

## Description

### ROTARY/LINEAR CONVERTERS

The invention is concerned with rotary/linear converters by which is meant devices for converting linear motion to rotary motion and vice-versa.

The principles of this invention may be applied to a fluid-operated engine or motor and particularly to such a device which is capable of producing rotary motion of a shaft to power motor vehicles, farm machinery, and stationary devices such as pumps, heat exchangers or generators.

In particular, the engine or motor of this preferred application is capable of being operated by a wide range of fluids and in fact may be operated with any type of expandable fluid, whether or not prior ignition is required. Thus, the device may be operated with a compressed or pressurised fluid such as air, steam or helium which is allowed to expand, or alternatively the device may be operated with fluids such as petrol, gas or other hydrocarbon or similar fuel which require ignition to cause the necessary expansion. Conversely, when operated as a pump, the device of this invention may be used to pump or compress both liquid and gaseous fluids.

In AU-B-501555, there is described a fluid-operated device comprising : a cylinder member, at least two mutually opposed piston members movable axially therein, a working chamber within said cylinder member defined by opposing ends of said piston members and the inner wall of said cylinder member, said cylinder member being provided with inlet and outlet means communicating with said working chamber for admission of working fluid to said chamber and for removal of spent working fluid from said chamber, respectively ; a shaft member extending through said piston members and said cylinder member concentrically with said members ; first coupling means coupling the piston members to one of the other mentioned members such that axial reciprocation of the piston member causes rotation of the piston members relative to said one of the other mentioned members ; second coupling means coupling the piston members to the other mentioned members to prevent relative rotation of the piston members and said other one of the other mentioned members while permitting axial reciprocation of the piston members ; and valve means in said working chamber operatively coupled to said shaft member for rotation with said shaft member relative to the cylinder member to control movement of working fluid into and out of said working chamber through said inlet and outlet means.

In AU-B-264825, there is described an internal combustion engine comprising casing means including a cylinder, a piston reciprocable therein and co-operating therewith to define a combustion chamber, an output shaft rotatably disposed adjacent to said

cylinder and parallel to the axis thereof, a rocker member extending transversely between said piston and said shaft, said rocker member having one end portion thereof comprising a journal engaging rotatably in a bearing opening in the end of said shaft obliquely and eccentrically to the shaft axis, the axis of said journal being inclined to intersect the axis of said shaft at a point spaced axially from said journal, said rocker member having a spherical end formation concentric with said axis intersection, said casing means having a spherical bearing seat coaxial with said shaft bearing against the spherical end formation of said rocker member to retain said journal in engagement with the end of said shaft, a member carried and guided by said piston for lineal sliding movement transverse to the piston axis and in the common plane of the piston and shaft axes, and a pivot connection comprising a pin through the other end of said rocker member and said piston carried slidable member, said pivot connection axis being at right angles to said common plane of the shaft axes.

It is an object of the present invention to provide an improved rotary/linear converter which is relatively simple in construction and more efficient.

According to the present invention, a rotary/linear converter comprises :

a first member adapted for linear movement in the direction of a central axis thereof ; a second member adapted for rotational movement about an axis thereof ;

and connecting means operatively interconnecting said first and second members so that linear or rotational movement of said first or second member respectively causes rotational or linear movement of said second or first member respectively ;

said connecting means including a connecting shaft disposed eccentrically of the axis of said first member ;

first coupling means operatively connecting said first member to said connecting shaft such that axial reciprocation of said first member causes orbital movement of said connecting shaft about the axis of said first member and vice versa ; and second coupling means operatively connecting said connecting shaft to said second member so that said orbital movement of said connecting shaft causes rotation of said second member about the axis of said second member and vice versa ;

said first coupling means including a sleeve coaxial with said connecting shaft, said sleeve being operatively connected to said first member for axial reciprocation therewith whilst said first member rotates about the axis thereof, said sleeve being associated with said connecting shaft for axial reciprocation relative thereto, and at least one link member extending between said

sleeve and a mounting which is in a fixed position disposed eccentrically to the axis of either said first or second member.

The position of the fixed mounting may be adjustable if desired.

Preferably, the second coupling means includes a disc-like member mounted for rotation about an axis, the connecting shaft being eccentrically connected with respect to said axis to the disc-like member and the second member being operatively connected to the disc-like member.

In one form the first coupling means includes a plurality of said link members extending between the sleeve and respective ones of the mountings which are fixed, and the or each of said link members may be pivotally connected to said sleeve and to its mounting for limited universal movement.

In one arrangement the second member is operatively connected to the disc-like member co-axially therewith. In another arrangement the second member is radially displaced from the axis of the disc-like member and operatively connected thereto by transmission means. Preferably the disc-like member comprises a circumferential gear section adapted to engage a further gear which is operatively connected to the second member.

A guide may be provided within or along which the first member is moved.

Preferably, the first member comprises a piston and the guide comprises a cylinder having a working chamber therein. Inlet means and outlet means are provided for communicating with the working chamber for the admission and removal of working fluid therefrom. In one preferred form the first member comprises two pistons disposed within the cylinder, there being a single said working chamber disposed between said pistons.

The device of this invention may further include a lubricating and/or cooling system including a delivery channel in the connecting shaft and the second coupling means for delivering lubricant and/or coolant from externally of the converter to the first member so that the orbital movement of the connecting shaft assists in distributing the lubricant and/or coolant at selected positions at or around the first member.

The fluid may be circulated by a pumping action or centrifugal force.

Further features of the present invention will be apparent from the following description of preferred embodiments as illustrated in the accompanying drawings in which :

Figure 1 is a longitudinal section through a first embodiment of a motor constructed in accordance with the present invention taken along line I-I of Figure 2 ;

Figure 2 is a cross-sectional view taken along line II-II of Figure 1 ;

Figure 3 is a longitudinal section through a sec-

ond embodiment of a motor which is constructed in accordance with this invention ;

Figure 4 is a cut-away perspective view of a unit of the present invention ;

Figure 5 is a perspective sketch of a single piston, an associated shaft, and their interconnections, partly cut-away at the central, longitudinal section thereof, this sketch being partly schematic ; and Figure 6 is a partly sectional, partly schematic perspective sketch showing the use of two links between a sleeve on the connecting shaft connected to a piston and respective mounting points for the links on the engine or pump housing.

In Figure 1, means (not shown) such as openings in cylinder 12, which may be provided with suitable valving arrangements, may be provided to communicate with each of the working chambers 18 and 19 for admission of working fluid to each chamber and subsequent removal of working fluid therefrom. The working fluid may either be a fluid under pressure, (for example, a pressurised gas such as air or steam or a pressurised liquid such as hydraulic oil) or a fluid which expands on ignition. In the latter case, each working chamber may also be provided with a suitable ignition device of any known type.

Shaft 20 extends eccentrically of the cylinder 12 and is eccentrically mounted at each end on the inner faces of disc members 21 and 22. Mounted concentrically on the outer faces of disc members 21 and 22 are output shafts 23 and 24, shafts 23 and 24 being mounted for rotation by suitable bearing means in end walls 25 and 26, respectively, of the cylinder 12.

Each of the pistons 14, 15, 16, 17 is coupled to shaft 20 such that axial reciprocation of the pistons causes orbital movement of the shaft within cylinder 12. As depicted in Figures 1 and 2, this coupling comprises sleeves 27, 28 and 29 surrounding shaft 20 and axially reciprocable thereon. It will be noted that whilst pistons 14 and 17 are mounted at one end of each of sleeve 27 and 29 respectively, pistons 15 and 16 are mounted one at each end of single sleeve 28 for movement in unison of these pistons. Thus, expansion of a working fluid within working chamber 18 will move piston 14 and sleeve 27 to the right, and piston 15 and sleeve 28 to the left, from the positions as shown in Figure 1. This movement can be utilised to exhaust spent working fluid from chamber 19 by movement of piston 16 also to the left and movement of piston 17 and sleeve 29 to the right, in addition to rotation of the discs 21 and 22 on orbital movement of shaft 20 and hence rotation of output shafts 23 and 24 as will now be described.

Discs 21 and 22 are caused to rotate an axial movement of sleeves 27, 28 and 29 along shaft 20 by means of reciprocating link arms 27A, 28A and 29A which extend through longitudinal slots 30, 31 and 32, respectively in the cylinder 12. Each of the link arms is pivotally mounted at one end thereof to a respective

one of the sleeves 27, 28 and 29, and at the other end thereof at a fixed point externally of the cylinder 12 within a longitudinally extending housing 33. (If desired, the embodiment illustrated may be modified so that this fixed point is internally of the cylinder 12). As will be apparent from Figure 2, each link arm 27A, 28A and 29A is mounted within housing 33 to not only reciprocate axially of the cylinder but also is pivotal in the transverse direction thereto. It will be appreciated that because of the link arms, as each sleeve is forced axially of the shaft 20, the shaft will be forced to perform an orbital movement, for example in the direction of arrow A in Figure 2, hence the discs 21 and 22 and output shafts 23 and 24 will be rotated.

If desired, the pivot point for each of the link arms 27A, 28A and 29A can be varied within the housing 33 or cylinder 12. This will have the effect of varying the compression within working chambers by altering the top and bottom dead centre positions of the pistons. In addition, variation of the length of these link arms will enable the length of the "stroke" to be selected as desired.

Turning now to Figure 3, the fluid operated motor illustrated is in many respects similar to the motor illustrated in Figures 1 and 2. Thus, it comprises a cylinder 112, pistons 114, 115, 116 and 117 movable axially therein and defining working chambers 118 and 119. In this embodiment, however, four shafts 120, 121, 122 and 123 are provided eccentrically of the cylinder 112, and sleeves 124, 125, 126 and 127 are axially reciprocable on respective ones of these shafts, each of these sleeves having a respective one of the pistons 114, 115, 116 and 117 mounted thereon. It will be appreciated that the respective pistons and sleeve could be one piece. Link arms 128, 129, 130 and 131 extend pivotally between a respective sleeve and an external pivot point as described and shown in detail in Figures 1 and 2. It will be seen in Figure 3, however, that shafts 120, 121, 122 and 123 are mounted eccentrically on one face of a respective toothed disc 132, 133, 134 and 135, each of which is mounted for rotation within the cylinder 112. Discs 132, 133, 134 and 135 each mesh, through an appropriate aperture in the wall of cylinder 112 with external gears 136 mounted on external output shaft 137. Thus, orbital movement of shafts 120, 121, 122 and 123 caused by axial movement of pistons 114, 115, 116 and 117 and sleeves 124, 125, 126 and 127 on expansion or contraction of working chambers 118 and 119, and link arms 128, 129, 130 and 131 is transmitted as rotary motion to the output shaft 137.

If desired, an external output shaft equivalent to output shaft 137 of Figure 3 may be incorporated into the embodiment of Figures 1 and 2, such a shaft being mounted for example on the side of the cylinder 12 opposite to the housing 33. Similarly, a single through shaft equivalent to shaft 20 of Figure 1 may, if desired, be incorporated into the embodiment of Figure 3 in

place of the half shafts 120, 121, 122 and 123.

Referring to Figure 4 there is shown an arrangement comprising a cylinder 112, two pistons 114 and 115 disposed therein with a working chamber therebetween. The interconnection between the pistons 114 and 115 to the output shaft 137 is the same and, as such, only the parts for piston 114 have been itemized. The piston 114 is operatively connected to an eccentric sleeve 124 which is reciprocable on connecting shaft 120 which in turn is connected to disc-like member 132. A link member 128 extends between the sleeve 124 and a mounting point which is fixed but enables limited universal movement of the link member 128 relative thereto. The disc member 132 has an external gear section which is connected to gear wheel 138 which in turn is operatively connected to shaft 137.

The operation of the device shown in Figure 4 is the same in principle to that described earlier. Working fluid is adapted to enter and be discharged from the working chamber between the pistons so that power can be transmitted to output shaft 137.

Referring to Figure 5, there is shown a cylinder 12 with a piston 14 moveable axially therein. The face or crown 14A of piston 14, with the face or crown 15A of a second piston 15 mounted within cylinder 12, and with the inner wall of cylinder 12, defines a working chamber 19 in cylinder 12. This arrangement is essentially the same as that shown in Figure 4. Other components of the portion of the engine depicted in Figure 5 all having corresponding features described earlier in the specification (and thus requiring no further explanation) are shaft 20 which is eccentric of cylinder 12, sleeve 29, disc 21, output shaft 24, housing 33, link arm or link 27, slot 30 in cylinder 12, and pivotal mounting arrangement 34 which includes a shaft 35 connected to housing 33. The operation of an engine or pump having these features will be apparent from the earlier description.

As shown, there is provided in shaft 24, disc 21 and shaft 20 of at least one channel (a single channel 40 is shown in Figure 5) through which a fluid can pass, to enter the region in cylinder 12 which is located between the back of piston 14 and the disc 21, and/or to enter other parts of the engine. To permit the fluid to enter the region between piston 14 and the disc 21, at least one aperture 41 will be provided in shaft 20 and its surrounding sleeve 29, to provide a passage to enable the fluid to leave the channel 40.

The fluid which flows through channel 40 will normally be a lubricant (such as oil), a coolant or a gas which also cools the pistons of the engine.

If the fluid is oil, it will normally enter the sump of the engine, in the bottom of housing 33, through the slot 30. If the fluid is a gas, it will also leave the inside of cylinder 12 through slot 30, to be vented to atmosphere through an aperture or valve in housing 33. If the interior of the housing 33 is to be maintained at a

pressure which is greater than atmospheric pressure, the venting to atmosphere will be through a valve.

If the fluid is to be used only to cool the pistons, aperture 41 will be omitted and the fluid will be supplied, via orifice 42 which connects with channel 40, to the hollow interior region 14B of piston 14. The coolant fluid will then leave region 14B via (a) a second channel running parallel to channel 40, (b) at least one aperture 43 in the rear of piston 14, or (c) at least one aperture (not shown in the drawing) which is located in the side wall of piston 14, rearward of the compression piston rings. It will be appreciated that in some applications no piston rings would be necessary. If this coolant is, or contains, oil which is also used for lubrication, it may leave the region 14B via at least one aperture located in the side wall of piston 14 rearward of the compression piston rings but forward of the scraper or oiler ring (if present). Aperture 43 may be provided with a valve to control the flow of coolant through the aperture. In another arrangement, the aperture may be omitted thereby providing a cushioning effect on the stroke.

The fluid may be pumped through channel 40, or it may be circulated through channel 40 by the combination of one-way valves and the reciprocal movement of the piston 14, or it may be circulated solely by the reciprocal movement of the piston 14. The same arrangements may be adopted if the fluid has to flow through more than one channel, or in one direction through one channel and in the reverse direction through another channel. If one-way valves are used, they may be positioned in any suitable location in the flow path of the fluid.

Referring to Figure 6 there is shown a modification which comprises the use of a plurality of links or link arms 50 connected to each sleeve 29. It should be noted that sleeve 29 is normally attached to shaft 20 in such a manner that there is no rotational movement between shaft 20 and sleeve 29. Thus it is not essential that shaft 20 has a circular cross-section. The circumference of a section through the shaft 20 may be circular but with one or more chords replacing part of the circle, or it may be elliptical, or hexagonal, or the shape of any other polygon, or (in general terms) any continuous or interrupted conic section. Desirably, the bearing surface 38, on which the connection to one end of each link moves, has a circular cross-section using a shaft 20 having a non-circular cross-section, one end of which is seated in a small well in the back of piston 14, preventing the tendency of the side of the piston 14 to touch the inner wall of cylinder 12 during rotation of the piston.

The ends of link arms 50 which are remote from sleeve 29 are connected to respective pivotal mounting points connected to rods 55 mounted on to the housing 33 of the engine. An alternative arrangement (not shown in the drawings) is to provide a mount to receive each rod 55, respectively, by affixing a

bracket (or a plurality of brackets) to the exterior of the cylinder 12, with the (or each) bracket having at least one bearing point adapted to receive an end of a rod 55.

The use of two or more links 55 improves the smoothness of operation of the engine.

Another feature that may be incorporated into engines and pumps of the type discussed above is the mounting of the shafts 20 and 20A (see Figure 5) of an opposed pair of pistons 14, 15 so that the axes of shafts 20 and 20A are not substantially co-linear. Preferably, the shafts 20 and 20A are mounted so that their axes lie on different radial planes passing through the axis of cylinder 12. More preferably shafts 20 and 20A are mounted so that their axes lie on radial planes of cylinder 12 which are 180° apart (that is, they lie on a diametrical plane of cylinder 12).

Yet another feature that may be incorporated into engines or pumps of this type is the shaping of the crowns or faces of the opposed pistons in such a manner as to achieve maximum turbulence or swirl of the combustion gases (or combustion aerosols or other type of combustion fluid) in the case of an engine, or of the gases, liquid or slurry in the case of a pump.

## Claims

1. A rotary/linear converter comprising :
  - a first member (14, 15, 16, 17 ; 114, 115, 116, 117) adapted for linear movement in the direction of a central axis thereof ; a second member (23, 24 ; 137) adapted for rotational movement about an axis thereof ; and connecting means operatively interconnecting said first and second members so that linear or rotational movement of said first or second member respectively causes rotational or linear movement of said second or first member respectively ;
  - said connecting means including a connecting shaft (20 ; 120, 121, 122, 123) disposed eccentrically of the axis of said first member ; first coupling means operatively connecting said first member to said connecting shaft such that axial reciprocation of said first member causes orbital movement of said connecting shaft about the axis of said first member and vice versa ; and second coupling means (21, 22 ; 132, 133, 134, 135) operatively connecting said connecting shaft to said second member so that said orbital movement of said connecting shaft causes rotation of said second member about the axis of said second member and vice versa ;
  - said first coupling means including a sleeve (27, 28, 29 ; 124, 125, 126, 127) co-axial with said connecting shaft, said sleeve being operatively connected to said first member for axial reciprocation therewith whilst said first member rotates



pressure which is greater than atmospheric pressure, the venting to atmosphere will be through a valve.

If the fluid is to be used only to cool the pistons, aperture 41 will be omitted and the fluid will be supplied, via orifice 42 which connects with channel 40, to the hollow interior region 14B of piston 14. The coolant fluid will then leave region 14B via (a) a second channel running parallel to channel 40, (b) at least one aperture 43 in the rear of piston 14, or (c) at least one aperture (not shown in the drawing) which is located in the side wall of piston 14, rearward of the compression piston rings. It will be appreciated that in some applications no piston rings would be necessary. If this coolant is, or contains, oil which is also used for lubrication, it may leave the region 14B via at least one aperture located in the side wall of piston 14 rearward of the compression piston rings but forward of the scraper or oiler ring (if present). Aperture 43 may be provided with a valve to control the flow of coolant through the aperture. In another arrangement, the aperture may be omitted thereby providing a cushioning effect on the stroke.

The fluid may be pumped through channel 40, or it may be circulated through channel 40 by the combination of one-way valves and the reciprocal movement of the piston 14, or it may be circulated solely by the reciprocal movement of the piston 14. The same arrangements may be adopted if the fluid has to flow through more than one channel, or in one direction through one channel and in the reverse direction through another channel. If one-way valves are used, they may be positioned in any suitable location in the flow path of the fluid.

Referring to Figure 6 there is shown a modification which comprises the use of a plurality of links or link arms 50 connected to each sleeve 29. It should be noted that sleeve 29 is normally attached to shaft 20 in such a manner that there is no rotational movement between shaft 20 and sleeve 29. Thus it is not essential that shaft 20 has a circular cross-section. The circumference of a section through the shaft 20 may be circular but with one or more chords replacing part of the circle, or it may be elliptical, or hexagonal, or the shape of any other polygon, or (in general terms) any continuous or interrupted conic section. Desirably, the bearing surface 38, on which the connection to one end of each link moves, has a circular cross-section using a shaft 20 having a non-circular cross-section, one end of which is seated in a small well in the back of piston 14, preventing the tendency of the side of the piston 14 to touch the inner wall of cylinder 12 during rotation of the piston.

The ends of link arms 50 which are remote from sleeve 29 are connected to respective pivotal mounting points connected to rods 55 mounted on to the housing 33 of the engine. An alternative arrangement (not shown in the drawings) is to provide a mount to receive each rod 55, respectively, by affixing a

bracket (or a plurality of brackets) to the exterior of the cylinder 12, with the (or each) bracket having at least one bearing point adapted to receive an end of a rod 55.

5 The use of two or more links 55 improves the smoothness of operation of the engine.

Another feature that may be incorporated into engines and pumps of the type discussed above is the mounting of the shafts 20 and 20A (see Figure 5) of an opposed pair of pistons 14, 15 so that the axes of shafts 20 and 20A are not substantially co-linear. Preferably, the shafts 20 and 20A are mounted so that their axes lie on different radial planes passing through the axis of cylinder 12. More preferably shafts 20 and 20A are mounted so that their axes lie on radial planes of cylinder 12 which are 180° apart (that is, they lie on a diametrical plane of cylinder 12).

Yet another feature that may be incorporated into engines or pumps of this type is the shaping of the crowns or faces of the opposed pistons in such a manner as to achieve maximum turbulence or swirl of the combustion gases (or combustion aerosols or other type of combustion fluid) in the case of an engine, or of the gases, liquid or slurry in the case of a pump.

#### Claims

1. A rotary/linear converter comprising :
  - a first member (14, 15, 16, 17 ; 114, 115, 116, 117) adapted for linear movement in the direction of a central axis thereof ; a second member (23, 24 ; 137) adapted for rotational movement about an axis thereof ; and connecting means operatively interconnecting said first and second members so that linear or rotational movement of said first or second member respectively causes rotational or linear movement of said second or first member respectively ;
  - said connecting means including a connecting shaft (20 ; 120, 121, 122, 123) disposed eccentrically of the axis of said first member ; first coupling means operatively connecting said first member to said connecting shaft such that axial reciprocation of said first member causes orbital movement of said connecting shaft about the axis of said first member and vice versa ; and second coupling means (21, 22 ; 132, 133, 134, 135) operatively connecting said connecting shaft to said second member so that said orbital movement of said connecting shaft causes rotation of said second member about the axis of said second member and vice versa ;
  - said first coupling means including a sleeve (27, 28, 29 ; 124, 125, 126, 127) co-axial with said connecting shaft, said sleeve being operatively connected to said first member for axial reciprocation therewith whilst said first member rotates



about the axis thereof, said sleeve being associated with said connecting shaft for axial reciprocation relative thereto, and at least one link member (27A, 28A, 29A ; 128, 129, 130, 131 ; 50) extending between said sleeve and a mounting which is in a fixed position disposed eccentrically to the axis of either said first or second member.

2. A rotary/linear converter according to claim 1 wherein said second coupling means includes a disc-like member (21, 22 ; 132, 133, 134, 135) mounted for rotation about an axis, said connecting shaft (20 ; 120, 121, 122, 123) being eccentrically connected with respect to said axis to said disc-like member and said second member (23, 24 ; 137) being operatively connected to said disc-like member.

3. A rotary/linear converter according to claim 2 wherein said second member (23, 24) is operatively connected to said disc-like member (21, 22) co-axially therewith.

4. A rotary/linear converter according to claim 2 wherein said second member (137) is radially displaced from the axis of said disc-like member (132, 133, 134, 135) and operatively connected thereto by transmission means (136 ; 138).

5. A rotary/linear converter according to claim 4 wherein said disc-like member comprises a circumferential gear section (132, 133, 134, 135) adapted to engage a further gear (136 ; 138) which is operatively connected to said second member.

6. A rotary/linear converter according to any preceding claim wherein said first coupling means includes a plurality of said link members (50) extending between said sleeve and respective ones of said mountings which are fixed.

7. A rotary/linear converter according to any preceding claim wherein the or each of said link members is pivotally connected to said sleeve and to its said mounting for limited universal movement.

8. A rotary/linear converter according to any preceding claim wherein a guide (12 ; 112) is provided within or along which said first member is moved.

9. A rotary/linear converter according to claim 8 wherein said first member comprises a piston (14, 15, 16, 17 ; 114, 115, 116, 117) and said guide comprises a cylinder (12 ; 112) having a working chamber (18, 19 ; 118, 119) therein, inlet means and outlet means communicating with said working chamber for the admission and removal of working fluid therefrom.

10. A rotary/linear converter according to claim 9 wherein said first member comprises two pistons (14, 15 ; 16, 17 ; 114, 115 ; 116, 117) disposed within said cylinder, there being a single said working chamber (18 ; 19 ; 118 ; 119) disposed between said pistons.

11. A rotary/linear converter according to any preceding claim wherein a lubricating and/or cooling system is provided including a delivery channel (40) in said connecting shaft (20) and said second coupling means (21) for delivering lubricant and/or coolant

from externally of the converter to said first member (14) so that the orbital movement of said connecting shaft assists in distributing the lubricant and/or coolant at selected positions at or around said first member.

## Ansprüche

1. Linear-/Drehbewegungswandler, mit einem ersten Element (14, 15, 16, 17 ; 114, 115, 116, 117), das in Richtung einer Mittelachse des Elementes linear bewegbar ist ; einem zweiten Element (23, 24 ; 137), das um eine Achse desselben drehbar ist ; und Verbindungsmitteln, welche das erste und das zweite Element antriebsmässig so miteinander verbinden, dass eine Linear- bzw. Drehbewegung des ersten oder des zweiten Elementes eine Dreh- oder Linearbewegung des zweiten bzw. des ersten Elementes bewirkt ; wobei die Verbindungsmittel folgendes enthalten : eine bezüglich der Achse des ersten Elementes exzentrisch angeordnete Verbindungswelle (20 ; 120, 121, 122, 123) ; erste Kupplungsmittel, welche daß erste Element antriebsmässig so mit der Verbindungswelle verbinden, dass eine axiale Hin- und Herbewegung des ersten Elementes eine Umlaufbewegung der Verbindungswelle um die Achse des ersten Elementes bewirkt und umgekehrt ; und zweite Kupplungsmittel (21, 22 ; 132, 133, 134, 135), welche die Verbindungswelle antriebsmässig so mit dem zweiten Element verbinden, dass die Umlaufbewegung der Verbindungswelle eine Drehung des zweiten Elementes um die Achse des zweiten Elementes bewirkt und umgekehrt ; wobei die ersten Kupplungsmittel folgendes enthalten : eine mit der Verbindungswelle koaxiale Hülse (27, 28, 29 ; 124, 125, 126, 127), welche mit dem ersten Element antriebsmässig verbunden ist zur axialen Hin- und Herbewegung mit dem ersten Element, während sich dasselbe um seine Achse dreht, und welche der Verbindungswelle zugeordnet und bezüglich derselben axial hin- und herbewegbar ist, und wenigstens ein Lenkerelement (27A, 28A, 29A ; 128, 129, 130, 131 ; 50), das sich von der Hülse zu einer Halterung erstreckt, welche exzentrisch zur Achse des ersten und/oder des zweiten Elementes feststehend angeordnet ist.

2. Linear-/Dehnbewegungswandler nach Anspruch 1, in welchem die zweiten Kupplungsmittel ein scheibenartiges Element (21, 22 ; 132, 133, 134, 135) enthalten, das um eine Achse drehbar ist, wobei die Verbindungswelle (20 ; 120, 121, 122, 123) mit dem scheibenartigen Element bezüglich dessen Achse exzentrisch verbunden ist und wobei das



zweite Element (23, 24 ; 137) mit dem scheibenartigen Element antriebsmässig verbunden ist.

3. Linear-/Drehbewegungswandler nach Anspruch 2, in welchem das zweite Element (23, 24) mit dem scheibenartigen Element (21, 22) coaxial zu diesem antriebsmässig verbunden ist.

4. Linear-/Drehbewegungswandler nach Anspruch 2, in welchem das zweite Element (137) bezüglich der Achse des scheibenartigen Elementes (132, 133, 134, 135) radial versetzt ist und mit diesem durch Getriebemittel (136 ; 138) antriebsmässig verbunden ist.

5. Linear-/Drehbewegungswandler nach Anspruch 4, in welchem das scheibenartige Element an seinem Umfang eine Verzahnung (132, 133, 134, 135) aufweist, die mit einem Zahnrad (136 ; 138) kämmt, welches mit dem zweiten Element antriebsmässig verbunden ist.

6. Linear-/Drehbewegungswandler nach einem der vorangehenden Ansprüche, in welchem die ersten Kupplungsmittel eine Mehrzahl der genannten Lenkerelemente (50) zwischen der Hülse und zugeordneten feststehenden Halterungen enthalten.

7. Linear-/Drehbewegungswandler nach einem der vorangehenden Ansprüche, in welchem das bzw. jedes Lenkerelement mit der Hülse und mit der zugeordneten Halterung zur beschränkten Universalbewegung schwenkbar verbunden ist.

8. Linear-/Drehbewegungswandler nach einem der vorangehenden Ansprüche, in welchem eine Führung (12 ; 112) vorhanden ist, in oder längs welcher das erste Element bewegbar ist.

9. Linear-/Drehbewegungswandler nach Anspruch 8, in welchem das erste Element einen Kolben (14, 15, 16, 17 ; 114, 115, 116, 117) aufweist und die Führung ein Zylinder (12 ; 112) mit einer Arbeitskammer (18, 19 ; 118, 119) darin ist, wobei mit der Arbeitskammer Einlassmittel und Auslassmittel für die Zufuhr und Abfuhr von Arbeitsfluid in Verbindung stehen.

10. Linear-/Drehbewegungswandler nach Anspruch 9, in welchem das erste Element zwei in dem Zylinder angeordnete Kolben (14, 15 ; 16, 17 ; 114, 115 ; 116, 117) aufweist, wobei sich die Arbeitskammer (18 ; 19 ; 118 ; 119) zwischen den beiden Kolben befindet.

11. Linear-/Drehbewegungswandler nach einem der vorangehenden Ansprüche, mit einer Schmier- und/oder Kühlanlage, welche einen Zufuhrkanal (40) in der Verbindungswelle (20) und in den zweiten Kupplungsmitteln (21) enthält für die Zufuhr von Schmiermittel und/oder Kühlmittel von ausserhalb des Wandlers zu dem ersten Element (14), so dass die Umlaufbewegung der Verbindungswelle die Verteilung des Schmiermittels und/oder Kühlmittels an ausgewählte Stellen bei dem ersten Element oder um dasselbe herum unterstützt.

## Revendications

1. Convertisseur rotatif/linéaire comportant :  
un premier élément (14, 15, 16, 17 ; 114, 115, 116, 117) agencé pour le mouvement linéaire dans le sens de son axe central ; un deuxième élément (23, 24 ; 137) agencé pour le mouvement rotatif autour d'un de ses axes ; et des moyens d'accouplement reliant lesdits premier et deuxième éléments de telle manière que le mouvement linéaire ou rotatif desdits premier et deuxième éléments provoquent le mouvement linéaire ou rotatif dudit deuxième ou premier élément respectivement ;  
lesdits moyens d'accouplement prévoyant un axe de raccord (20 ; 120, 121, 122, 123) installé excentrique par rapport à l'axe dudit premier élément ; des premiers moyens d'accouplement de raccord fonctionnel en service dudit premier élément audit axe de raccord de telle façon que le mouvement axial réciproque dudit premier élément provoque le mouvement orbital dudit axe de raccord autour de l'axe dudit premier membre et vice-versa ; et des deuxièmes moyens d'accouplement (21, 22 ; 132, 133, 134, 135) de raccord fonctionnel dudit axe de raccord audit deuxième élément de telle manière que ledit mouvement orbital de l'axe de raccord provoque la rotation dudit deuxième élément autour de l'axe dudit deuxième élément et vice versa ;  
lesdits premiers moyens d'accouplement prévoyant un manchon (27, 28, 29 ; 124, 125, 126, 127) coaxial avec ledit axe de raccord, ledit manchon étant en raccord fonctionnel avec ledit premier élément pour le mouvement axial réciproque y relatif lors de la rotation dudit premier élément de raccord, ledit manchon étant associé audit axe de raccord pour le mouvement axial réciproque y relatif, et au moins un élément de liaison (27A, 28A, 29A ; 128, 129, 130, 131 ; 50) situé entre ledit manchon et un support monté fixe et excentrique à l'axe soit du premier ou du deuxième élément.
2. Convertisseur rotatif/linéaire selon la revendication 1, dont le deuxième moyen d'accouplement prévoit un élément sous forme de disque (21, 22 ; 132, 133, 134, 135) prévu pour la rotation autour d'un axe, ledit axe de liaison (20 ; 120, 121, 122, 123) étant raccordé de manière excentrique par rapport audit axe à l'élément sous forme de disque et le deuxième moyen (23, 24 ; 137) étant en raccord fonctionnel avec ledit élément sous forme de disque.
3. Convertisseur rotatif/linéaire selon la revendication 2, dont le deuxième moyen (23, 24) est en raccord fonctionnel coaxial y relatif avec ledit élément sous forme de disque.
4. Convertisseur rotatif/linéaire selon la revendication 2, dont le deuxième moyen (137) est en déca-



lage radial de l'axe dudit élément sous forme de disque (132, 133, 134, 135) et lui est en raccord fonctionnel par l'intermédiaire de moyens de transmission (136 ; 138).

5. Convertisseur rotatif/linéaire selon la revendication 4, dont l'élément sous forme de disque prévoit une portion d'engrenage circonférentiel (132, 133, 134, 135) adaptée pour la prise avec un autre engrenage (136 ; 138) en raccord fonctionnel avec ledit deuxième élément.

6. Convertisseur rotatif/linéaire selon l'une ou l'autre des revendications antérieures, dont les moyens d'accouplement prévoient une série d'éléments de liaison (50) disposés entre ledit manchon et lesdits éléments de supports qui sont fixes.

7. Convertisseur rotatif/linéaire selon l'une ou l'autre des revendications antérieures, dont l'élément ou chacun des éléments de liaison est raccordé en pivotement audit manchon et à son support à l'effet d'un mouvement universel restreint.

8. Convertisseur rotatif/linéaire selon l'une ou l'autre des revendications antérieures, dont un guide (12 ; 112) est prévu à l'intérieur duquel ou le long duquel le premier élément se déplace.

9. Convertisseur rotatif/linéaire selon la revendication 8, dont ledit premier élément prévoit un piston (14, 15, 16, 16 ; 114, 115, 116, 117) et ledit guide prévoit un vérin (12 ; 112) avec un compartiment de service (18, 19 ; 118, 119) à l'intérieur, des moyens d'amenée et de sortie en communication avec ledit compartiment de service pour y admettre et en refouler le fluide de service.

10. Convertisseur rotatif/linéaire selon la revendication 9, dont ledit premier élément prévoit deux pistons (14, 15 ; 16, 17 ; 114, 115, 116, 117) situés dans ledit vérin, un compartiment unique de service (18 ; 19 ; 118, 119) étant prévu entre lesdits pistons.

11. Convertisseur rotatif/linéaire selon l'une ou l'autre des revendications antérieures, dans lequel est prévu un système de lubrification et/ou de réfrigération y compris un conduit d'amenée (40) dans l'axe de raccord (20) ainsi que lesdits deuxièmes moyens d'accouplement (21) pour amener le lubrifiant et/ou le réfrigérant de l'extérieur du convertisseur audit premier élément (14) de telle manière que le mouvement orbital de l'axe de raccord appuie la distribution du lubrifiant et/ou du réfrigérant en plusieurs endroits prévus audit premier élément ou aux alentours.

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