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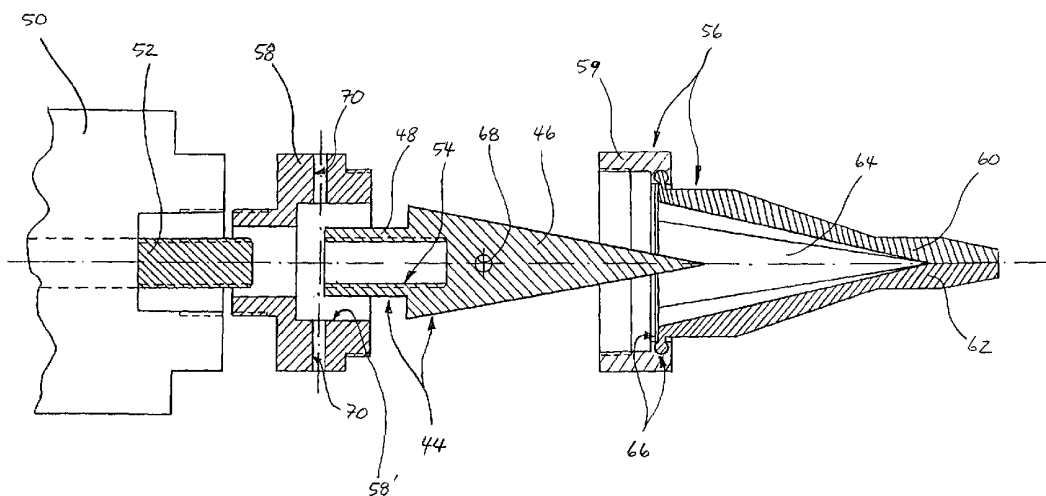
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(54) Title: SLIDE PLUNGER DEVICE



(57) Abstract: A slide plunger device (44) in an expansion device of an expansion tool, the slide plunger (44) and a cooperating expansion head (56) being used to cold-expand an end portion of preferably a plastic pipe (40, 68), so that, immediately thereupon, a connecting nipple, e.g., may be inserted into the plastic pipe (40, 68), the plastic pipe (40, 68) then shrinking firmly round the connecting nipple, so that a pressure-tightening connection is achieved. The device is releasable and has the effect that through an actuator shaft (52) the conical slide plunger (44) may have an actuator releasably arranged thereto, the actuator preferably being of the electromechanical kind and located in a portable gun tool (50).



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SLIDE PLUNGER DEVICE

Field of Invention

This invention relates to a slide plunger device in an expansion device in connection with an expansion tool. The expansion device is used in connection with the simultaneous cold expansion of an end portion of a plastic pipe and possibly an external ring associated with the end portion of the plastic pipe, said pipe, and possibly the ring, preferably being formed of so-called PEX plastic material.

Immediately after the expansion, a connecting nipple, e.g., may be inserted into the plastic pipe, the plastic pipe and the associated ring contracting thereupon due to their elastic properties, thereby shrinking firmly around the connecting nipple, so that a pressure-tight connection is achieved. Thereby several lengths of plastic pipe and/or other necessary plumbing components may be connected/interconnected. Such pipes and rings of PEX plastic material are normally used in connection with plumbing operations with the aim of supplying for example pressurized water to family houses and other buildings.

Background of the Invention

The invention has its background in the limitations or drawbacks exhibited by the known expansion tools in practical use thereof in connection with the fitting of plastic pipes preferably of PEX plastic material.

Known technique

In plumbing with e.g. PEX plastic pipes in family houses and buildings, a pair of manually operated expansion tongs may be used to cold-expand an end portion of a PEX plastic pipe and possibly to cold-expand an associated PEX plastic ring positioned externally thereon, the expansion tongs being operated manually. The expansion tongs are provided with an expansion device formed by a conical slide plunger and an expansion head with several expansion jaws, the constructional character and operation of the expansion tongs being described in detail in the exemplary embodiment mentioned below, the purpose thereof being to visualize differences between the expansion device of the expansion tongs and the expansion device according to the invention.

Other known technique applied for cold expansion of e.g. PEX plastic pipes/PEX plastic rings, is that of an expansion tool based on the supply of hydraulic thrust force. Like the expansion tongs, the hydraulically activated expansion tool is based on the use of a similar expansion device formed, i.a., by a conical slide plunger and a corresponding and surrounding expansion head provided with several elongate expansion jaws. The conical slide plunger of the hydraulically activated expansion tool is also formed by an elongate spacer positioned along the centre axis of the cone,

the cone and the spacer being fixedly arranged to one another, but the spacer being arranged, at the opposite end of the cone, to a hydraulic thrust device, e.g. a hydraulic cylinder, exerting the necessary thrust force in the axial
5 direction of the slide plunger.

The hydraulically activated expansion tool is normally used on PEX plastic pipe diameters larger than the diameter dimensions that manual expansion tongs may normally be used for, the expansion of larger pipe diameters requiring greater
10 expansion force than what such expansion tongs can provide. Therefore, such an expansion tool is preferably used industrially, e.g. in plumbing in larger buildings and facilities.

Drawbacks of Known Technique

15 A pair of manually operated expansion tongs is cumbersome in practical use. To use the tongs manually, both tong parts must be operated simultaneously, which requires that one hand is placed on each tong part. Thereby it may be difficult, at the same time to hold securely a flexible PEX plastic pipe
20 which is sought to be expanded, and which is e.g. projecting freely from a wall and/or is placed in a not easily accessible and possibly narrow area. In practice the result of this inconvenience is often that such expansion tongs, and thereby PEX plastic pipes, are not used, and other more rigid
25 types of pipes, e.g. copper pipes, are used instead, in particular then in minor pipe installation jobs and repairs, such as in family houses. This is unfavourable, since in many ways PEX plastic pipes are advantageous in use for such plumbing operations, as the PEX plastic pipe materials, as
30 compared to metal pipes, do not corrode, e.g., they bend more

flexibly, are less prone to internal depositing, have better flow properties, are cheaper to buy and relatively maintenance-free.

As mentioned, the hydraulically activated expansion tool is normally used for PEX plastic pipe diameters larger than the diameter sizes that manual expansion tongs may normally be used for, and such an expansion tool is therefore used preferably in larger buildings and facilities. In addition to the fact that a hydraulically activated expansion tool is expensive to buy, the tool is, seen relative to expansion tongs, big and heavy and impractical to use in small, narrow and relatively inaccessible areas, which are often found in a family house.

Object of the Invention

The object of the invention is to provide a slide plunger device in an expansion device, so that the slide plunger may preferably be releasably arranged to an actuator, the actuator preferably being of an electromechanical kind and placed in a portable gun tool. The actuator should exert the required thrust force on, and cause displacing motion of, the slide plunger. Thereby the expansion jaws of the expansion device are supplied with the required expansion force for the expansion of an end portion of a plastic pipe and possibly an associated ring, located externally on the plastic pipe, the plastic pipe and possibly the ring preferably being formed of PEX plastic material. Immediately after expansion, a connecting nipple, e.g., may be inserted into the plastic pipe, the plastic pipe and the associated ring contracting thereupon, due to their elastic properties, thereby shrinking firmly around the connecting nipple. By means of such an

expansion device with a gun tool arranged thereto, it would be possible to increase the practical use of e.g. PEX plastic pipes in connection with plumbing operations in family houses and buildings, preferably.

5 Realization of the Object

The object is realized through the use of a slide plunger device in an expansion device in an expansion tool.

The slide plunger used in the present invention has many similarities to the conical slide plunger used in the above-mentioned expansion tongs. I.a., the expansion tongs are provided with a slide plunger, which is formed longitudinally of two slide element portions, one slide element portion being a cone, the other slide element portion being an elongate spacer positioned along the centre axis of the cone, the cone and the spacer being fixedly arranged to one another, the cone projecting further than the spacer from the centre line of the cone near the transition between the cone and the spacer.

In the present invention also the slide plunger may be formed longitudinally by just one plunger body, e.g. a cone, possibly a plunger body provided with an end piece fixedly arranged thereto, the plunger body, possibly the end piece fixedly arranged to the plunger body, being arranged to allow an actuator to be arranged preferably releasably thereto, and preferably an electromechanical actuator arranged in a portable gun tool. The expansion device is formed, moreover, by an expansion head with expansion jaws and a jaw sleeve, the internal surfaces of the expansion jaws, surrounding the plunger body in the position of use, being formed

complementary relative to the external surface shape of the plunger body. By means of a connecting element, the expansion device is arranged, fixedly or releasably, to the actuator, so that the connecting element preferably forms the muzzle
5 portion of the gun tool. The characteristic of the present invention is that the actuator is arranged to one end portion of an actuator shaft, preferably a non-rotating actuator shaft, whereas the other end portion of the actuator shaft is arranged, preferably releasably, to the plunger body, or
10 possibly is arranged, preferably releasably, to the end piece which is fixedly arranged to the plunger body, a possible releasable coupling connection being formed of a threaded coupling connection or a bayonet connection.

By the use of a threaded coupling connection, the plunger
15 body and the connecting element may for example be arranged with a diametrically located hole therethrough, so that by means of a key tool placed in the hole the threaded connection may be made up to a sufficiently great torque.

Advantages obtained through the Invention

20 The most obvious advantage of the invention is that by means of a preferably releasable slide plunger, the expansion device may be arranged to an actuator, preferably of the electromechanical kind in a portable gun tool, wherein such a gun tool may have an external configuration and size
25 resembling e.g. an electric power drill, and such a tool may be provided with e.g. a rechargeable battery or be connected to an electric supply cable. Thereby, as compared to a pair of manual expansion tongs, a simpler, more efficient and usable tool may be provided for the expansion of e.g. PEX
30 plastic pipes and PEX plastic rings. In its position of use,

such a gun tool may be operated just by one hand, which means that the other hand may be used, for example, to hold securely a flexible PEX plastic pipe which is sought to be expanded and which is projecting freely from a wall.

- 5 Moreover, the use of such a gun tool requires little space, which makes this tool well suited for plumbing operations in areas of little space. By thus providing a working tool which is adapted for the user, for example the plumber, to a substantially greater degree, as compared to expansion tongs
10 or a large hydraulically activated expansion tool, the use of for example PEX plastic pipes and PEX plastic rings could increase in connection with pipe installation jobs in e.g. family houses and buildings.

Brief Description of the Figures of the Drawings

- 15 In the following part of the description reference will be made to one non-limiting exemplary embodiment of the present slide plunger device, cf. Fig. 2 and Fig. 3, and expansion tongs according to known technique, cf. Fig. 1:

Fig. 1 showing a view in a partial section of a pair of
20 expansion tongs according to known technique, the components of the tongs being visualized in the position of use, the expansion jaws of the tong cold-expanding a PEX plastic pipe and an externally located PEX plastic ring;

Fig. 2 showing a view and a partial section of an expansion
25 device with a portable gun tool arranged thereto, said expansion device comprising the present slide plunger device, the components of the expansion device moreover being shown in the form of a split view, wherein the expansion jaws of the expansion device are shown in an inactive position, in

which the jaws are bearing on each other, and in which the expansion device is releasably connected by means of a conical slide plunger to an electromechanical actuator positioned in the gun tool, the drawings only showing the portion of the gun tool which is connected to the expansion device; and

Fig. 3 showing the same expansion device as that shown in Fig. 2, but the components of the expansion device otherwise being assembled, the expansion jaws of the expansion device cold-expanding a PEX plastic pipe and a PEX plastic ring placed externally thereon.

Description of an Exemplary Embodiment of the Invention

An actuator, preferably of the electromechanical kind positioned in a portable gun tool, is not indicated any further or described in further detail in this exemplary embodiment. Even though the actuator does not concern the invention itself, it is a necessary condition for the invention to be usable in connection with the expansion of a plastic pipe, and possibly a plastic ring surrounding the plastic pipe, the pipe and the ring preferably being formed of PEX plastic material.

The difference in constructional features of the present slide plunger device and known expansion tongs will be visualized in the following.

A pair of such expansion tongs 2 is formed by two elongate and connected tong parts 4 and 6. The two tong parts 4 and 6 are connected at respective end portions by means of a connecting piece 8, which is provided with a through bore 10

and 12 at the respective end portions. The through bores 10 and 12 correspond with through bores, not shown in the drawings, in the material of the tong parts 4 and 6, there being positioned through each bore 10 and 12 and through each
5 through bore, not shown in the drawings, of the material of the tong parts 4 and 6, a rotary shaft 14 and 16, cf. Fig. 1.

At its connecting portion the tong part 4 has an elongate slide plunger 18 rotatably arranged thereto, whereas the tong part 6 is provided with a through bore 20 and an external
10 connecting element 22 at its connecting portion, the bore 20 and the connecting element 22 being in a through connection with each other, and through which connecting element 22 and bore 20 the elongate slide plunger 18 is positioned
displaceable along the centre axis of the connecting element
15 22.

Longitudinally, the slide plunger 18 is formed by two slide element portions, one slide element portion thereof being formed by a cone 24, the other slide element portion being formed by an elongate spacer 26 placed along the centre axis
20 of the cone 24, the cone 24 and the spacer 26 being fixedly arranged to each another, the cone 24 projecting further than the spacer 26 from its centre line, near the transition between the cone 24 and the spacer 26. The free end portion of the spacer 26 is rotatably arranged to the tong part 4,
25 the slide plunger 18 being provided with a through bore 28 corresponding with corresponding through bores, not shown in the drawings, of the material of the tong part 4, there being placed through the bore 28 and each through bore, not shown in the drawings, of the material of the tong part 4, a rotary
30 shaft 30, cf. Fig. 1.

In its position of use, the cone 24 of the slide plunger 18 has an expansion head 32 arranged surroundingly thereto. The expansion head 32 is formed by a sleeve 34, there being rotatably arranged to the circumference of said sleeve 34 several elongate expansion jaws, of which only two expansion jaws 36 and 38 are shown in Fig. 1, the expansion jaws, including the expansion jaws 36 and 38, projecting from the sleeve 34, in the following referred to as a jaw sleeve 34, along the longitudinal axis of the slide plunger 18. In its position of use the cone 24 of the slide plunger 18 is surrounded by the expansion jaws, including the expansion jaws 36 and 38, the internal surfaces thereof together forming a conical surface shape which is complementary to the external surface shape of the cone 24. On the opposite side of the common and not further described support area 39 of the expansion jaws, including the expansion jaws 36 and 38, the jaw sleeve 34 of the expansion head 32 is connected by a threaded connection to the connecting element 22 of the tong part 6. Internally, the connecting element 22 is formed cylindrically, so that the cone 24 may be reciprocated longitudinally in this cylinder area. When the jaw sleeve 34 and the associated expansion jaws, including the expansion jaws 36 and 38, are connected to the connecting element 22, as the cone 24 is displaced in its longitudinal direction outwards towards the internal and conical surfaces of the expansion jaws, the cone 24 exerts a plunger-like thrust force on internal surfaces of the expansion jaws, including the expansion jaws 36 and 38. Thereby the free end portions of the expansion jaws, including the expansion jaws 36 and 38, are pushed outwards, exerting an outward expansion force against an externally located end portion of a PEX plastic pipe 40 and an associated PEX plastic ring 42 positioned externally on the PEX plastic pipe 40. Thereby, in one or

more turns, the internal diameters of the PEX plastic pipe 40 and the PEX plastic ring 42 are expanded, so that immediately after that, a connecting nipple, not shown in the drawings, of a suitable external diameter may be inserted into the expanded end portion of the PEX plastic pipe 40. The subsequent shrinking of the PEX plastic pipe 40 and the PEX plastic ring 42 then provides a pressure-tightening connection between the connecting nipple and the PEX plastic pipe 40.

10 The relative displacing motion that brings about the required outward expansion force between the cone 24 of the slide plunger 18 and the expansion jaws, including the expansion jaws 36 and 38, is provided in that at their free end portions opposite their connecting portions, the two tong parts 4 and 6 of the expansion tool are pushed manually towards each other in one or more turns by a certain thrust force. In the expansion tongs 2 the manual thrust force is subjected to a force transmission (gearing), as the tong parts 4 and 6 are arranged, at their connecting portions, with a torque transmitting device based on the lever principle, while at the same time the surface of the cone 24 relative to the centre axis of the cone 24 has been given a suitable pitch angle, so that the expansion force transferred to, and acting between, the cone 24 and the internal surfaces of the expansion jaws, including the expansion jaws 36 and 38, is far greater than the manually provided thrust force on the tong parts 4 and 6.

As compared to the expansion device of the expansion tongs 2, the expansion device of the present invention is provided with a thrust plunger 44, which is formed in its longitudinal direction by a plunger body, the plunger body being in the

shape of, and in this exemplary embodiment being formed by, but not being limited to, a cone 46 provided with an end piece 48 arranged fixedly thereto, the end piece 48 being positioned at the end opposite the apex of the cone 46.

5 Alternatively, in an exemplary embodiment not shown, the slide plunger 44 may be formed by a cone without an end piece.

In its position of use the end piece 48, alternatively a cone not shown, has an actuator, not shown in the drawn figures, 10 releasably arranged thereto, the actuator being positioned in a portable gun tool 50. The actuator, and thereby the gun tool 50, has one end portion of an actuator shaft 52 arranged thereto, preferably a non-rotating actuator shaft 52. The characteristic of the present invention is that the second 15 end portion of the actuator shaft 52 is releasably connected to the end piece 48 of the cone 46, or alternatively, that the second end portion of the actuator shaft 52 is releasably connected to the cone, not shown in the figures of the drawings, the releasable coupling connection of this 20 exemplary embodiment being formed by a threaded connection. Alternatively this coupling connection may be formed of a bayonet connection, for example. In this exemplary embodiment the end piece 48 is formed with a circular bore 54, the centre axis of the bore 54 coinciding with the centre axis of 25 the cone 46, the bore 54 being provided with an internal threaded portion corresponding, in its position of use, with a corresponding external threaded portion in the other end portion of the actuator shaft 52. In an exemplary embodiment, not shown, when a cone without an end piece is used, the 30 cone may correspondingly be formed with a circular bore and a threaded coupling connection with an actuator shaft.

In its position of use, the slide plunger 44 of the present invention also has, and is surrounded by, an expansion head 56 and a connecting element 58. The expansion head 56 is formed of a jaw sleeve 59, to the circumference of which jaw sleeve 59 several elongate expansion jaws are arranged rotatably, three expansion jaws 60, 62, and 64 thereof being shown in Fig. 2, projecting from the jaw sleeve 59 and along the longitudinal axis of the slide plunger 44. The expansion jaws, including the expansion jaws 60, 62 and 64, have the jaw sleeve 59 rotatably arranged thereto in a support area 66. By means of e.g. an internally threaded end portion, the jaw sleeve 59 has e.g. an externally threaded end portion on the connecting element 58 releasably arranged thereto. At the opposite end portion and by means of a similar threaded connection, the connecting element 58 has a circular opening of the gun tool 50 releasably arranged thereto, the connecting element 58 at the same time surrounding the actuator shaft 52 of the gun tool 50. In an exemplary embodiment not shown, the connecting element 58 may be fixedly arranged to the gun tool 50, so that the connecting element 58 forms the muzzle portion of the gun tool. Internally, the connecting element 58 is formed with a cylindrical bore 58', so that the cone 46 in its position of use and in its longitudinal direction may be reciprocated in the bore 58', cf. Fig. 3. In its position of use, when the actuator shaft 52 is releasably connected to the end piece 48 of the cone 46, or alternatively, when the actuator shaft 52 is releasably connected to the cone without an end piece, not shown in the drawings, the actuator is activated, pushing the slide plunger 44, and thereby the cone 46, towards the internal and conical surfaces of the expansion jaws, including the expansion jaws 60, 62 and 64. By means of this expansion device this plunger-like thrust force is converted

into an outward, and compared to the thrust force, much larger expansion force against a surrounding inner end portion of a PEX plastic pipe 68 and a surrounding PEX plastic ring 70, cf. Fig. 3, so that a connecting nipple, not shown, may then be inserted into the expanded end portion of the PEX plastic pipe 68. The subsequent shrinking of the PEX plastic pipe 68 and PEX plastic ring 70 then provides a pressure-tightening connection between the connecting nipple and the PEX plastic pipe 68.

By the use of a threaded connection for releasably connecting the actuator shaft 52 to the end piece 48 of the cone 46, possibly for connecting the actuator shaft 52 to a cone without an end piece, not shown, the cone 46, for example, may be provided with a through hole 72 positioned diametrically, cf. Fig. 2 and Fig. 3, so that by means of a key tool, not shown, placed in the hole 72, the threaded connection may be made up to a sufficiently great torque. For a corresponding reason the connecting element 58 may be provided with a through hole 74 located diametrically.

C L A I M S

1. A slide plunger device (44) in an expansion device, which is connected, by means of a connecting element (58) fixedly or releasably arranged thereto, to an expansion tool, wherein the expansion device may be formed of an expansion head (56) provided with a jaw sleeve (59) which has several rotatable expansion jaws, including expansion jaws (60, 62, 64) arranged thereto, in the position of use complementarily surrounding the whole or parts of the slide plunger (44), and wherein the connecting element (58) is used to connect the expansion device to an actuator located in the expansion tool, the expansion device preferably being used for cold expansion of an end portion of a plastic pipe (40, 68) and possibly a surrounding plastic ring (42, 70), characterized in that the slide plunger (44) is provided with a preferably releasable coupling connection which connects the slide plunger (44) to the free end portion of an actuator shaft (52), the actuator shaft (52) having, at the opposite end portion, an actuator arranged thereto, placed in a portable gun tool (50), preferably.
2. A device according to claim 1, characterized in that the slide plunger (44) is formed by just one plunger body, e.g. a cone (46), or possibly a plunger body provided with an end piece (48) fixedly arranged thereto, the plunger body, possibly the end piece (48) fixedly arranged to the plunger body, being provided with a releasable coupling connection, which is arranged to connect the slide plunger (44) to the free end portion of the actuator shaft (52).

3. A device according to claim 1 or 2,
c h a r a c t e r i z e d i n that the releasable
coupling connection is formed by a threaded coupling
connection.
4. A device according to claim 1 or 2,
c h a r a c t e r i z e d i n that the releasable
coupling connection is formed by a bayonet connection.
5. The use of a slide plunger device (44) in an expansion
device according to one or more of the claims 1-4, the
expansion device being coupled to an actuator shaft (52)
and an associated actuator, preferably of an
electromechanical kind, in a portable gun tool (50).

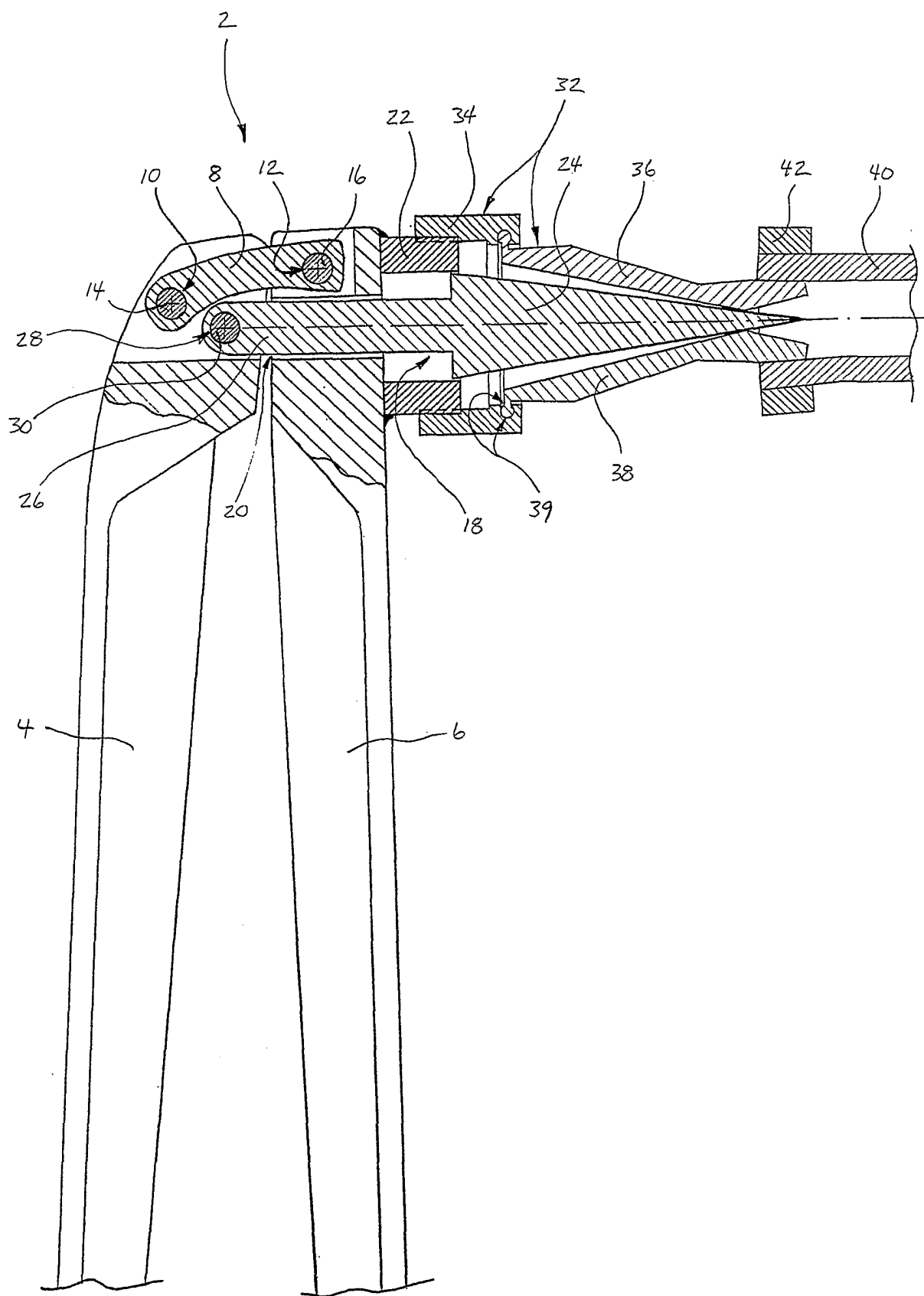


Fig. 1

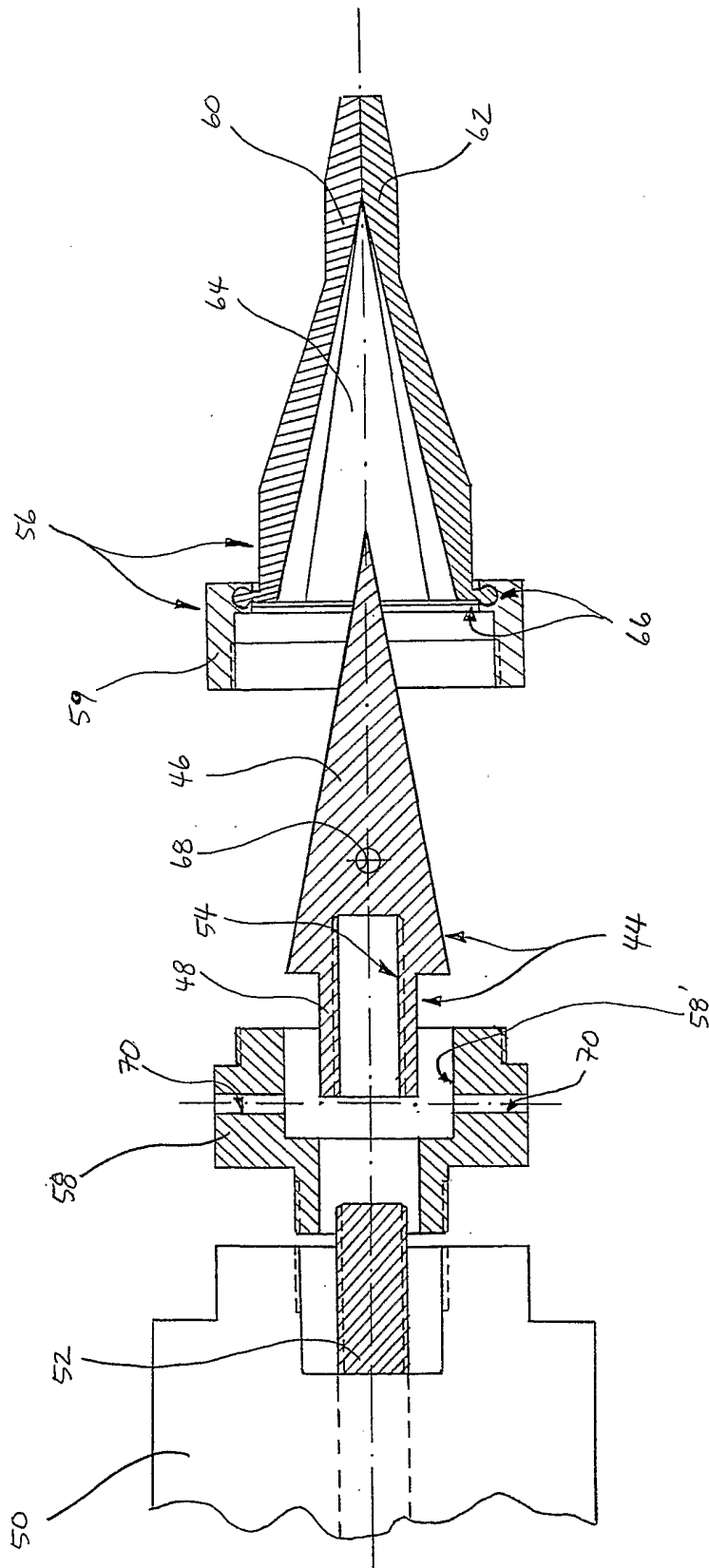


Fig. 2

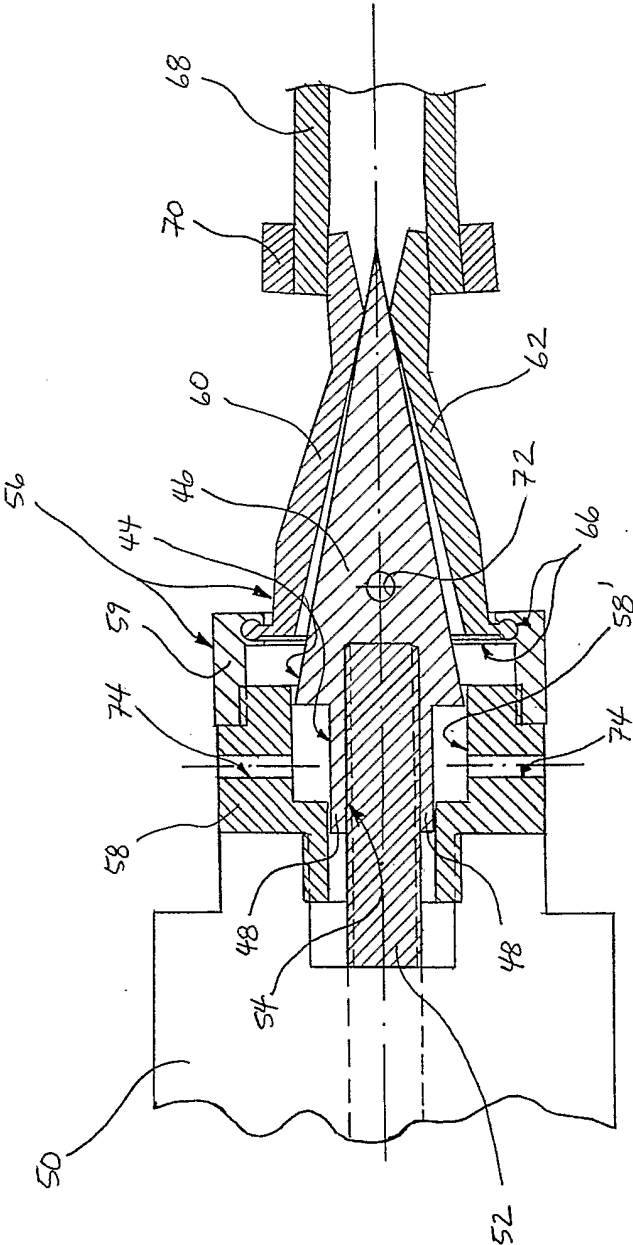


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NO 01/00213

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B21D 39/20, B29C 57/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B21D, B24C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI-DATA, EPO-INTERNAL

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9806519 A1 (WIRSBO ROHRPRODUKTION UND VERTRIEBS-GMBH), 19 February 1998 (19.02.98), page 4, line 20 - line 30; page 6, line 25 - page 7, line 8, figure 1, abstract	1-4
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Y	EP 0689886 A1 (SANEPR, S.A.), 3 January 1996 (03.01.96), figures 1,4, abstract	5
A	US 5090230 A (KAUNO L.J. KOSKINEN), 25 February 1992 (25.02.92), figure 1, abstract	1-5

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

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INTERNATIONAL SEARCH REPORT

International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/NO 01/00213

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