(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 June 2014 (26.06.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/094804 A1

(51) International Patent Classification:
B25B 13/46 (2006.01) *B25B 13/48* (2006.01)

(21) International Application Number:
PCT/EP2012/005334

(22) International Filing Date:
21 December 2012 (21.12.2012)

(25) Filing Language: English

(26) Publication Language: English

(71) Applicant: **VOLVO TRUCK CORPORATION** [SE/SE]; c/o Volvo Business Service AB, Avd. 501842 ARHK5, S-405 08 Göteborg (SE).

(72) Inventors: **OMERSPAHIC, Ervin**; Tranegatan 8A, S-414 53 Göteborg (SE). **ALDENSJÖ, Ola**; Häggvägen 38B, S-423 53 Torslanda (SE). **NORÉN, David**; Götabergsgatan 26A, S-411 34 Göteborg (SE).

(74) Agent: **JÖNRUP, Emil**; Volvo Technology Corporation, Volvo Corporate Intellectual Property, Dept: BF14100, M1.7, S-405 08 Göteborg (SE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: A TOOL FOR MANUALLY TURNING AN AXLE OF AN INTERNAL COMBUSTION ENGINE

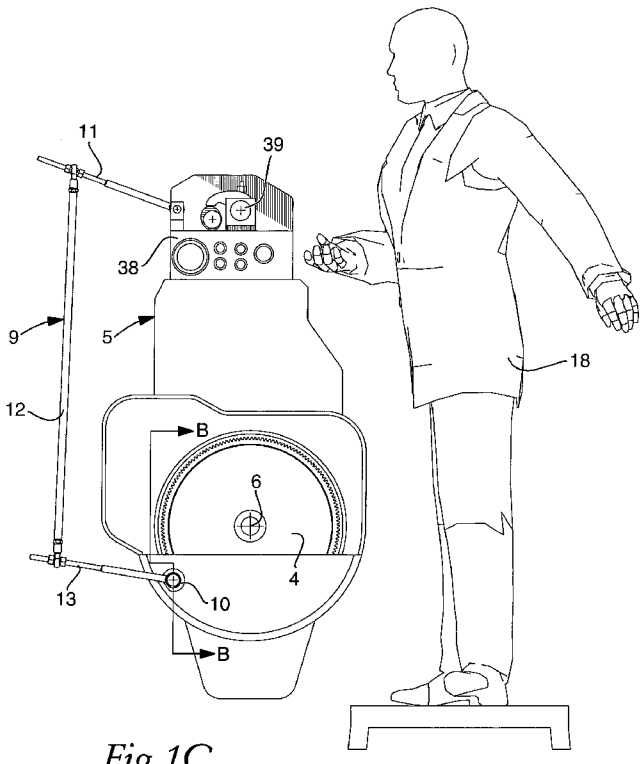

Fig 1C

(57) Abstract: A tool for manually turning an axle (6) of an internal combustion engine (5), wherein the tool comprises an engagement means for engagement with the axle (6) or a rotating part (4) connected thereto, a hand-operable means (11) and a torque- transmitting means (9) operably connected between the engagement means and the hand-operable means (11) and arranged so as to transmit a torque to the axle (6) when the hand-operable means (11) is operated by an operator (18), such that said axle (6) can be turned between different angular positions. The torque-transmitting means (9) is configured for extending partly around the engine (5) permitting the operator (18) to turn the axle (6) via the hand-operable means (11) from an engine service position, in which adjustment procedures to said engine (5) is performed and the axle (6) or the rotating part (4) connected thereto is without reach of the operator (18).

WO 2014/094804 A1

Published:

— *with international search report (Art. 21(3))*

A tool for manually turning an axle of an internal combustion engine

TECHNICAL FIELD

The present invention relates to a tool for manually turning an axle of an internal combustion engine, wherein the tool comprises an engagement means for engagement with the axle or a rotating part connected thereto, a hand-operable means and a torque-transmitting means operably connected between the engagement means and the hand-operable means and arranged so as to transmit a torque to the axle when the hand-operable means is operated by an operator, such that said axle can be turned between different angular positions.

A hand-operable means, as referred to herein, may comprise an element connected to an end of the torque-transmitting means or comprise an end of the torque-transmitting means that may be gripped by an operator.

BACKGROUND OF THE INVENTION

Performing adjustment of the valve train lash of internal combustion engines, in particular if the engine is of considerable size, is a labour intensive operation that requires both turning of the crank shaft of the engine and adjustment of the valve lash for each individual valve. If only one person executes the operation, that person will need to move between a first position in which he or she adjusts the valves and a second position in which he or she is able of turning the crank shaft by means of a cranking tool connected to the crank shaft. According to prior art, there is suggested to use a cranking tool that engages the teeth of the flywheel of the engine, and thereby the crank shaft. The cranking tool may or may not comprise a ratchet mechanism in order to function like a one-way wrench. The tool either comprises a handle by means of which an operator grips the tool and applies a torque thereon or a nut that is to be gripped by means of a further, separate tool by means of which a torque is applied to the cranking tool.

CONFIRMATION COPY

As an alternative, two persons need to be involved in the adjustment of the train lash, one for turning the crank shaft and the other for performing the adjustment of the valves.

A similar situation may appear also for operations other than valve train lash adjustments, where the operation in question requires turning of the crank shaft and where there is a distance and/or an obstacle between the position in which an operator performs said operation and the position in which he or she is able of turning the crank shaft by means of contemporary tools of prior art. It is thus a general problem of the prior art that it does not provide means for turning of the crank shaft from positions remote therefrom in connection to the performing of operations on the engine that requires such turning of the crank shaft.

THE OBJECT OF THE INVENTION

It is an object of the present invention to present an improved axle cranking tool that enables turning of the crank shaft of an engine from a position remote from the position in which the tool engages the crank shaft or any component connected thereto, such as a flywheel of the engine.

In this context, the term "remote" is referred to as meaning a distance so far from the point of engagement between the cranking tool and the crank shaft that a person is unable of simultaneously handling a cranking tool of prior art from such a remote position and performing any kind of operation on the engine that requires turning of the crank shaft. Typically, such an operation is the adjustment of a valve train lash on a large engine. However, other operations, such as adjustment of a transmission system of the engine, may also be conceived.

SUMMARY OF THE INVENTION

The object of the present invention is achieved by means of the initially defined tool, characterised in that the torque-transmitting means is configured for extending partly

around the engine permitting the operator to turn the axle via the hand-operable means from an engine service position, in which adjustment procedures to said engine is performed and the axle or the rotating part connected thereto is without reach of the operator. In particular, the torque-transmitting means is configured to extend from a region of an engine in which the engagement means engages a flywheel of the engine to a top region of the engine in which inlet and outlet valves to/from a combustion chamber are arranged and where an operator would be positioned when performing valve lash adjustment on the engine. The extension of the tool should be such that it enables the operator to perform valve lash adjustment and to turn the crank axle by means of said tool from one and the same position. The design and length of the torque-transmitting means may differ depending on engine design and size. Other service operations than valve lash adjustment are, however, also envisaged.

According to one embodiment, the torque-transmitting means comprises a plurality of interconnected elongated rigid elements or is elongated and flexible and able of extending along a curved path by means of bending thereof. By comprising a plurality of interconnected elongated elements the torque-transmitting means may be construed so as to circumvent any obstacle and the extension thereof may be tailored depending on the application. Said plurality of elongated rigid elements should be arranged such that they may either be displaced in relation to each other by displacement of at least one joint that connects at least one pair of said elements or by elongation or shortening of at least one of said elements. Hence, any of said elongated rigid elements may be telescopically arranged, such that it may adopt at least two different total lengths. Thereby, the geometry and the extension of the path defined by the torque-transmitting means can be adapted to the application in which the tool is to be used. A flexible torque-transmitting means as defined will inherently have the same ability of circumventing different obstacles.

Preferably, the torque-transmitting means is connected to the engagement means through a ratchet mechanism. Preferably, the tool thereby defines a one-way wrench by means of which said axle or part connected thereto is turned. Thereby, more

complex shapes, i.e. paths, of the torque-transmitting means are enabled since it will suffice that the torque-transmitting means only permits a limited rotation of the engagement means at a time, and a reciprocating cranking motion of the tool can be used instead of a rotating motion.

Preferably, the torque-transmitting means has a length L, and that L>1 meter, preferably L>1.5 meter.

It is preferred that the torque-transmitting means extends along a curved path or is able of extending along a generally curved path by bending thereof. A curved path is referred to as a path different than rectilinear, i.e. any path that will enable the torque-transmitting means to extend around and thereby circumvent an obstacle. Also paths with angles, such as those existing between neighbouring elongated rigid elements of a torque-transmitting means, will be regarded as curved in accordance with this definition.

According to one embodiment, the torque-transmitting means comprises a wire enclosed in a tubular sheath. A wire-sheath combination can be used for applying a force onto an object, such as an arm of a ratchet mechanism, by interaction of the wire and the sheath and relative displacement thereof.

Preferably, the hand-operable means comprises an element for displacing the wire in its longitudinal direction in relation to the tubular sheath.

Preferably, the tool comprises a support element with attachment means suitable for attachment to an engine, wherein the support element is in engagement with the torque-transmitting means. Preferably, the support element is provided in the region of a ratchet mechanism through which the torque-transmitting means is connected to the engagement means in order to form a support or holder for either of the wire or the sheath in said region.

According to one embodiment, the end of the wire is attached to the ratchet mechanism, and the tubular sheath is in supporting engagement with the support

element. The opposite connection (wire connected to support element and sheath to the ratchet mechanism) could also be envisaged.

According to one embodiment, the ratchet mechanism presents a rotation axis, wherein the torque-transmitting means engages the ratchet mechanism at a position off-set from said rotation axis and extends with an angle to the rotation axis. The ratchet mechanism may thereby form part of a one-way wrench with an arm to which the torque-transmitting means is connected.

According to one embodiment, the tool comprises a return mechanism arranged so as to return the torque-transmitting means to a predetermined rotational position with regard to the engagement means. Provided that the ratchet mechanism defines a one-way wrench, the return mechanism is arranged so as so return the wrench to a predetermined position after displacement, i.e. rotation, from that position by the action of the torque-transmitting means. Thereby, it will be sufficient to apply a pulling force onto the torque-transmitting means, such that the engagement means is rotated only a part of a full turn, and then, as soon as the force is relieved, the ratchet (one way wrench) will return to a start position due to the action of said return mechanism. The return mechanism may comprise a spring mechanism, the spring force of which is larger than the counteracting force of the ratchet mechanism in the free rotational direction thereof (the rotational direction in which generally no torque is transmitted from the torque-transmitting means to the engagement means through the ratchet mechanism). As an alternative, the ratchet mechanism may comprise an arm to which the torque-transmitting means is attached, and the return mechanism may comprise a mass provided on said arm such that the arm returns to a start position due to the effect of the gravity on said mass (provided that the force applied to the arm upon transmission of torque by means of the torque transmission means is a force that lifts the arm, and that said mass then forces the arm back down to a start position). As a primitive alternative to the above-mentioned wire-sheath design, the torque-transmitting means may thus comprise only a wire or string attached to said arm of the ratchet mechanism, i.e. a string attached to the arm of a one way wrench, wherein the one way wrench comprises said return mechanism (which may then be formed by a weight attached to said arm or a spring mechanism). Turning of the one

way wrench, and hence transmission of torque will be achieved by simply pulling the string such that a predetermined rotation of the wrench is achieved, after which the return mechanism is permitted to return the wrench to its start position, from which a further rotation of the engagement means can be achieved by a further pulling of the string by the operator.

According to an alternative embodiment, the torque-transmitting means comprises a plurality of interconnected rigid elongated elements, where the respective longitudinal axes of pairs of elongated elements that are directly interconnected intersect each other and extend with an angle relative to each other.

Preferably, said plurality of interconnected rigid elements forms a parallelogram. A parallelogram, if connected to an arm of a ratchet mechanism, such as the arm of a one-way wrench, has the advantage of permitting a rotation of the engagement means by means of a reciprocating motion of the parallelogram induced by an operator. No return mechanism is thus needed. Preferably, the rigid elements are connected to each other through joints that permit a limited change of angle between each pair of said interconnected elements.

Preferably, said plurality of interconnected rigid elements extends in a plane perpendicular to a rotation axis of the engagement means.

It is also preferred that at least one pair of said plurality of interconnected elongated rigid elements are connected to each other through a joint which in an unlocked state permits displacement thereof in a longitudinal direction of one of said elongated rigid elements and that there are provided means for locking said joint in at least two different positions along said rigid element. Thereby, adjustment of the extension of the torque-transmitting means is enabled, such that the extension thereof and path defined thereby can be adapted with regard to the position of an operator and possible obstacles between the latter and the region in which the tool engages the axle or rotating part connected thereto.

According to one embodiment said axle is a crank axle of said engine. Preferably, the engagement means is in engagement with a flywheel attached to said crank axle when the tool is in its operative position.

The invention also refers to a method of performing a service operation on an internal combustion engine, in which a first end of a cranking tool according to the invention is set in engagement with an axle of an internal combustion engine or a rotating part connected thereto, and wherein the torque-transmitting means of said tool is arranged along a path such that a second end of the tool is within reach for an operator at a position where the first end of the tool is without reach of the operator and where said service operation is performed.

According to a preferred embodiment, said service operation comprises an adjustment of the play of a valve provided on top of a motor block of said engine.

Further features and advantages of the present invention will be presented in the follow detailed description, supported by the annexed drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described with reference to the annexed drawing, on which:

Fig. 1A is a perspective view of tool according to the invention, arranged in an operative position on an engine, a part of which is schematically shown,

Fig. 1B is a side view of fig. 1A,

Fig. 1C shows an embodiment of the tool as applied in a preferred application,

Fig. 2A is a perspective view of an alternative embodiment of a tool according to the invention, arranged in an operative position on an engine, a part of which is schematically shown,

Fig. 2B is a side view of fig. 2A,

Fig. 2C is a side view of a part of the tool shown in fig. 2A and 2B, showing a functional feature thereof,

Figs. 3A-3C show an alternative embodiment of the tool, and

Fig. 4 is a detailed view of a part of the tool, including a ratchet mechanism of the tool according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 shows a first embodiment of the tool 1 according to the invention. The tool 1 comprises an engagement means 2 for engagement with the teeth 3 provided on the outer circumference of a flywheel 4 of an engine 5. The flywheel 4 is connected to a crank axle 6 of the engine 5, such that a rotation thereof will induce a rotation the crank axle 6. As can be seen more in detail in fig. 4, the engagement means 2 comprises a shaft 7 provided with teeth 8 for engagement with the teeth 3 of the flywheel 4.

The tool 1 also comprises a torque-transmitting means 9 which, in one end thereof, is connected to the engagement means 2 through a ratchet mechanism 10. The ratchet mechanism 10 has the functionality of a one-way wrench, permitting rotation of the part thereof connected to the torque-transmitting means 9 in one direction without torque transmission to the engagement means 2 and rotation in the opposite direction with torque transmission to the engagement means 2.

The torque-transmitting means 9 of the embodiment shown in fig. 1A-1C is elongated and comprises a plurality of interconnected elongated rigid elements 11, 12, 13 that define a parallelogram, extending in a common plane. The elements 11, 12, 13 are connected to each other through joints14, 15 which in an unlocked state permit displacement thereof in a longitudinal direction of one of said elongated rigid elements 11, 12, 13 that it engages. There are provided means, here locking nuts 16, 17, for locking said joints 14, 15 in any position along one of two elements interconnected by said joint 14, 15. Obviously, other locking means than nuts may be envisaged and will be obvious to the person skilled in the art. The joints 14, 15 are arranged at the end of one said elements, here at the opposite ends of a middle element 12 connected to the neighbouring elements 11 and 13. However, it should be understood that other arrangements of the joints may be conceived. Each joint 14,

15permits a limited change of the angle between the elements that it interconnects. Fig. 1B shows the motion that is to be induced to the torque-transmitting means 9 in order to induce a rotation of the axle 6. A first position of the torque-transmitting means 9 is indicated with continuous lines and a second position thereof is indicated with dotted lines. It can be seen that the angles between the middle element 12 and the neighbouring elements 11 and 13 is different for the two positions indicated and that, thus, a predetermined flexibility of the joints 14, 15 is required in order to enable such change of angle.

Fig. 1B and 1C show the principle of how to rotate the crank axle 6 by means of manual operation of the tool 1. An operator 18 located at the end of the torque-transmitting means 9 that is opposite to the end connected to the engagement means 2 will be able of inducing a reciprocating motion of the torque-transmitting means 9, as indicated with arrows in figure 1B, such that a torque is transferred to the engagement means 2 through the ratchet mechanism 10. Here, the elongated element 11which forms the end of the torque-transmitting means 9 opposite to the end connected to the engagement means 2 is rotationally connected to a holder element 19 provided on the top of the engine at a location from which the operator would be unable of reaching and operating a cranking tool according to prior art arranged in the region of the flywheel. According to one embodiment of the invention, the tool 1 extends around a part of the engine to the region of a top 38 of the engine where inlet and outlet valves 39 to the combustion chamber of the engine 5 are located and where adjustment of the valve lash of the engine valves is done manually by an operator 18. The end of the elongated element 11opposite the end connected to the holder element 19 may be gripped by the operator 18 and will thereby form part of a hand-operable means by means of which the operator may induce said motion of the torque-transmitting means 9. It is easily realised that there may be numerous alternative embodiments of how to arrange the end of the tool such that the operator will be able of inducing said motion and that the solution presented here is only by way of example. The tool 1 has the functionality of a one-way wrench that extends around a part of the engine, thereby enabling manual rotation of the flywheel 4 and

that crank axle 6 from a position remote from the end of the tool 1 that engages the flywheel 4.

Fig. 2A, 2B and 2C show an alternative embodiment in which the torque-transmitting means 20 comprises a wire 21 and a tubular sheath 22 surrounding the latter. The wire 21 is free to be displaced in the longitudinal direction thereof relative to the sheath 22. The wire 21 of the torque-transmitting means 20 is connected to the engagement means 2 through a ratchet mechanism 23. The ratchet mechanism 23 is provided with an arm 24, and an end of the wire 21 is connected thereto, such that a pulling force applied on the wire 21 will result in a torque being transmitted to the ratchet mechanism 23 and to the engagement means 2. The latter is, likewise to the embodiment in fig.1, arranged so as to engage teeth 3 of the flywheel 4 of the engine 5 in order to enable cranking of the crank axle 6 thereof.

A supporting element 25 for supporting an end of the sheath 22 is provided in the region of the ratchet mechanism 23. The supporting element 25 is fixed such that it is in a fixed position. Hence it will not follow any rotation of the ratchet mechanism 23. It is attached by an attachment means, here a screw joint 26, to the engine 5. The end of the sheath 22 bears on the supporting element 25, while the wire 21 extends through and beyond the supporting element 25 to the arm 24 of the ratchet mechanism 23, to which it is attached. Pulling of the wire 21 will result in a rotation of the arm 24 of the ratchet mechanism 23 towards the supporting element 25.

There is provided a return mechanism 27 arranged so as to return the torque-transmitting means 20 and the ratchet mechanism 23 to a predetermined rotational position with regard to the engagement means 2 after rotation of the ratchet mechanism 23 through a pulling of the wire. In the embodiment shown in fig. 2 the return mechanism 27 comprises a spring, here a helical spring, provided between the arm 24 of the ratchet mechanism 23 and the support element 25. The spring 27 bears on the arm 24 of the ratchet mechanism 23 and the support element 25 and will be compressed upon rotation of the arm 24 towards the support element 25. After relief

of a pulling force on the wire 21, the spring 27 will strive to return the arm 24 away from the support element 25 towards its initial position (see fig. 2C).

At the end of the torque-transmitting means 20 opposite the end in which the latter is connected to the engagement means 2 there is provided a hand-operable means 28 arranged for the purpose of permitting manual displacement of the wire 21 relative to the sheath 22 and thereby pulling of the wire 21 such that the requested rotation of the ratchet mechanism 23 is achieved. The hand-operable means 28 comprises a further support element 29 against which the end of the sheath 22 that is opposite to the end adjacent the ratchet mechanism 23 bears. Accordingly, the sheath 22 extends between and bears with its opposite ends against the support element 23 adjacent the ratchet mechanism 23 and the further support element 29. The hand-operable means 28 further comprises a lever arm 30 which is rotationally arranged. The wire 21 extends through the further support element 29 and is attached to the lever arm 30. The rotational arrangement of the lever arm 30 is achieved as the latter is fixedly arranged on a rotationally arranged holder element 31. A further lever arm 32 is fixedly arranged on the holder element and may be gripped by an operator for the purpose being used for rotating the holder element 31 and the first-mentioned lever arm 30 such that the wire 21 is pulled and the flywheel 4 is rotated. The holder element 31 and the further lever arm 32 are thus also part of the hand-operable means 28. It should be understood that there may be numerous embodiments of the hand-operable means that will be obvious for the person skilled in the art, and that the solution presented here is only by way of example.

Fig. 3A, 3B and 3C show an embodiment that differs from the one of fig. 2 only in that the hand operated element is differently designed. Instead of being connected to a holder element, the end of the torque-transmitting means comprises a free hand-operable means 33 configured to permit displacement of the wire 21 in relation to the tubular sheath 22. Thereby, further flexibility regarding the choice of the position of an operator is achieved. The hand-operable means 33 comprises two shanks 34, 35 that are interconnected through a joint permitting rotation of one of the shanks in relation to the other, whereby the distance between the ends of the shanks 34, 35 can

be altered. The principle is the same as for a pair of scissors or the like. In one end of said shanks 34, 35, the sheath 22 bears on and is supported by one shank 35, while the wire extends through and beyond said shank 35 to the other shank 34, to which it is attached. The ends of the shanks 34, 35 opposite to the ends in which the sheath 22 and wire 21 are arranged comprises handles 36, 37 to be gripped by an operator and by means of which a rotation of the shanks around said joint is permitted, as indicated with arrows in Fig. 3B and 3C. It should be understood that there are numerous solutions of how to design the hand-operable means 33 such that it will be free and yet able of permitting displacement of the wire relative to the sheath, and that the embodiment disclosed here is only presented by way of example. For example, the joint may have a different design and position, and the shanks may have a different design than in the presented embodiment.

It should be understood that the above detailed description of the invention is only by way of example and that the scope of protection is not restricted thereto but defined by the annexed claims, supported by the description and the annexed drawing.

PATENT CLAIMS

1. A tool for manually turning an axle (6) of an internal combustion engine (5), wherein the tool comprises an engagement means (2) for engagement with the axle (6) or a rotating part (4) connected thereto, a hand-operable means (11; 28; 33) and a torque-transmitting means (9, 20) operably connected between the engagement means (2) and the hand-operable means (11; 28; 33) and arranged so as to transmit a torque to the axle (6) when the hand-operable means (11; 28; 33) is operated by an operator (18), such that said axle (6) can be turned between different angular positions, **characterised in** that the torque-transmitting means (9, 20) is configured for extending partly around the engine (5) permitting the operator (18) to turn the axle (6) via the hand-operable means (11; 28; 33) from an engine service position, in which adjustment procedures to said engine (5) is performed and the axle (6) or the rotating part (4) connected thereto is without reach of the operator.

2. A tool according to claim 1, **characterised in** that, the torque-transmitting means (9, 20) comprises a plurality of interconnected elongated rigid elements (11, 12, 13) or is elongated and flexible and able of extending along a curved path by means of bending thereof.

3. A tool according to claim 1 or 2, **characterised in** that the torque-transmitting means (9, 20) is connected to the engagement means (2) through a ratchet mechanism (10, 23).

4. A tool according to any one of claims1-3, **characterised in** that the torque-transmitting means (9, 20) has a length L, and that L>1 meter, preferably L>1.5 meter.

5. A tool according to any one of claims 1-4, **characterised in** that the torque-transmitting means (9, 20) extends along a curved path or is able of extending along a generally curved path by bending thereof.

6. A tool according to any one of claims 1-5, **characterised in** that the torque-transmitting means (20) comprises a wire (21) enclosed in a tubular sheath (22).

7. A tool according to claim 6, **characterised in** that the hand-operable means (28; 33) comprises an element (34, 35) for displacing the wire (21) in its longitudinal direction in relation to the tubular sheath (22).

8. A tool according to claim 6 or 7, **characterised in** that it comprises a support element (25) with attachment means (26) suitable for attachment to an engine (5), and that the support element is in engagement with the torque-transmitting means (20).

9. A tool according to claim 8, **characterised in** that an end of the wire (21) is attached to the ratchet mechanism (23) and that the tubular sheath (22) is in supporting engagement with the support element (25).

10. A tool according to claim 3 and any one of claims 6-9, **characterised in** that said ratchet mechanism (23) presents a rotation axis and that the torque-transmitting means (20) engages the ratchet mechanism (23) at a position off-set from said rotation axis and extends with an angle to the rotation axis.

11. A tool according to any one of claims 6-10, **characterised in** that it comprises a return mechanism (27) arranged so as to return the torque-transmitting means (20) to a predetermined rotational position with regard to the engagement means (2).

12. A tool according to any one of claims 1-5, **characterised in** that the torque-transmitting means (9, 20) comprises a plurality of interconnected elongated rigid elements (11, 12, 13), where the respective longitudinal axes of pairs of elongated elements (11, 12, 13) that are directly interconnected intersect each other and extend with an angle relative to each other.

13. A tool according to claim 12, **characterised in** that the plurality of interconnected rigid elements (11, 12, 13) together form a parallelogram.

14. A tool according to claim 12 or 13, **characterised in** that said plurality of interconnected rigid elements (11, 12, 13) extend in a plane perpendicular to a rotation axis of the engagement means (2).

15. A tool according to any one of claims 2-5 or any one of claims 12-14, **characterised in** that at least one pair of said plurality of interconnected elongated rigid elements (11, 12, 13) are connected to each other through a joint which in an unlocked state permits displacement thereof in a longitudinal direction of one of said elongated rigid element and that there are provided means (16, 17) for locking said joint in at least two different positions along said rigid element.

16. A tool according to any one of claims 1-15, **characterised in** that said axle (6) is a crank axle (6) of said engine (5).

17. A method of performing a service operation on an internal combustion engine (5), in which a first end of a cranking tool according to any one of claims 1-16 is set in engagement with an axle (6) of an internal combustion engine (5) or a rotating part (4) connected thereto, and **characterised in** that the torque-transmitting means (9, 20) of said tool is arranged along a path such that a second end of the tool is within reach for an operator at a position where a first end of the tool is without reach of the operator and where said service operation is performed.

18. A method according to claim 17, **characterised in** that said service operation comprises an adjustment of the play of a valve provided on top of a motor block of said engine (5).

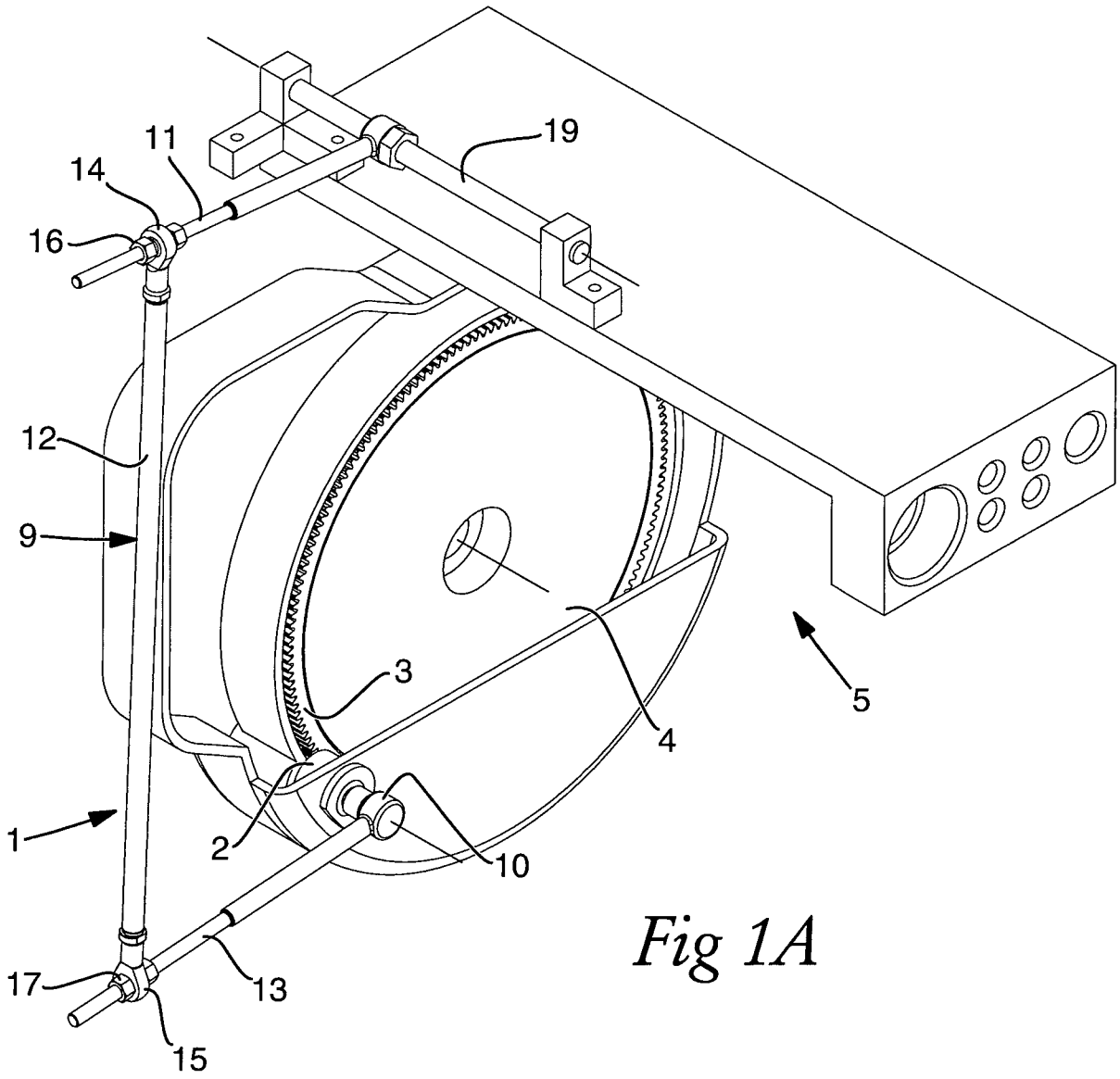

Fig 1A

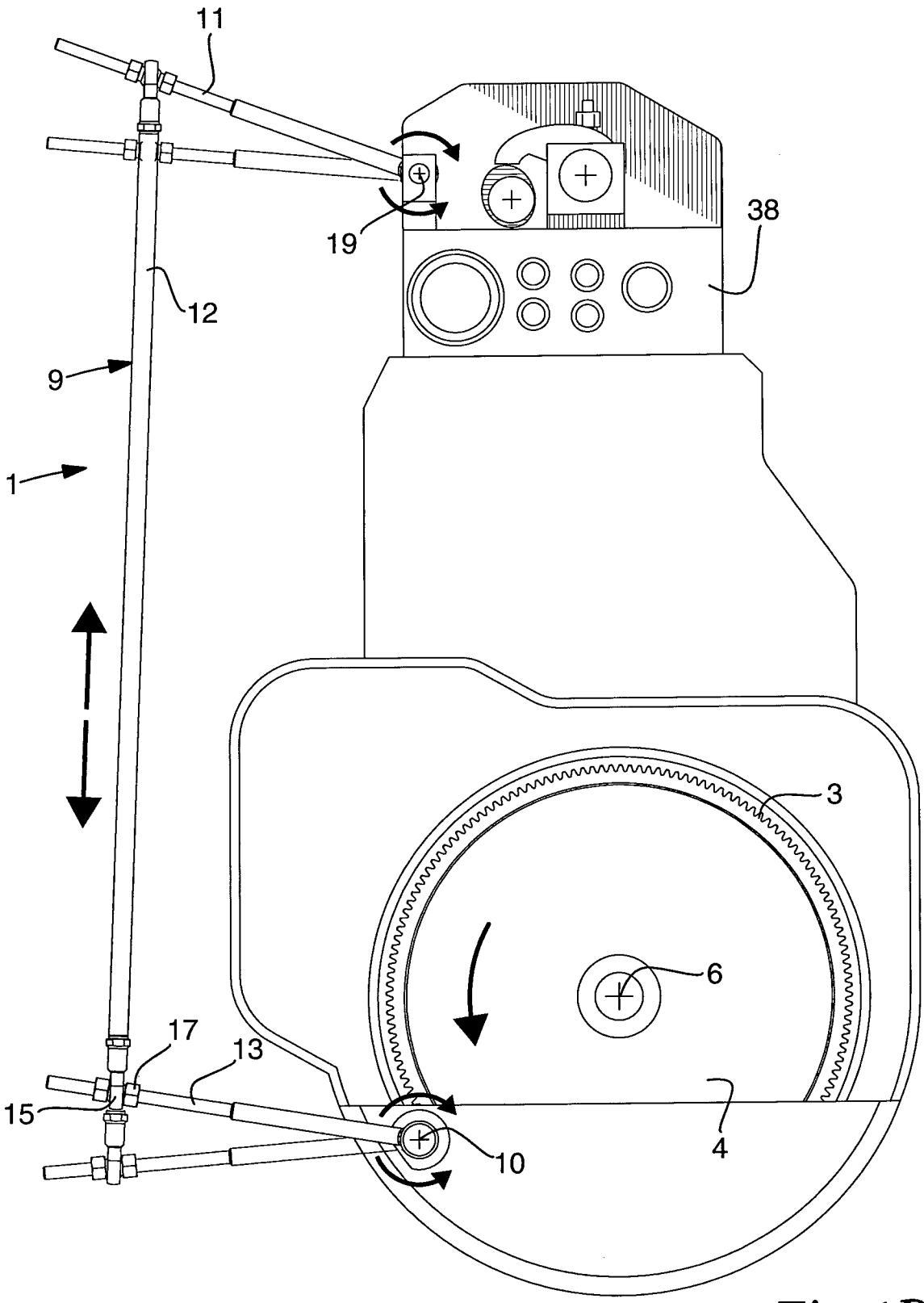

Fig 1B

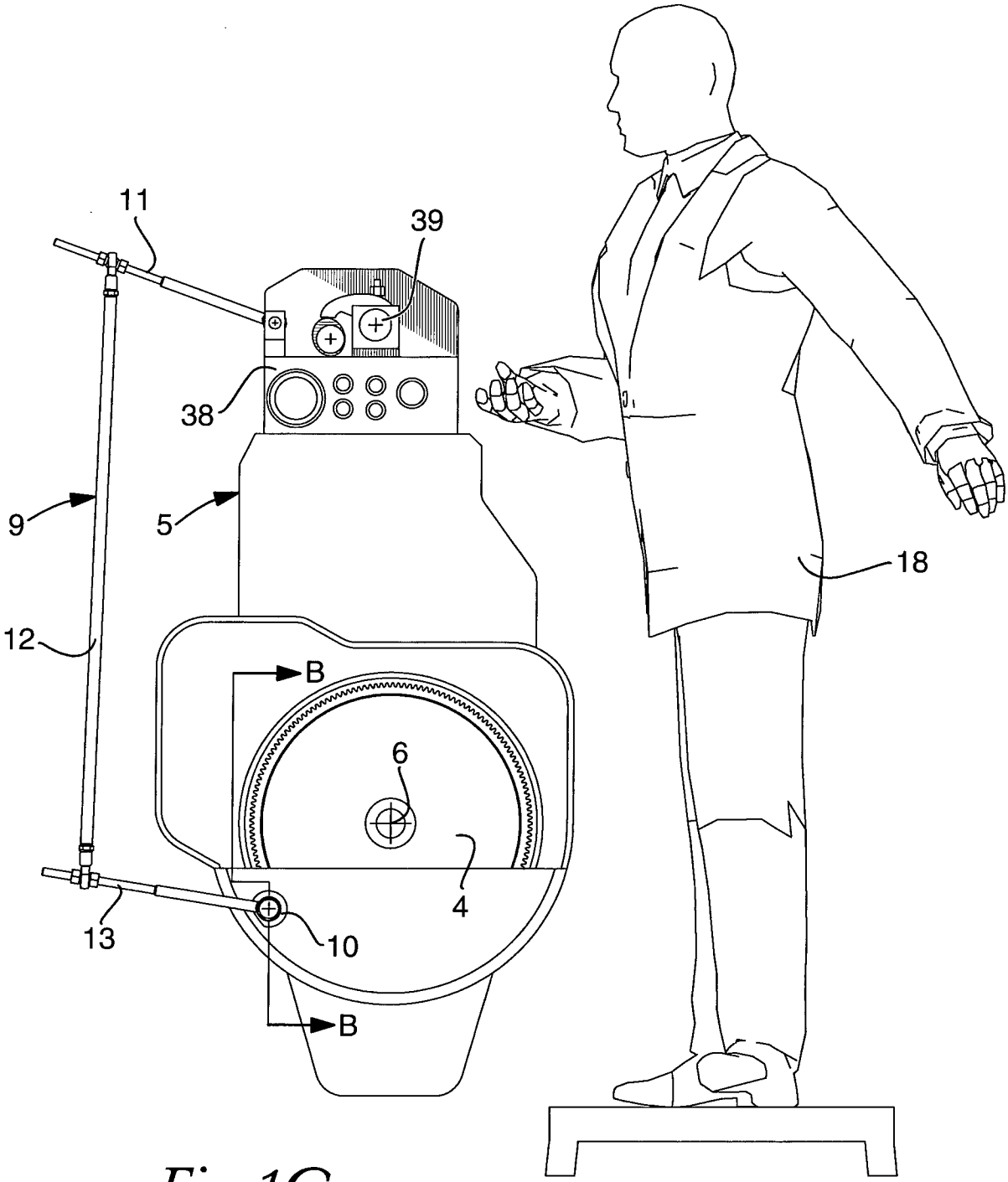

Fig 1C

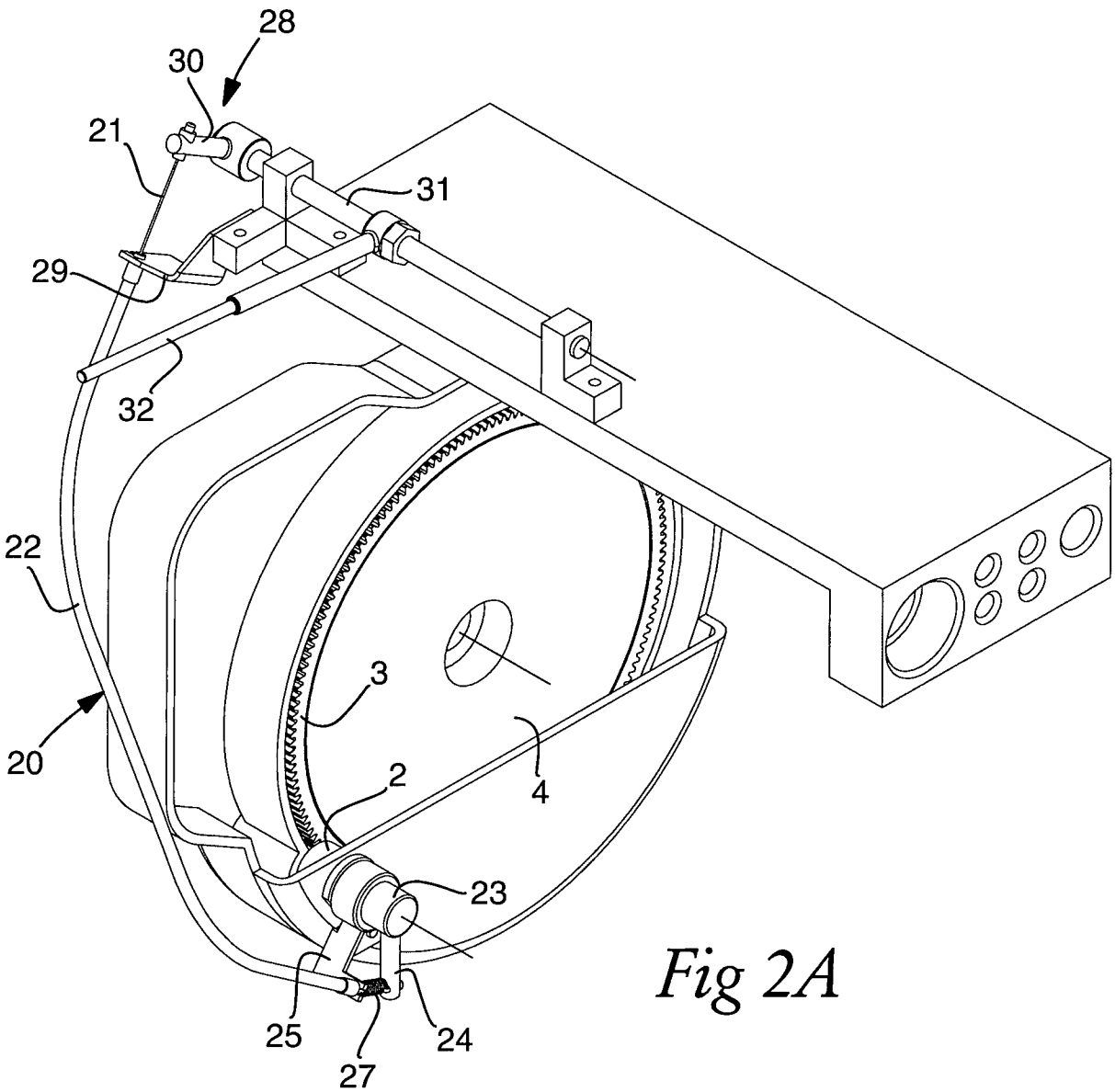

Fig 2A

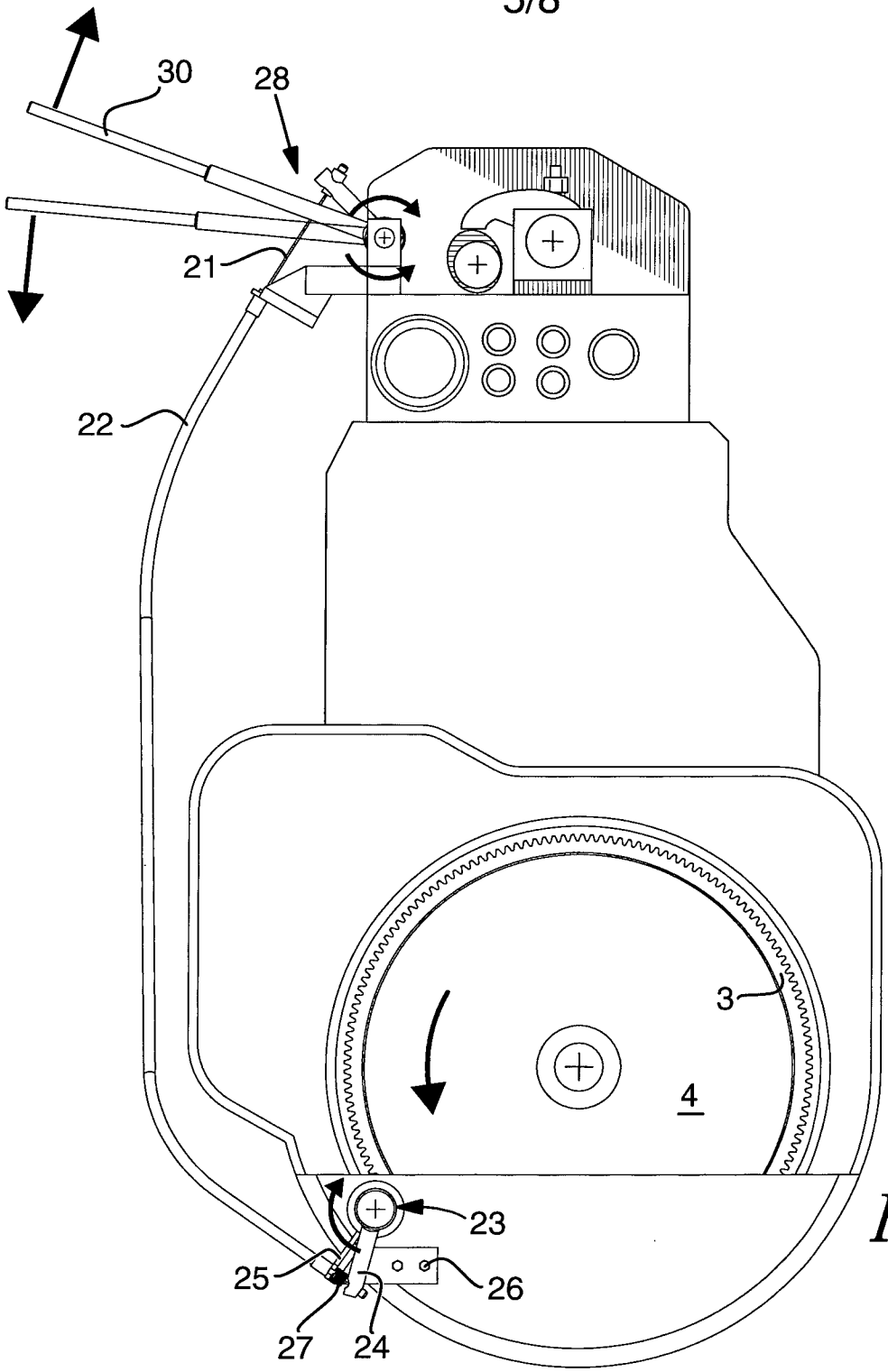

Fig 2B

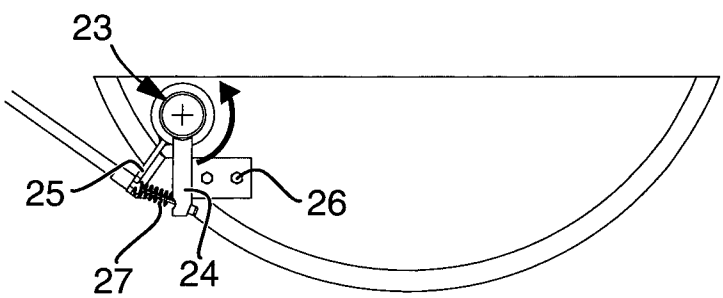

Fig 2C

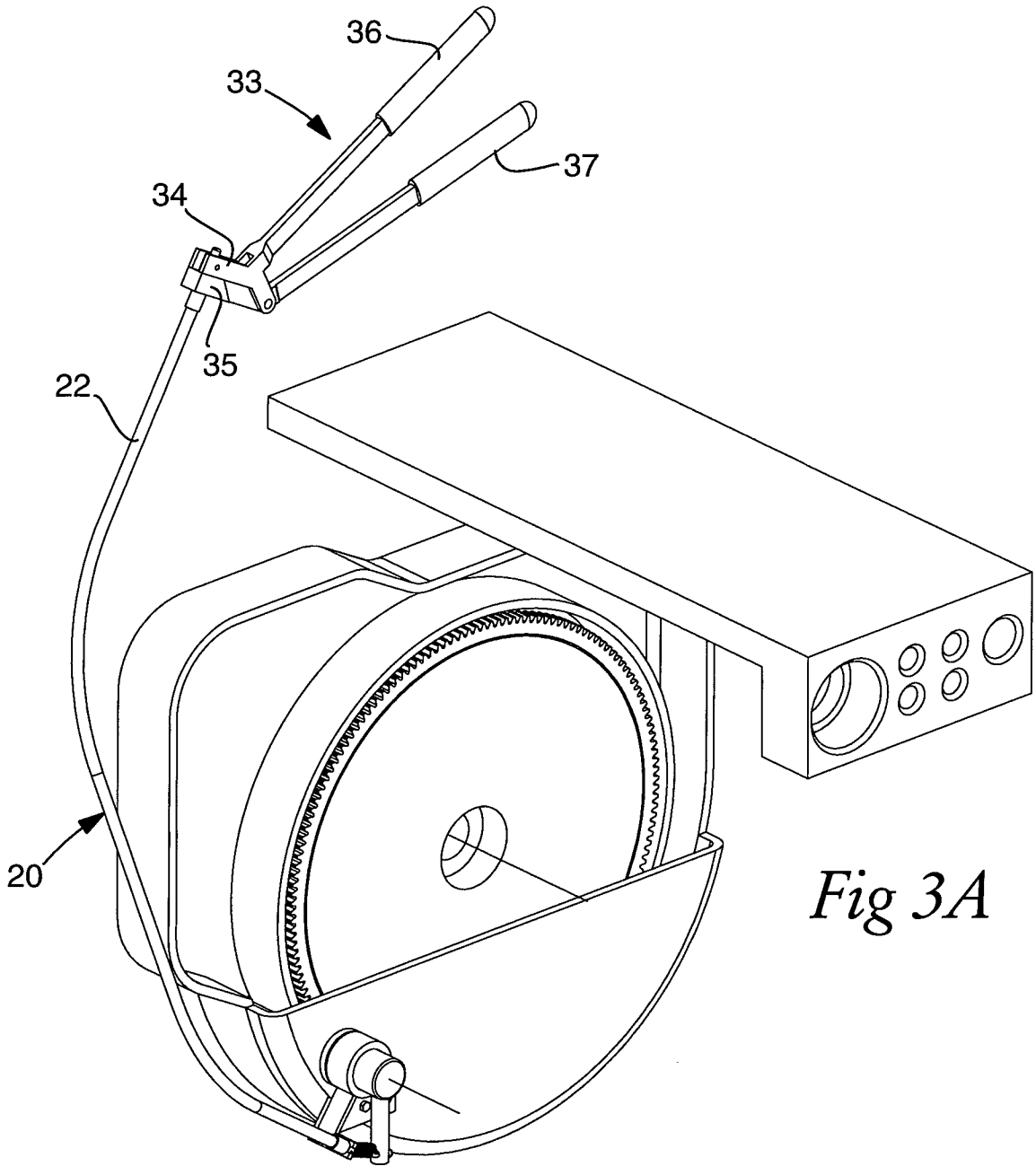

Fig 3A

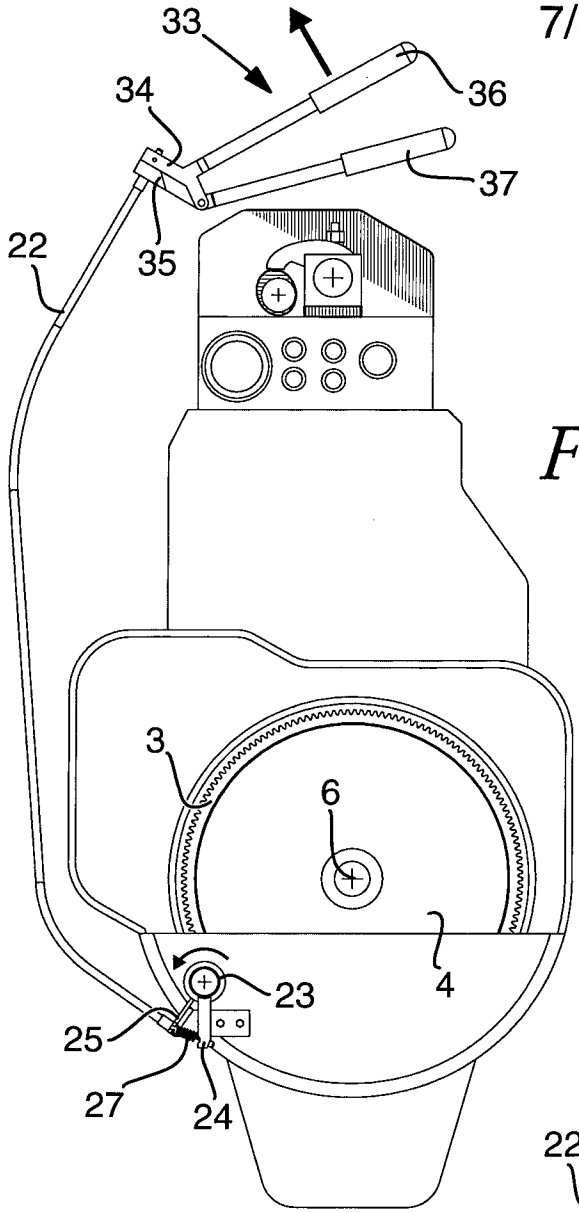

Fig 3B

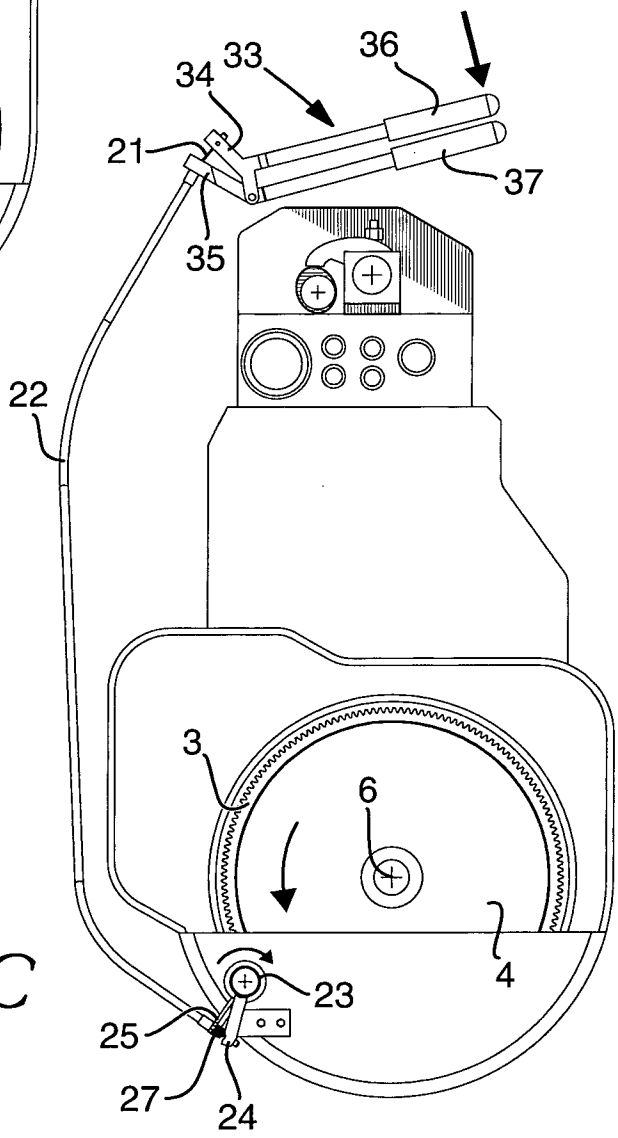

Fig 3C

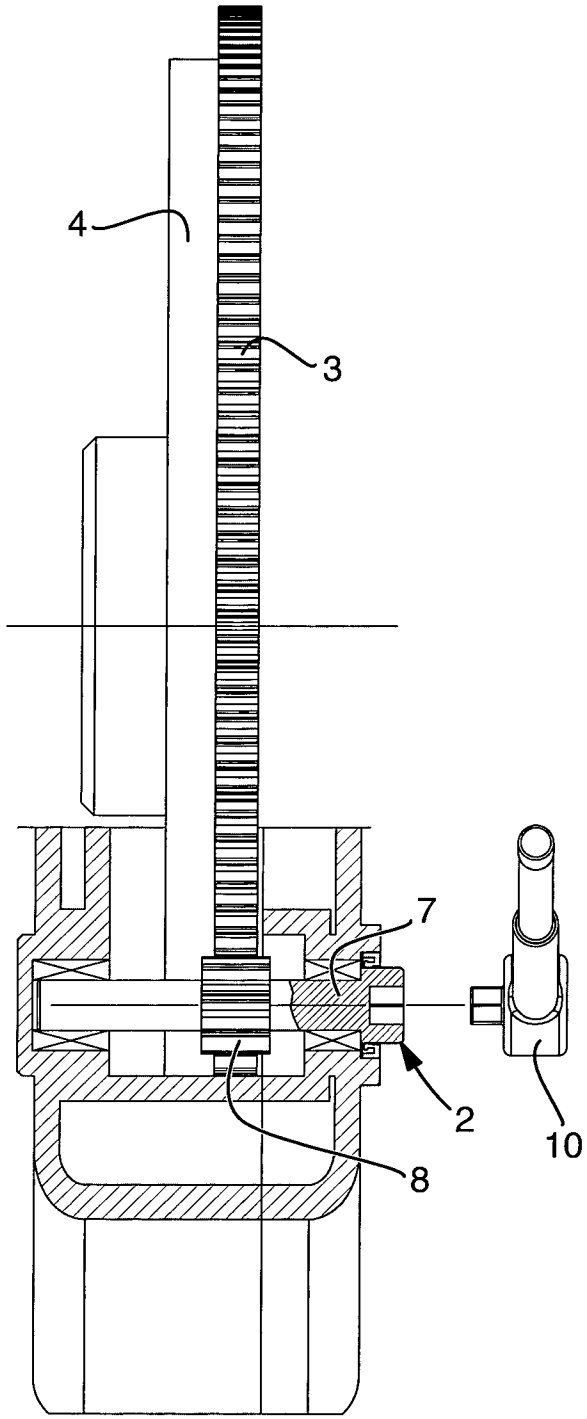

Fig 4

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/005334

A. CLASSIFICATION OF SUBJECT MATTER
INV. B25B13/46 B25B13/48
ADD.

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)
B25B

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

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/307933 A1 (HUNG CHENG-CHING [TW]) 18 December 2008 (2008-12-18) the whole document -----	1-5,10, 12-14, 17,18
X	DE 20 2008 005239 U1 (CHANG JI JONG [TW]) 10 July 2008 (2008-07-10) the whole document -----	1,3,5,6, 10,16-18

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 2013	28/08/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pothmann, Johannes

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/005334

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008307933 A1	18-12-2008	NONE	
DE 202008005239 U1	10-07-2008	NONE	