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(54) **Pipe swaging device with hydraulic transmission**

Rohrschmiedegerät mit hydraulischem Antrieb

Machine à rétreindre de tuyaux à transmission hydraulique

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GB-A- 1 344 784 **US-A- 2 869 407**

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Description

[0001] This invention relates to a metal pipe swaging apparatus of the type claimed in the preamble of claim 1. Such an apparatus is known from GB-A-1 344 784. Similar devices are already known and in recent years have been increasingly used in plant construction (for example in heating plants and water or air distribution plants) for example for connecting together two pieces of metal pipe by means of a metal sleeve, without using heat. The sleeve is inserted in known manner into the outer pipe piece, which is then squeezed usually in two different positions to form the connection. The seal is provided by two or more O-rings. As is well known, the connection can also be formed using a connector to which the two pipe pieces to be connected together are fixed, these being mounted over it or inserted into it.

[0002] Traditionally, the outer pipe is squeezed to achieve the connection using a conventional device provided with a swaging gripper comprising two jaws operated manually by the operator by means of levers.

[0003] Such a device is bulky and laborious to use, hence attempts have been made to motorize it. This has been done by applying to the pipe swaging device an operating means comprising an electric motor of the type used in hand drills. In practice a hand drill from which the chuck has been removed is used. A conventional mechanical transmission converts the rotary movement of the drill motor shaft into a closure movement of the jaws of said swaging gripper. The mechanical transmission used in this known device comprises a release mechanism which operates when the maximum required thrust is reached, or a friction clutch which slips on reaching this maximum thrust. In all cases the aforesaid motorized swaging devices are not only heavy and bulky, but also have the further drawback that their mechanical transmission is subject to considerable wear (thrusts of up to 4000 kg are involved) whether a clutch or a release mechanism is used, with easily imaginable results. To return the device to its initial state it is always necessary to reverse the direction of rotation of the motor (hence an inverter must be provided), which also contributes to increasing the wear of the mechanical transmission. A manually operated pipe bending apparatus with hydraulic transmission is known from the EP-A-775 538. The object of this invention is to overcome the aforesaid drawbacks, in the case of motorized devices.

[0004] This object is attained by the pipe swaging apparatus as claimed in claim 1.

[0005] Preferably the deformable wall portion of the reservoir is an elastic membrane (for example of rubber). The pump operating means are an electric motor which is used together with relative conventional means for converting the rotary motion of the motor shaft into reciprocating movement of the pump piston. Such means are disclosed in EP-A-389716. An electric hand drill fixable to the casing of the pipe swaging apparatus

is usefully used, with the drill chuck removed and replaced by a gear train which transmits the rotary movement of the drill motor shaft to a cam, the periphery of which engages a cam follower rigid with the outer end of the rod of the plunger pump.

[0006] Conveniently a safety valve is provided to discharge liquid from the first chamber into the second chamber, and hence into the reservoir, when the cylinder rod reaches its end of travel (maximum first chamber volume).

[0007] The invention will be more apparent from the ensuing description of one embodiment thereof. In this description reference is made to the accompanying drawings, on which:

Figure 1 is a partly sectional side view of the pipe swaging device of the invention, complete with a motorized operating device formed from an electric hand drill;

Figure 2 is a partly sectional plan view thereof from above;

Figure 3 is a perspective view showing how a conventional pipe swaging gripper is applied to the device of the invention; and

Figure 4 is a perspective view showing the use of the pipe swaging device.

[0008] Figures 1 and 2 show a pipe swaging device 82 of the invention combined with an operating means 15 of electric motor type. The operating means 15 comprises an electric drill 10 of hand type (ie provided with a gun-type handgrip 12), from which the chuck has been removed and replaced with a train of gears (14, 16, 18) which transmit the rotary movement of the motor shaft pinion of the drill 10 to a cam 22, the lateral surface of which engages a cam follower 24 provided with a helical spring 26. The cam follower is integral with the end of a plunger 28 of a pump 30, the plunger 28 being movable in both directions within the cylinder 32.

[0009] When the electric motor (not shown) of the drill 10 is operated the pinion 20 rotates, as does the cam 22 by virtue of the gears 14, 16, 18. Consequently the plunger moves with reciprocating movement on account of the cam follower 18. This means that when the plunger 28 rises (with reference to Figure 1), the incompressible liquid (preferably hydraulic transmission mineral oil) contained in the reservoir 34 is drawn into the cylinder 32 through the conduit 36 and the unidirectional ball valve 38. When the plunger 28 is lowered the valve 38 closes, whereas the unidirectional valve 40 opens, so that the liquid contained in the cylinder 32 is fed through a first conduit 46, 48 to a first chamber 42 provided in the cylinder 44.

[0010] A rod 52 integral with a piston 54 provided with an O-ring 56 is slidable in both directions within the cylinder 44. The piston 54 divides the interior of the cylinder 44 into two chambers, one of which is the aforesaid first chamber 42, the second chamber being indicated by 58.

The chambers 42 and 58, in which the same liquid contained in the reservoir 34 is present, are of variable volume in the sense that their volume depends on the position of the rod 52 and relative piston 54. As already stated, on operating the pump 30 the liquid contained in the reservoir 34 is gradually fed under pressure into the first chamber 42. Consequently on the right face (with reference to Figure 1) of the piston 54 there is a greater pressure than on its opposite face. This causes the piston 54 and its rod 52 to move towards the left.

[0011] The rod 52 is hollow and contains a ball valve 68 maintained closed by the elastic reaction force of a precompressed spring 62, which when overcome results in the first chamber 42 communicating (via the channel 50) with the second chamber 58 and hence with the reservoir 34 via a second channel 72, to hence equalize the pressure in the two chambers 42 and 58. In this manner unwanted and dangerous overpressures in the first chamber 42 are prevented. The valve 68 can be adjusted by varying the extent by which a grub screw 67 is screwed into a partially threaded internal cavity 71 in the rod 52. As can be seen from Figure 1 the rod 52 has an annular step 60 which operates as a stop by abutting against the left end wall 70 of the cylinder 44 when the piston has moved completely to the left.

[0012] As incompressible liquid is also present in the second chamber 58, when the piston 54 moves towards the left the liquid contained in the second chamber 58 is made to flow out into the reservoir 34 by virtue of the second (return) channel 72 which connects the second chamber 58 to the reservoir 34.

[0013] As already stated, a portion of the inner wall of the reservoir 34 is deformable, this deformable portion consisting of a cup-shaped elastic membrane 74 (for example of a suitable rubber or plastic), sealedly locked in position by a cover 76 having a through hole 78 so that the pressure which acts on the outside of the membrane 74 is atmospheric. The elastic membrane allows compensation of the incompressible liquid volumes involved.

[0014] As can be seen from Figures 1 and 2, on the left end of the cylinder 44 there is mounted a fork 84 which is rotatable relative to the cylinder 44, the axis of rotation of the fork 84 coinciding with that of the rod 52. On the fork 84 there are mounted two idle rollers 80 which, when the rod 52 advances towards the left, engage the respective jaws 92 (Figures 3 and 4) of a conventional pipe swaging gripper 90 applicable to the pipe swaging device 82. It is applied as shown in Figure 3, ie by inserting the shank 94 of the pipe swaging gripper 90 into the fork 84 (the gripper could also comprise two such shanks, the description being equally valid). The connection pin 86 is then inserted into the holes 88 provided in the arms of the fork 84 and into the corresponding hole 96 in the shank 94 (or into the corresponding holes in the two said shanks). At this point the jaw 92 of the gripper 90 is opened manually in the usual manner and the pipe to be swaged is positioned between the

jaws 92 (the illustrated embodiment shows a sleeve into which two pieces of metal pipe 102 and 104 to be connected together have been previously inserted). At this point the electric motor of the drill 10 is operated (by pressing the pushbutton 11 with a finger of the hand holding the handgrip 12) to cause the rollers 80 to advance (to the position indicated by 80') and make contact with the interior of the respective jaws 92 (not shown open for simplicity in Figures 3 and 4), so that these latter close to squeeze the sleeve in the corresponding position. When swaging has been effected to the desired degree the pushbutton 11 is released. However if the rod 52 has not reached its end-of-travel position the incompressible liquid in the first chamber 42 remains under pressure, so that the jaws 92 remain closed. To release the jaws 92 a handwheel 49 has to be unscrewed, this handwheel when screwed down maintaining the ball valve 51 in position so as to interrupt communication with the conduit 53 which connects the conduit 48 to the reservoir 34. The opening of the valve 51 consequent on the unscrewing of the handwheel 49 causes the pressure in the first chamber 42 to equal the pressure in the second chamber 58, so that a return spring 55 mounted coaxial with the rod 52 returns this latter to its rest position, so releasing the jaws 92.

[0015] The illustrated pipe swaging device 82 comprises a means for orientating the fork 84 in predetermined angular positions relative to the cylinder 44. In this respect, Figure 1 shows by way of example a positioning device of the aforesaid type consisting of a ball 83 pressed against the fork 84 by a precompressed spring, a notch 73 which the ball 83 can partly enter being provided in the surface of the fork 84 in the required angular positions (for example every 30 degrees).

[0016] It should be noted that using the swaging device of the invention, pieces of pipe coated internally or externally with a suitable plastic can also be connected together.

[0017] The aforescribed pipe swaging device has great power and is of much smaller dimensions and weight than known motorized pipe swaging devices, in addition to being simple to use and subject to much less wear than known pipe swaging devices.

Claims

1. Apparatus for swaging metal pipes (100), including a swaging gripper (90) with two jaws (92) and a device (82) for actuating the gripper (90) and including two idle rollers (80) mounted on one end of a rod (52) axially movable in both directions, the rod (52) being thrustable in one of said directions to cause each roller (80) to contact the corresponding inner rear portion of one jaw (92), thereby causing the closure of the jaws (92), the device (82) also including a hydraulic transmission comprising:

- a cylinder (44) within which the rod (52) is movable, the end of the rod (52) having the rollers (80) emerging from the cylinder (44) through a suitable sealed aperture, to the other end of the rod (52) being coaxially fixed a sealed piston (54),
characterised in that, said piston (54) divides the interior of the cylinder (44) into a first chamber (42) and a second chamber (58) both containing an incompressible liquid, the volume increase of the first chamber (42) causing the closure of the jaws (92);

said hydraulic transmission further comprising :

- a reservoir (34) also containing said incompressible liquid, the reservoir (34) shell having a part (74) deformable elastically within a predetermined range as a result of variation in the liquid quantity within the reservoir (34);
- a plunger pump (30) actuated by an electric motor to withdraw the liquid contained in the reservoir (34) and to feed it under pressure into the first chamber (42) of the cylinder (44) via a first conduit (36, 46, 48);
- a second conduit (72) which connects the second chamber (58) of the cylinder (44) to the reservoir (34);
- a third conduit (53) which connects the first chamber (42) to the reservoir (34) by by-passing the pump (30);
- manually operable shut-off means (51, 49) provided in the third conduit (53); and
- elastic return means (55) for returning the rod (52) into the position corresponding to minimum volume of the first chamber (42) of the cylinder (44) when the shut-off means (51, 49) in the third conduit (53) are open,

wherein the electric motor actuating the pump (30) pertains to an electric hand drill (10) fixable to the casing of the device (82), with the drill chuck removed and replaced by a train of gears (20, 14, 16, 18) which transmit the rotary movement of the drill (10) motor shaft to a cam (22) the periphery of which engages a cam follower (24) rigid with the outer end of the rod of the plunger pump (30).

2. Apparatus as claimed in claim 1, wherein the elastically deformable wall portion of the reservoir (34) is an elastic membrane (74).
3. Apparatus as claimed in any one of the preceding

claims,prising a safety valve (68) enabling the incompressible liquid to be discharged from the first chamber (42) into the second chamber (58) when the rod (52) of the cylinder (44) reaches its end-of-travel position, with maximum external extension of the rod (52).

4. Apparatus as claimed in claim 3, wherein the safety valve (68) is adjustable.
5. Apparatus as claimed in any one of the preceding claims, wherein the manually operable shut-off means are a handwheel (48) which on being unscrewed opens a ball valve (51) which closes the third conduit (53).
6. Apparatus as claimed in claim 1, wherein the rollers (80) are arranged between the two arms of a fork (84) rotatably mounted on the cylinder (44), the axis of rotation of the fork (84) coinciding with that of the rod (52).

Patentansprüche

1. Gerät zum Schmieden von Metallrohren (100), mit einem Schmiede-Greifer (90) mit zwei Einspannbacken (92) und einer Vorrichtung (82) zum Betätigen des Greifers (90) und mit zwei Leerlauf-Walzen (80), die an einem Ende einer Stange (52) montiert sind, die in beide Richtungen axial beweglich ist, wobei die Stange in eine der Richtungen verlagerbar ist, um zu bewirken, daß jede Walze (80) mit dem zugehörigen inneren hinteren Bereich von einer Einspannbacke (92) in Kontakt kommt, wodurch das Schließen der Einspannbacken (92) bewirkt wird, wobei die Vorrichtung (82) außerdem eine hydraulische Übertragungseinrichtung aufweist, mit:

- einem Zylinder (44), in dem die Stange (52) beweglich ist, wobei das Ende der Stange (52) mit den Walzen (80) aus dem Zylinder (44) durch eine geeignet abgedichtete Öffnung austritt und an dem anderen Ende der Stange (52) ein abgedichteter Kolben (54) koaxial angebracht ist, dadurch gekennzeichnet, daß der Kolben (54) das Innere des Zylinders (44) in eine erste Kammer (42) und eine zweite Kammer (58) unterteilt, die beide eine inkompressible Flüssigkeit enthalten, wobei ein Anstieg des Volumens in der ersten Kammer (42) das Schließen der Einspannbacken (92) bewirkt;

wobei die hydraulische Übertragungseinrichtung außerdem aufweist:

- ein Behältnis (34), in dem ebenfalls die inkompressible Flüssigkeit enthalten ist, wobei das

- Gehäuse des Behältnisses (34) einen Abschnitt (74) beinhaltet, der als eine Folge der Veränderung der Flüssigkeitsmenge in dem Behältnis (34) in einem bestimmten Bereich elastisch verformbar ist;
- eine Plungerpumpe (30), die durch einen Elektromotor betrieben wird, um die in dem Behältnis (34) enthaltene Flüssigkeit abzusaugen und sie unter Druck durch eine erste Leitung (36, 46, 48) in die erste Kammer (42) des Zylinders (44) zu pumpen;
 - eine zweite Leitung (72), die die zweite Kammer (58) des Zylinders (44) mit dem Behältnis (34) verbindet;
 - eine dritte Leitung (53), die die erste Kammer (42) unter Umgehung der Pumpe (30) mit dem Behältnis (34) verbindet;
 - manuell betätigbare Verschlußmittel (51, 49), die in der dritten Leitung (53) vorgesehen sind; und
 - elastische Rückziehmittel (55), um die Stange (52) in eine Position zurückzuziehen, die einem minimalen Volumen der ersten Kammer (42) des Zylinders (44) entspricht, wenn die Verschlußmittel (51, 49) in der dritten Leitung (53) offen sind, wobei der Elektromotor, durch den die Pumpe (30) betrieben wird, zu einer elektrischen Handbohrmaschine (10) gehört, die an dem Gehäuse der Vorrichtung (82) anbringbar ist, wobei das Bohrfutter entfernt und durch ein Getriebe (20, 14, 16, 18) ersetzt ist, durch das die Drehbewegung der Motorwelle der Bohrmaschine (10) auf einen Nocken (22) übertragen wird, dessen Umfang mit einem Nockenstößel (24) eingreift, der mit dem äußeren Ende der Stange der Plungerpumpe (30) starr verbunden ist.
2. Gerät nach Anspruch 1, bei dem der elastische verformbare Wandabschnitt des Behältnisses (34) eine elastische Membran (74) ist.
 3. Gerät nach einem der vorhergehenden Ansprüche, mit einem Sicherheitsventil (68), das es ermöglicht, die inkompressible Flüssigkeit aus der ersten Kammer (42) in die zweite Kammer (58) abzuleiten, wenn die Stange (52) des Zylinders (44) ihre Verlagerungs-Endposition bei maximaler äußerer Erstreckung der Stange (52) erreicht.
 4. Gerät nach Anspruch 3, bei dem das Sicherheitsventil (68) einstellbar ist.
 5. Gerät nach einem der vorhergehenden Ansprüche, bei dem die manuell betätigbaren Verschlußmittel ein Handrad (48) sind, das beim Aufschrauben ein Kugelventil (51) öffnet, durch das die dritte Leitung (53) geschlossen wird.

6. Gerät nach Anspruch 1, bei dem die Walzen (80) zwischen den beiden Schenkeln einer Gabel (84) angeordnet sind, die drehbar an dem Zylinder (44) montiert ist, wobei die Drehachse der Gabel (84) mit der der Stange (52) zusammenfällt.

Revendications

1. Appareil à refouler les tuyaux métalliques (100) comportant un mors de refoulement conventionnel (90) à deux mâchoires (92) et un dispositif (82) destiné à actionner le mors (90) et comportant deux galets (80) montés à une extrémité d'une tige (52) se déplaçant axialement dans les deux sens et pouvant être poussée dans l'un de ces deux sens de façon à mettre chaque galet (80) en contact avec la partie arrière intérieure correspondante d'une des mâchoires (92), provoquant ainsi la fermeture des mâchoires (92), le dispositif (82) comportant également une transmission hydraulique comprenant :

- un cylindre (44) à l'intérieur duquel se déplace la tige (52) portant les galets (80), lesquels dépassent du cylindre (44) par une ouverture appropriée pourvue d'un joint, l'autre extrémité de la tige (52) étant reliée coaxialement à un piston (54) pourvu de joints, l'appareil étant caractérisé en ce que ledit piston (54) divise l'intérieur du cylindre (44) en une première chambre (42) et une deuxième chambre (58) contenant toutes deux un liquide incompressible, une augmentation de volume dans la première chambre (42) provoquant la fermeture des mâchoires (92),

ladite transmission hydraulique comprenant en outre :

- un réservoir (34) contenant lui aussi ledit liquide incompressible et possédant une partie (74) déformable élastiquement au sein d'une plage prédéterminée lors des variations de la quantité de liquide présent dans le réservoir (34),
- une pompe à piston (30) actionnée par un moteur électrique, qui puise le liquide dans le réservoir (34) et l'envoie sous pression dans la première chambre (42) du cylindre (44) via un premier passage (36, 46, 48),
- un deuxième passage (72) reliant la deuxième chambre (58) du cylindre (44) au réservoir (34),
- un troisième passage (53) reliant la première chambre (42) au réservoir (34) sans passer par la pompe (30),

- un dispositif d'obturation à action manuelle (51, 49) installé dans le troisième passage (53), et
- un dispositif de rappel élastique (55) ramenant la tige (52) à la position correspondant au volume minimum de la première chambre (42) du cylindre (44) lorsque le dispositif d'obturation (51, 49) du troisième passage (53) est ouvert,

ledit appareil étant en outre caractérisé en ce que le moteur électrique entraînant la pompe (30) est celui d'une perceuse électrique portative (10) pouvant être fixée au boîtier de l'appareil (82) une fois le mandrin de perçage retiré et remplacé par un train d'engrenages (20, 14, 16, 18) qui transmet le mouvement rotatif de l'arbre de la perceuse (10) à une came (22) sur la périphérie de laquelle porte un poussoir (24) en liaison rigide avec l'extrémité extérieure de la tige de la pompe à piston (30).

2. Appareil selon la revendication 1, caractérisé en ce que la partie élastiquement déformable de la paroi du réservoir (34) est une membrane élastique (74) .
3. Appareil selon l'une quelconque des revendications précédentes, comprenant une soupape de sécurité (68) permettant d'évacuer le liquide incompressible de la première chambre (42) dans la deuxième (58) lorsque la tige (52) du cylindre (44) atteint sa position de fin de course, c'est-à-dire son extension maximum à l'extérieur.
4. Appareil selon la revendication 3, caractérisé en ce que la soupape de sécurité (68) est réglable.
5. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que le dispositif d'obturation à action manuelle est une molette (48), laquelle, lorsqu'on la dévisse, ouvre un clapet à bille (51) fermant le troisième passage (53).
6. Appareil selon la revendication 1, caractérisé en ce que les galets (80) sont disposés entre les deux bras d'une fourche (84) montée libre en rotation sur le cylindre (44), l'axe de rotation de la fourche (84) coïncidant avec celui de la tige (52).

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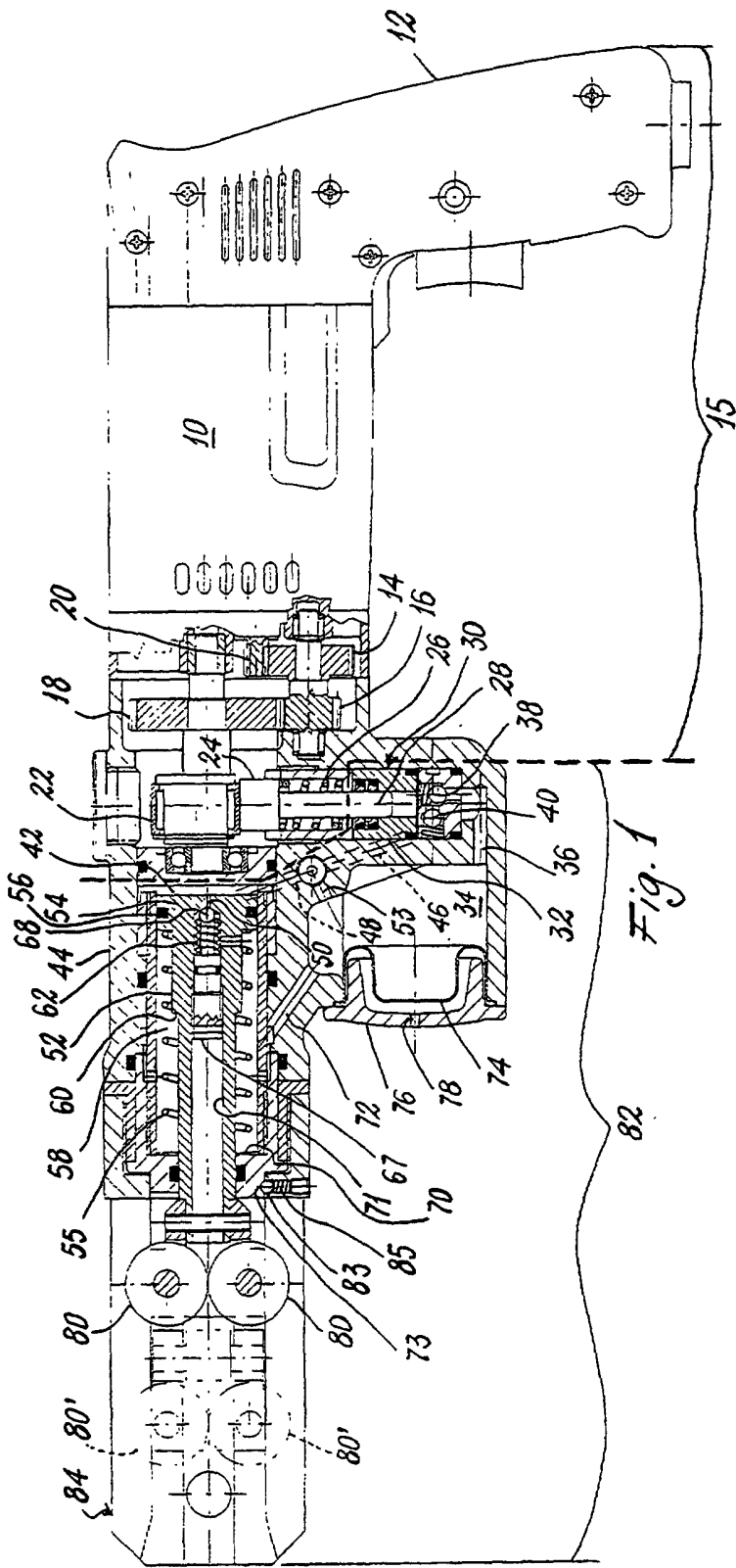


Fig. 1

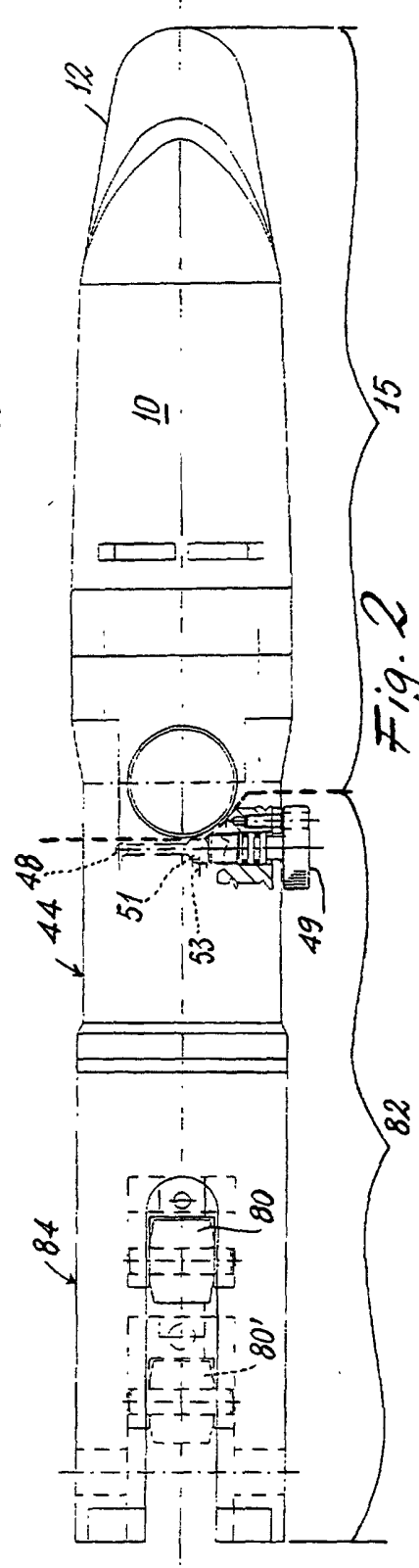


Fig. 2

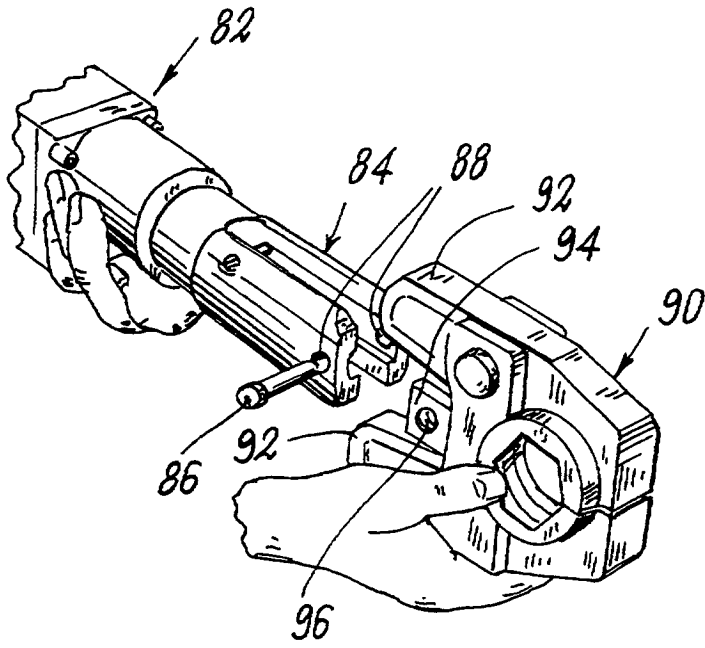


Fig. 3

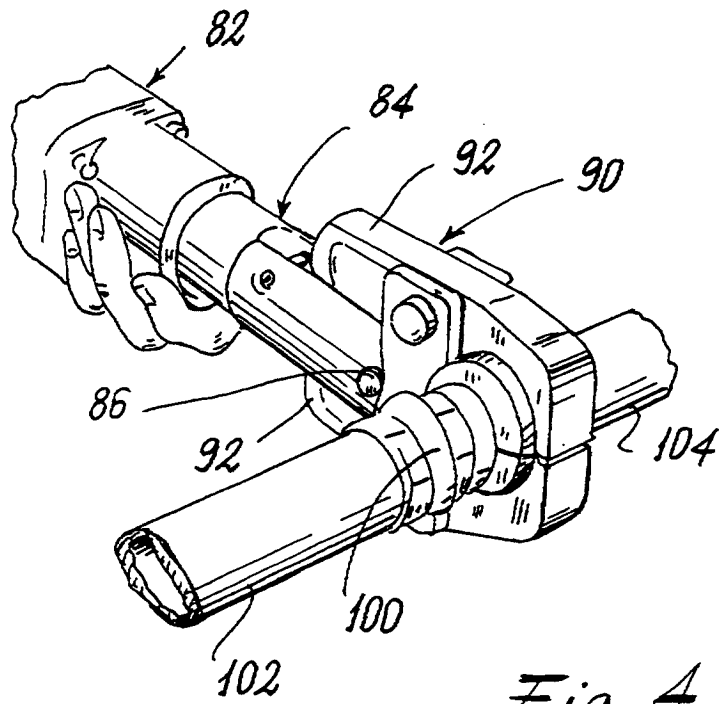


Fig. 4