freely rotated in either direction independently of the forearm and its attached parts.

Now it is evident that the strap 12 when reciprocated in respect to the forearm will, by its indirect engagement with the gear 20 meshing with the ring gear 21, cause the wrist portion to correspondingly rotate. That is to say, when the elbow is bent and the forearm thus raised and lowered, the strap 12 will in respect to the forearm be reciprocated though in reality remain stationary and the before described rotation of the wrist take place. The object of this comparatively slight rotation of the wrist portion is for the purpose of turning the hand into the position of facing the wearer when the forearm is raised for example in the act of the user holding an instrument in the hand and bringing it to his face.

Now the relative position of the wrist por-

tion 8 which carried the hand may be from time to time adjusted by the following described mechanism:

A spring actuated bolt 32 is mounted within a suitable hole through the partition wall 22 of the wrist portion 8 adjacent the outer wall thereof and the inner reduced end 33 of said bolt is reciprocably carried in a suitable bracket 34 attached to the inner face of the wrist wall, there being an expansive spiral spring 35 intermediate of the bracket 34 and the shoulder formed upon the bolt by the reducing of the end 33 thereof. This spring tends to keep the bolt at all times thrust forwardly toward the forearm and the forward end of the bolt is rectangularly shaped as at 36 to normally engage the notches 37 formed in the ring gear 27. An L-shaped slot 38 is formed through the wall of the wrist 8 and through this slot projects a short inclined arm 39 formed integral with the bolt 32 and by which the bolt may be both reciprocated and rotated; thus when the arm 39 is pulled backwardly and swung over into an angle of the slot 38 as shown in Fig. 10 the forward end 36 of the bolt 32 will be disengaged from the ring gear 37 when the wrist 8, with its hand portion, may be turned either one way or the other as desired for positioning the hand in relation to the forearm when the bolt 32 may be released by rotating same until the arm 39 is in line with the opposite angle of the slot 38 when the spring 35 will automatically bring the forward end of the bolt into engagement with the nearest notch on the ring gear 27 and thus become locked; this however in no way interfering with the relative rotation of the hand when the forearm is raised or lowered by the bending of the elbow thereof.

By this means the wearer may quickly adjust the position of the artificial hand in relation to the forearm by manipulation of the bolt 32 with his remaining natural arm by hand, provided he has one, or by engagement with a stationary object, this being done to accomplish various modifications of actions by the artificial hand desired.

The finger and thumb operating pitman 40 is reciprocally mounted within the sleeved hub 26 of the ring gear 27, it passing through the nut 30 and into the hollow palm of the hand 9, we previously having shown a pivotal joint as at 41 to permit of flexibility in said pitman.

We shall hereinafter refer to the end of this pitman extending within the forearm as the inner end and the opposite end as the outer end.

Upon one face of the inner end of the pitman is formed a series of notches indicated at 42 which are engaged by a pawl 43 carried upon the end 44 of a somewhat L-

shaped lever pivotally mounted at 45. and having to its opposite end 46 attached a flexible operating string 47, there being provided upon the extreme end 44 a contractile spiral spring 48 attached to the inner wall of the sleeve 26 for normally holding the pawl 43 in engagement with the notches 42. The string 47 passes through the outer wall of the forearm at any desired point, the frictional contact of which may be reduced by suitable twin rollers or sheaves indicated at 49, and thence outwardly of the forearm as at 50 and upwardly intermediate of the anti-friction rollers 51 carried on the strap 3. From this point the line extends to the horizontal strap 52 of the shoulder harness worn by the user of the arm. This harness is provided with an upper horizontal strap 53 and two vertical back straps 54 and 55, the latter being endless forming a loop through which the wearer's right arm is shown extended and the opposite end of the horizontal strap 53 falls down forwardly as at 56 in front of the wearer's left arm where it is attached as at 57 to the string 58 which passes over an anti-friction roller or sheave 59 carried in the lower extreme end of the opposite strap 3 which supports the forearm. This string 58 thence traverses a suitable slot 60 in the side wall of the forearm and enters same as at 61 and is attached to the free end 62 of a diametrically disposed lever transverse the inner end of the sleeve 26 of the ring gear 27 said lever being pivotally attached as at 63 to the innermost end of the pitman 40 and the opposite end 64 of this lever is pivotally attached as at 65 to the edge of the sleeve 26.

By these two string attachments it is seen that the wearer of the arm by shrugging his left shoulder forwardly will tend to pull upwardly on the string 58, thus drawing inwardly on the pitman 40 and the pawl 43 being normally active will take up and hold each of the notches 42 presented to it thus holding the pitman in such position until when desired by the user of opposite shrugging of the shoulders will bring sufficient stress on the string 50 to release the pawl when the pitman will be drawn outwardly again by the action of the contractile spiral spring 66 which is attached to the end 62 of the pitman actuating lever together with the action of the other springs herein-after described.

By this means it is seen that the pitman 40 will be normally held in any desired position or quickly released by the motion of the user's body, it being understood that the relative positions of the stump of the user's arm is made to correspondingly cooperate with such body action.

Transverse the palm of the hand is rotatably mounted a shaft 67, which has inter-

mediate of its ends a depending crank arm 68, which is pivotally attached to the bifurcated end of the pitman 40, the shaft being rocked by the reciprocal action of said pitman. Adjacent the thumb end of the shaft 67 is a like crank arm 69 which has a link 70 attached thereto, the opposite end being pivotally attached as at 71 to the inner crank arm end 72 of the thumb 73 which is pivotally mounted in the palm of the hand as at 74. A like crank arm 75 for each one of the fingers of the hand extends downwardly and forwardly from the shaft 67 and are pivotally connected with the first phalanges of each finger as at 76 by a suitably arcuately shaped thin metal strip or rod 77, said rods or strips being housed within suitable slots or holes longitudinally of the fingers and inwardly in respect to the palm of the hand of the pivotal points 78 and 79 of the fingers so that an inward pull on the rod 77 will cause the fingers to close, simultaneously with the closing action of the thumb which obviously takes place when the shaft 67 is rotated by an inward pull on the pitman 40 as previously described. As an additional assistance in the hand normally staying open we have shown two spiral springs 80 as being attached to and surrounding the shaft 67 either of their free ends bearing against the roof of the palm of the hand and they being expansive will exert such assisting stress together with the spiral springs 66 to produce the desired results.

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

1. The combination with an artificial arm comprising a forearm having means for attaching same to a stump of a natural arm, a rotatable adjustable wrist portion attached to said forearm, and a hand portion attached to said wrist portion, of an axially disposed reciprocable rod through the wrist portion for opening and closing the fingers, means whereby said rod is reciprocated in one direction by an action of the wearer's body, a contractile spring for operating said rod in the opposite direction, means for automatically locking said rod in the position acquired by the action of the wearer's body, and means for releasing said locking means by an action of the wearer's body, substantially as described.

2. The combination with an artificial arm comprising a forearm having means for attaching same to a stump of a natural arm, a rotatable adjustable wrist portion attached to said forearm, and a hand portion attached to said wrist portion, of an axially disposed reciprocable rod through the wrist portion for opening and closing the fingers, means whereby said rod is reciprocated in one direction by an action of the wearer's body,

a contractile spring for operating said rod
in the opposite direction, means for auto-
matically locking said rod in the position
acquired by the action of the wearer's body,
5 means for releasing said locking means by
an action of the wearer's body, means for
rotating said hand and wrist portion about
said reciprocable rod, and manually adjust-
able locking means for holding said wrist
10 and hand portions in any desired rotative
position.

In testimony whereof we hereunto affix
our signatures in the presence of witnesses.

WILLIAM SOUREK.

Witnesses for Mr. Sourek:

S. GEO. STEVENS,

S. C. BRONSON.

JOSEPH KOPFHAMER.

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