

Dec. 5, 1939.

J. SARGESON

2,182,214

HYDRAULIC ARTIFICIAL HAND

Filed April 10, 1937

2 Sheets-Sheet 1

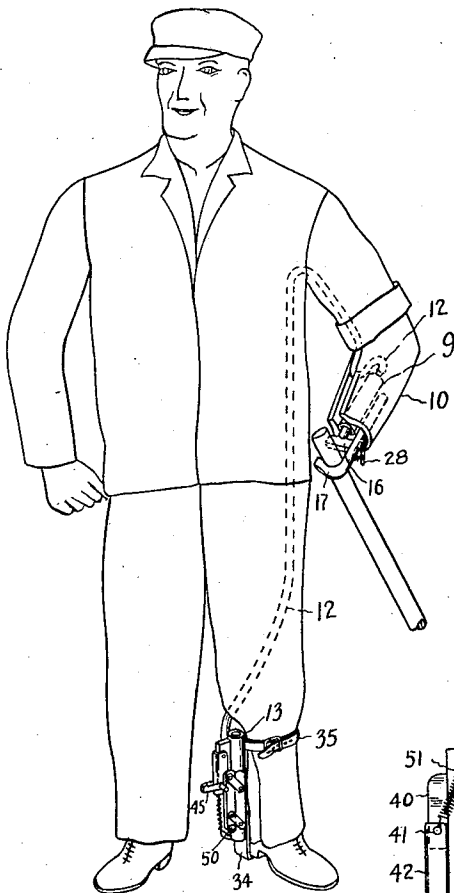


Fig. 1.

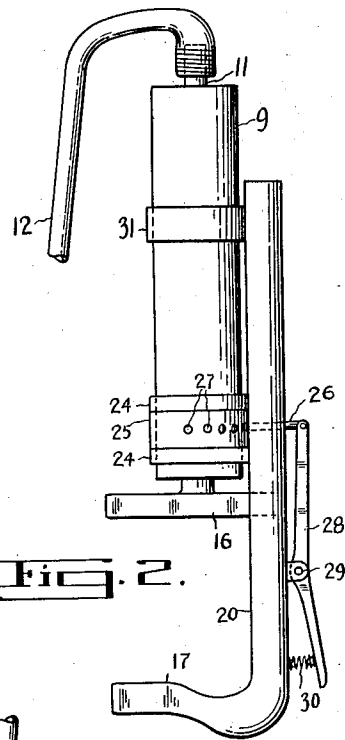


Fig. 2.

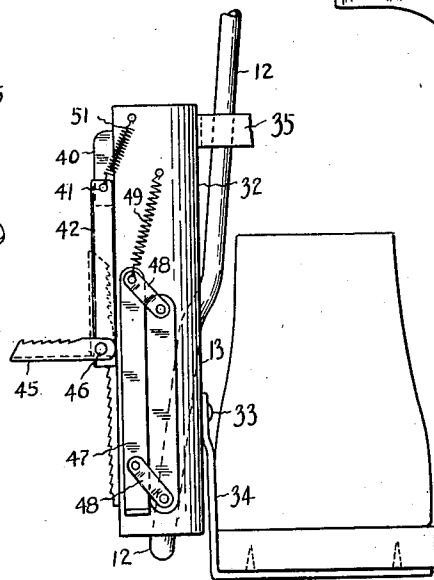


Fig. 3.

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2 Sheets-Sheet 2

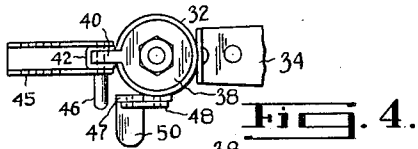


Fig. 4.

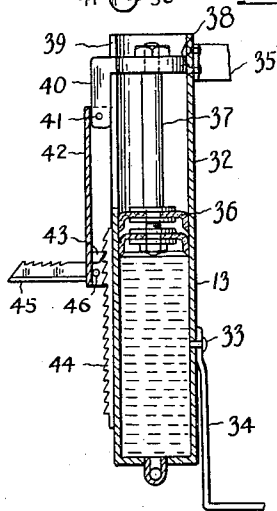


Fig. 5.

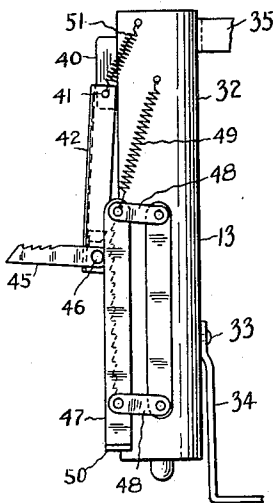


Fig. 6.

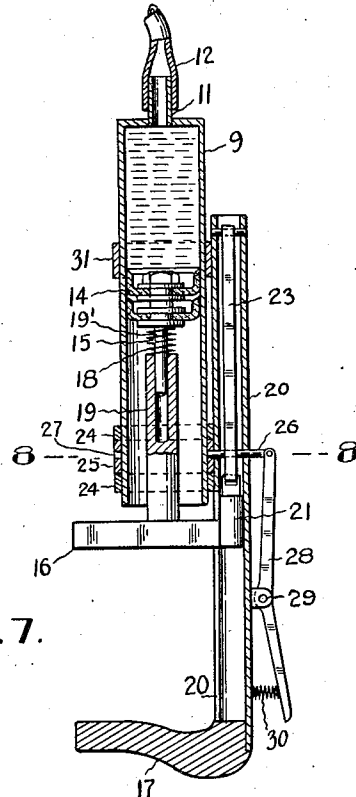


Fig. 7.

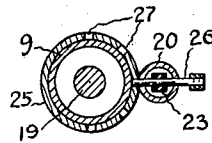


Fig. 8.

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UNITED STATES PATENT OFFICE

2,182,214

HYDRAULIC ARTIFICIAL HAND

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Application April 10, 1937, Serial No. 136,094

9 Claims. (Cl. 3—12)

The invention relates to a hydraulic gripping device for a person who has lost a hand or arm. The device is adapted to be carried by the stump of the limb according to the nature of the amputation. The invention essentially concerns a device for gripping objects both for the purpose of holding them and for manipulating them. The appliance may be applied to a stump of an arm by means of a socket or corset or it may be incorporated in an artificial arm.

The invention comprehends a pair of relatively movable jaws for positively gripping an object irrespective of the spread of the jaws, and a hydraulic actuating mechanism. One of the jaws is connected to a piston of a fluid cylinder into which fluid is forced by a pump strapped to a leg of the wearer. The pump is equipped with a reciprocal piston depressible by a pedal having an associated locking mechanism and a trip mechanism for release purposes. Accordingly, by carrying the pump on one foot, the other foot is available for operating the control mechanism.

Having described the nature and main object of the invention, subsidiary objects and advantages will be apparent as the invention is recounted in greater detail.

Referring to the drawings, Figure 1 illustrates the manner in which the invention is worn.

Figure 2 is a side elevation of the fluid cylinder and gripping jaws carried by the amputated limb.

Figure 3 is a side view of the pump attached to a shoe.

Figure 4 is a top plan view of the pump.

Figure 5 is a vertical section of the pump.

Figure 6 is a further side view of the pump, but showing the pedal released by the trip mechanism.

Figure 7 is a longitudinal section of the fluid cylinder and the jaws.

Figure 8 is a cross section thereof taken on line 8—8.

Like numerals of reference indicate corresponding parts in each figure throughout the drawings.

In carrying out the invention, it is proposed that the fluid cylinder 9 shall be rigidly mounted in a conventional socket or corset member 10 fitted on the stump of the amputated limb according to the nature of the amputation. The cylinder has a nipple 11 connected to a length of flexible tubing 12 extending to the pump 13; which pump will be later described in detail.

The cylinder is supplied with a reciprocal piston 14 having an outwardly protruding rod 15

extending to the movable jaw 16 opposite the fixed jaw 17 which is preferably shaped as shown. The rod 15 is axially compressible to a certain degree by means of the interposition of a resilient element, such as the spring 18. This is achieved by making the rod of an outer telescopic part 19 rigid with the jaw 16, and an inner telescopic part 19' rigid with the piston 14. The spring is interposed between the piston and the inner end of the telescopic part 19.

By this construction, it will be gathered that as the piston is outwardly urged by fluid pressure, the spring will yield when the jaws close on an object and thus the compressive force will prevent it from loosening in the jaws.

The rigid jaw 17 is integral with or secured to a stock 20 co-extensive with the cylinder, which stock is constructed to form a longitudinal guiding connection for the movable jaw 16. For example, the guiding connection may consist of a guide piece 21 slidably mounted in a channel 22 and rigid with the movable jaw. The channel may be formed in the forepart of the stock and the rear part of the stock may be hollow to accommodate a resilient member, such as the endless elastic band 23 that is connected to the guide piece 21 so as to retract the jaw 16 together with its operating piston. This retractile movement forces the fluid back into the pump when the pump piston is released by the trip mechanism.

To adjust the angular position of the jaws, it is desirable that they be so mounted as to be rotatable about the cylinder axis. This may be accomplished in convenient manner, such as, for example, by the provision of a pair of spaced rings 24, 24 rotatably encircling the cylinder 9 and endwise shouldered by an intervening collar 25 rigid with the cylinder. These rings are integral with or secured to the stock 20 so as to allow the jaws to swivel as a unit about the cylinder.

To retain the jaws in any angular position relative to the cylinder, a locking mechanism is employed, which is shown as consisting of a detent pin 26 slidably mounted in the stock 20 for selective engagement in any one of a circumferential series of radial holes 27 in the collar 25. The detent pin is operable by a lever 28 pivoted at 29 and furnished with a spring 30 for normally pressing the detent pin in the direction of the 50 holes 27. The pin is releasable from the collar by depression of the free end of the lever.

To strengthen the rotatable mounting of the stock on the cylinder, a rear ring 31 may be resorted to, which is similar to the rings 24. The 55

use of this additional ring is optional and may not be required.

Adverting to the pump 13, this consists of a fluid cylinder 32 pivoted at one side, at 33, to a plate 34 attached to an ordinary boot or shoe. The cylinder is vertically arranged at the inner side of the leg and the pivot 34 is aligned with the ankle joint so as to facilitate movement of the foot. The upper end of the cylinder may have a strap 35 for attachment about the leg. The flexible tubing 12 communicates with the lower end of the cylinder.

The reciprocal piston 36 of the pump has an upwardly directed rod 37 fastened to a guide 38 freely slidable within the bore and projecting outwardly through a slot 39 in the upper end of the cylinder clear of the travel or stroke of the piston. The projecting part 40 of the guide is pivoted at 41 to a depending detent 42 co-extensive with the cylinder, but on the far side of the plate 34.

The pivotal connection of the detent is so arranged that the lower end of the detent may have a limited movement to and away from the adjacent side of the cylinder. This lower end carries a fixed tooth 43 engageable with teeth of a ratchet bar 44 united with the cylinder.

A pedal 45 is pivoted at 46 to the lower end of the detent so that it may swing from a vertical to a horizontal position. It is sustained by a shoulder in known manner in its unfolded horizontal position so as to enable the wearer of the appliance to raise his other foot and place it on the pedal for the purpose of depressing it to eject fluid into the other cylinder 9. The pedal is vertically folded when not in use.

It will be evident that by this construction the detent automatically locks the piston 36 in any position to which it is lowered, and that the jaw 16 will thus be held in its advanced position until the detent is released from the toothed engagement with the ratchet.

The pedal release mechanism herein disclosed comprises a parallel bar 47 swingable outwardly by links 48 and normally held raised by a spring 49. The lower end of the bar has a trip 50 consisting of a bent out portion of this bar. The pivotal pin 46 of the detent is outwardly projected from a side of the pedal 45 so as to be disposed in the path of movement of the bar 47.

It will be manifest that by this construction the detent can be released from whatever position it happens to be in. The wearer merely places his other foot on the trip 50 to urge it downwardly. This throws the parallel bar 47 outwardly into contact with the pin 46 urging the lower end of the detent away from the ratchet to free the toothed engagement. When the detent is released, the resilient member 23 drives the fluid back into the pump cylinder, raising the piston thereof ready for recurrent operation. The return of the piston may be assisted by a spring 51 connected to the detent.

What I claim is:

1. A hydraulic artificial hand comprising a cylinder, a piston therein adapted to be advanced by liquid pressure, a rigid jaw, a movable jaw guided for opening and closing movement relative to the rigid jaw, supporting means for the jaws, a compressible mechanical connection between the said piston and said movable jaw for effecting a closing movement of the movable jaw by advance movement of the piston, a pump connected to the cylinder for passage of liquid therebetween, a piston therein for delivery of liquid

to the cylinder, releasable means for precluding the discharge of liquid delivered to the cylinder so as to lock the movable jaw against retrograde movement, and resilient means for retracting the movable jaw and the cylinder piston when the liquid is allowed to discharge from the cylinder.

2. A hydraulic artificial hand comprising the combination with a fluid cylinder having a piston rod extending axially therefrom, of a stock co-extensive with the piston rod to one side of the cylinder, a pair of jaws transversely extending from the stock, one of said jaws being rigid with the stock and the other being connected to the piston rod and slidably associated with the stock, and means whereby the stock is rotatably mounted on the cylinder to adjust the transverse angular position of the jaws relative to the cylinder.

3. A hydraulic artificial hand comprising a pump adapted to be vertically attached to the leg of a person, said pump having a depressable piston, means for locking the piston in a depressed position, a pedal adapted to depress the piston, a trip carried by the pump for releasing the locking means, a tubing extending from the pump, a fluid cylinder carried by an amputated arm of the person and connected to said tubing, a piston in said cylinder, and gripping elements associated with the piston of said cylinder for operation thereby.

4. A hydraulic artificial hand in accordance with claim 3, in which the pump has a plate pivoted in the vicinity of its lower end adapted for attachment to a shoe so that the pivot axis will be in alignment with the ankle joint of the foot, and in which the pump has a strap at its upper end adapted for fastening it to the leg of the wearer.

5. A hydraulic artificial hand comprising a cylinder, a piston reciprocally mounted therein, a pair of clamping jaws carried by the cylinder, one of the jaws being stationary and the other movable, an axially compressible rod connecting the piston to the movable jaw and consisting of a pair of interfitting members having a resilient element so interposed as to be compressible when the piston urges the movable jaw into clamping engagement, and a pump connected to the cylinder for exerting hydraulic pressure on the aforesaid piston therein to close the said jaws.

6. A hydraulic artificial hand comprising a cylinder, a piston reciprocally mounted therein, a pair of clamping jaws carried by the cylinder, one of the jaws being stationary and the other movable, an axially compressible rod connecting the piston to the movable jaw, a pump connected to the cylinder for exerting hydraulic pressure on the piston therein to thus advance the movable jaw aforesaid into clamping engagement, means for retaining the movable jaw in advanced position comprising a stationary ratchet bar, a co-acting detent shiftable by operation of the pump into locking engagement with the ratchet bar, means connected with the detent to retain the cylinder-piston in an advanced position when the detent is engaged with the ratchet bar, and means for disengaging the detent consisting of a plurality of links each of which is pivoted at one end to a support, a spring-retracted bar pivoted to the other end of said links and disposed alongside of the detent, a depressible trip carried by the bar, and a member carried by the detent and projecting into the path of movement of the bar.

7. A hydraulic artificial hand comprising a

5 pump adapted to be vertically attached to the
leg of a person, said pump being composed of a
cylinder having a displacement chamber in the
lower portion thereof, a depressible piston in
the cylinder for discharge of fluid from the cham-
ber in the down stroke, an upwardly extending
rod connected to the piston and guidably sup-
ported by the cylinder, an elongated detent dis-
posed exteriorly of the cylinder and lengthwise
thereof; the lower end of the detent being adapted
10 to engage teeth of a ratchet bar and the up-
per end being pivotally connected to the rod, a
pedal carried by the detent, a ratchet bar united
with the cylinder in juxtaposition to the detent
15 such that the detent may engage the teeth
thereof when depressed by the pedal, and a trip
mechanism for releasing said detent from the
ratchet bar, a conduit extending from the pump
chamber, a fluid cylinder carried by an ampu-
tated arm of the person and connected to said
20 tubing, a piston in this cylinder, and gripping
elements associated with the last mentioned pis-
ton for operation thereby.

8. A hydraulic artificial hand comprising a

cylinder, a piston therein operated by fluid pres-
sure, jaw mechanism actuated by the piston, a
pump connected to the cylinder for passage of
fluid therebetween, a fluid piston in the pump,
means for actuating this piston, means for lock-
ing the jaws in a gripping position, and means
for releasing the locking means. 5

9. In combination, an artificial limb member
including a movable element adapted to be at-
tached to a human body, means for actuating said
movable element comprising a first cylinder 10
adapted to be attached to said body, a piston in
said first cylinder connected for operation by
movement of said body, a second cylinder mount-
ed in said artificial limb member, an operative
connection between said first cylinder and said
15 second cylinder comprising a conduit adapted
to contain an inelastic fluid, a piston in said sec-
ond cylinder, and a rod affixed to said last named
piston and attached through resilient means to
20 said movable element of said artificial limb mem-
ber for the actuation thereof.

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