

## Description

The present invention relates to apparatus for converting reciprocating motion to rotary motion and vice-versa comprising a reciprocatory assembly guided for reciprocation in a first direction and comprising first and second reciprocating members each terminating in a planar guide surface transverse to the direction of reciprocation, and spacing tie means interconnecting the two reciprocatory members at opposite ends of the guide surfaces to maintain the guide surfaces parallel, spaced apart and facing each other, a drive block having opposed guide faces each slidably engaged with a respective one of the guide surfaces of the reciprocatory members, and a rotary member mounted for rotation about an axis transverse to the said direction of reciprocation and having an eccentric portion rotatably engaged in the drive block.

Such apparatus is particularly suitable for interconnecting pistons with a crankshaft in positive fluid displacement machines such as pumps and internal combustion engines as proposed for example in EP-A 0,241,243 (compare with claims 1,2 ; first part). A different interconnection is described in US-A-2 122 676 or DE-A-2 926 391. These documents propose the use of two connecting plates as tie means.

A problem in such known apparatus arises from deflections of the guide surfaces due to high loads imposed on them particularly at high speeds, under the tensions generated in the tie means and applied at the ends of the guide surfaces while the drive block bears against an intermediate part of one guide surface.

Apparatus according to one aspect of the invention is characterised in that the spacing tie means comprises, at each end of the guide surfaces, two ties positioned one on each side of the end part of the travel of the outer portion of the drive block. Such an arrangement enables the bending moments applied to the guide-surface-forming portions of the reciprocatory members to be reduced since the two sets of tie means are now less far apart. At the same time, the length of the drive block (in the direction of its motion) may be increased, in relation to the eccentricity or throw of the eccentric portion of the rotary member, to a value such that in all positions of the drive block, the central plane of the apparatus passing through the said axis passes through the drive block.

Apparatus according to another aspect of the invention is characterised in that the spacing tie means comprises, for each end of the guide surfaces, two side plates positioned one on each side of the reciprocatory members and secured to the two reciprocatory members at least at intervals along the outer portions of the guide surfaces, each side plate having a reentrant providing clearance for the eccentric portion of the rotary member as it moves relatively to the reciprocatory members parallel to the guide surfaces.

Preferably, the reentrant is formed by a parallel-sided and curved-ended slot of width sufficient to clear the said eccentric portion but preferably less than the distance between the opposed guide surfaces. Advantageously, the portions of the side plates, beyond the reentrants, which form the tie means, are made sufficiently stiff to maintain the portions each side of the reentrant parallel, thereby reinforcing the end portion of the reciprocatory members forming the guide surfaces.

Where the eccentric portion is formed by a crankpin connected to the remainder of the rotary member (thus in the form of a crankshaft) by webs, the radially outer portions of the webs may advantageously terminate at a smaller distance from the crankshaft axis than the radially outer part of the crankpin so that the latter projects beyond the webs. This enables the side plates to be brought still closer together.

Advantageously, the side plates and the adjacent portions of the reciprocatory members have load-transmitting interfitting formations therealong.

These measures together result in a very rigid construction which reduces deflection of the guide surfaces, preferably in conjunction with the first aspect of the invention.

In one variant of the apparatus, each side plate is made integral with one of two members forming the two said portions of the reciprocatory assembly. Preferably two side plates are integral with one said member and the other two with the other said member.

Advantageously each member is formed integrally with one side plate on one side thereof at one end of its guide surfaces and with its further side plate on the other side and at the other end of this guide surface.

In an alternative variant, the two said portions and the two side plates at one end of the transverse guideway are formed integrally as one component and the other two side plates, at the other end of the guideway are secured to this component at least at intervals.

Also according to the present invention there is provided an eight-cylinder internal combustion engine having a crankshaft with four crankpins and two cylinder banks each of four cylinders the two banks being on opposite sides of the crankshaft axis with their cylinder axes in a common plane through the crankshaft axis, and connecting means according to claims 1 or 2 connecting each crankpin to a corresponding piston in each bank. By arranging the crankpins in a predetermined order at angles of 0°, 90°, 180° and 270°, equal firing intervals of 90° of crankshaft rotation are obtainable. Advantageously, the apparatus of one or both of the first two aspects of the invention is used for each of the four connecting means.

An embodiment of the invention will now be de-

scribed by way of example with reference to the accompanying drawings, in which:

Figure 1 shows schematically and mainly in section an internal combustion engine according to the invention as seen from the end adjacent the timing gears and chains;

Figure 2 is a plan view, mainly in section on the line II-II of figure 1;

Figure 3 is a sectional view on the line III-III of figure 2, on an enlarged scale;

Figure 4 is a section on the line IV-IV of figure 3;

Figure 5 is a section on the lines V-V of figure 3;

Figure 6 is an elevational view of one of the two connecting links of the variant;

Figures 7 and 8 are views similar to Figures 4 and 5; and

Figure 9 is a perspective view of the connecting link shown in Figure 6.

Figures 1 and 2 show diagrammatically the principal components of an eight-cylinder horizontally-opposed internal combustion engine having two banks each of four cylinders. The cylinders C1, C3, C5 and C7 are arranged in line in one bank while the other cylinders C2, C4, C6 and C8 are arranged in line in the other bank B. Each cylinder is formed by a cylinder liner 11 all of which are mounted in a crankcase 12, the lower end of which is closed in the normal manner by an oil sump 13.

Each pair of opposed cylinders, such as C1 and C2, are coaxial. A crankshaft 14 is rotatably mounted in five main bearings 15 in the crank case 12 and has four crankpins 16, one for each opposed pair of cylinders. Measured in the direction of rotation of the crankshaft 14, the angular spacings of the crankpins 16 are, from the front of the engine (i.e. the left hand side in figure 2) 0°, 180°, 270° and 90°. Thus, the firing order for the engine in four stroke form is 1-6-3-8-4-7-2-5-1.

Each cylinder contains a piston 17. The two pistons 17 of an opposed pair of cylinders such as C1 and C2 are connected together by a reciprocatory connecting assembly shown on an enlarged scale in figures 3 to 5.

Each connecting assembly consists of a connecting link 18 for each piston and four connecting plates 19a, 19b, 19c and 19d which are each of a U-shaped formation. Each connecting link 18 has a spigot 20 at one end which engages in a bore in its associated piston 17 and is itself formed with a screw threaded bore to receive a stud 21 carrying a nut 22 securing the piston to the connecting link. Each nut 22 is located in an aperture in the piston crown and this aperture is subsequently closed by a plug 23 screwed into the centre of the piston and suitably locked.

At its other end, each connecting link 18 widens out to form a long rectangular flat guide surface 24 which is surface-hardened, for example by nitriding. The links 18 are stiffened by appropriate ribs in the

form of two outer ribs 25 and a central rib 26 with the spaces therebetween formed by web portions 27.

A drive block 28 is formed in two halves 28a and 28b which are secured together by screws 29 and are accurately located relatively to each other by tubular dowels 30. In opposite faces of the drive block 28 are located bearing plates 31 of appropriate bearing-forming material to engage slidably the guide surfaces 24. Movement of the bearing plates 31 relative to the drive block 28 in the direction along the drive block is prevented by transverse ribs 32 formed at the corners of the drive block.

The two connecting links 18 are secured with their guide surfaces 24 at the correct distance apart by the connecting plates 19 which also reinforce the connecting links against deformation in operation. For this purpose each connecting plate 19 is formed with a rib 33 engaged as a close fit in a corresponding groove 34 extending along each lateral face of the connecting link 18. The connecting plates 19 are secured to the connecting links 18 by screws 35 having heads 35a at one end located in counter bores in one connecting plate and having screw threaded portions at their other ends engaged in screw threaded holes in the opposite plate.

The connecting plates 19 have flange portions 36 which extend inwardly from the guide surface 24 towards each other. These flange portions increase the rigidity of the connecting links 18 in the region of the guide surfaces and are themselves surface-hardened to form lateral guide surfaces for the drive block 28 and its bearing plates 31. The flange portions 36 bound the parallel sides of a reentrant 37 having a semi-circular end 38. A reentrant 37 provides clearance for the portions of the crankshaft web immediately adjacent the crankpin 16.

The stiffness of the connecting plates 19 is increased by increasing the thickness of the connecting link portions 39. The distance between the connecting portions 39 on opposite sides of the central plane is reduced by shaping the crankpin 15 between the two plates at each end as shown in figure 4. Thus, the radially outermost portion 15x of the crankpin projects radially beyond the radially outer portions of the crankshaft webs 41 and 42. By reducing the distance between the connecting portions 39, the bending moments in the guide surface portions of the connecting links are further reduced.

As can be seen from figure 3, even in the extreme position of its travel along the guide surfaces, the drive block 28 always has some portion on the centre line of the reciprocatory assembly.

Turning again to figures 1 and 2, it will be seen that each bank of cylinders has a respective cylinder head 43 forming combustion chambers for the cylinders. Each combustion chamber has two inlet valves 44a and 44b and an exhaust valve 45. The cylinder heads may be formed with separate inlet ducts 46a

and 46b leading to the respective inlet valves or a single inlet duct supplying both valves may be used instead. Where the engine is a spark-ignition engine, each combustion chamber will include a spark plug and the inlet manifold branches (not shown) supplying the inlet ducts will include fuel injectors.

The valves 44 and 45 are operated by a cam shaft in each cylinder head, the cam shafts being of the "single overhead" type operating valves through rocker arms (not shown). The cam shafts are themselves driven at half crankshaft speed by roller-chain and sprocket drives driven by respective timing gears 49 meshing with a gear 50 on the front end of the crankshaft 14.

Also mounted on the front end of the crankshaft 14 is a helical gear 51 meshing with a gear 52 on a shaft 53 driving an oil pump 154 (figure 1) which draws oil from the sump 2 and supplies it under pressure to the main bearings 15. Internal drillings 54, 55, 56 in, the crankshaft supply oil from the main bearings to the crankpin bearings in the drive blocks. The drillings 56 also supply oil into an arcuate groove 57 behind the bearing shell in the drive block. The grooves 57 communicate through inclined drillings 58 with central apertures 59 in the bearing plates 31. With this arrangement, oil is delivered to replenish the oil film between the drive plate 31 and guide surfaces 24 just before the imposition of high loads between these two elements.

At its rear end, the crankcase 1 may include or have attached to it a bell housing 61 (figure 1) to enclose a flywheel (not shown) and torque convertor (not shown) on the rear end of the engine's crankshaft 14 and to enable the crankcase to be secured to a change speed gear box.

Axial location of the crankshaft 14 may be effected by a suitable main bearing construction 62 at its centre bearing (or at its rear bearing) and the main bearings are completed by normal main bearing caps 63.

In the variant shown in Figures 6 to 8, the reciprocating assembly is formed by two connecting links 118 and 218 which are in most respects similar to the connecting links 18 shown in Figures 1 to 5 of the above-mentioned application. The two connecting links 118 and 218 are of identical construction. As shown in figure 6, a connecting link 118, formed for example as a forging, has integral with it a first side plate 119a on the front face of the connecting link as seen in the drawing and a second connecting plate 119b at the rear face. Each of the connecting plates 119 extends for half of the length of the connecting link measured in the direction of the guide surface 134. Each connecting plate 119 is formed with a rib 133 to engage in a corresponding groove 234 of the other connecting link 218. Similarly, the grooves 134 of the connecting link 118 receive the ribs 233 of the connecting plates 219 of the connecting link 218.

Assembly of the two connecting links together with the drive block therebetween is effected by relative movement towards each other along the direction of reciprocation of the reciprocating assembly with subsequent relative angular adjustment of the two connecting links about an axis extending in this direction (i.e. the common axis of the two opposed cylinders). The two connecting links can then be secured together by screws 35.

In both variants mentioned above, the guide surfaces 124, 224 and the ribs and the grooves may all be formed in a single broaching operation or by appropriate grinding and machining operations.

## Claims

1. Apparatus for converting reciprocating motion to rotary motion and vice-versa comprising a reciprocating assembly guided for reciprocation in a first direction and comprising first and second reciprocating members each terminating in a planar guide surface transverse to the direction of reciprocation, and spacing tie means (19,119,219) interconnecting the two reciprocating members at opposite ends of the guide surfaces to maintain the guide surfaces parallel, spaced apart and facing each other, a drive block (28) having opposed guide faces each slidably engaged with a respective one of the guide surfaces of the reciprocating members, and a rotary member (16) mounted for rotation about an axis transverse to the said direction of reciprocation and having an eccentric portion rotatably engaged in the drive block, characterised in that the spacing tie means comprises, at each end of the guide surfaces, two ties (19,119,219) positioned one on each side of the end part of the travel of the outer portion of the drive block (28), the elements which form the spacing tie means at one end of the guide surfaces being separate from those at the other end.
2. Apparatus for converting reciprocating motion to rotary motion and vice-versa comprising a reciprocating assembly guided for reciprocation in a first direction and comprising first and second reciprocating members each terminating in a planar guide surface transverse to the direction of reciprocation, and spacing tie means (119,19,219) interconnecting the two reciprocating members at opposite ends of the guide surfaces to maintain the guide surfaces parallel, spaced apart and facing each other, a drive block (28) having opposed guide faces each slidably engaged with a respective one of the guide surfaces of the reciprocating members, and a rotary member (16) mounted for rotation about an axis transverse



and 46b leading to the respective inlet valves or a single inlet duct supplying both valves may be used instead. Where the engine is a spark-ignition engine, each combustion chamber will include a spark plug and the inlet manifold branches (not shown) supplying the inlet ducts will include fuel injectors.

The valves 44 and 45 are operated by a cam shaft in each cylinder head, the cam shafts being of the "single overhead" type operating valves through rocker arms (not shown). The cam shafts are themselves driven at half crankshaft speed by roller-chain and sprocket drives driven by respective timing gears 49 meshing with a gear 50 on the front end of the crankshaft 14.

Also mounted on the front end of the crankshaft 14 is a helical gear 51 meshing with a gear 52 on a shaft 53 driving an oil pump 154 (figure 1) which draws oil from the sump 2 and supplies it under pressure to the main bearings 15. Internal drillings 54, 55, 56 in, the crankshaft supply oil from the main bearings to the crankpin bearings in the drive blocks. The drillings 56 also supply oil into an arcuate groove 57 behind the bearing shell in the drive block. The grooves 57 communicate through inclined drillings 58 with central apertures 59 in the bearing plates 31. With this arrangement, oil is delivered to replenish the oil film between the drive plate 31 and guide surfaces 24 just before the imposition of high loads between these two elements.

At its rear end, the crankcase 1 may include or have attached to it a bell housing 61 (figure 1) to enclose a flywheel (not shown) and torque convertor (not shown) on the rear end of the engine's crankshaft 14 and to enable the crankcase to be secured to a change speed gear box.

Axial location of the crankshaft 14 may be effected by a suitable main bearing construction 62 at its centre bearing (or at its rear bearing) and the main bearings are completed by normal main bearing caps 63.

In the variant shown in Figures 6 to 8, the reciprocatory assembly is formed by two connecting links 118 and 218 which are in most respects similar to the connecting links 18 shown in Figures 1 to 5 of the above-mentioned application. The two connecting links 118 and 218 are of identical construction. As shown in figure 6, a connecting link 118, formed for example as a forging, has integral with it a first side plate 119a on the front face of the connecting link as seen in the drawing and a second connecting plate 119b at the rear face. Each of the connecting plates 119 extends for half of the length of the connecting link measured in the direction of the guide surface 134. Each connecting plate 119 is formed with a rib 133 to engage in a corresponding groove 234 of the other connecting link 218. Similarly, the grooves 134 of the connecting link 118 receive the ribs 233 of the connecting plates 219 of the connecting link 218.

Assembly of the two connecting links together with the drive block therebetween is effected by relative movement towards each other along the direction of reciprocation of the reciprocating assembly with subsequent relative angular adjustment of the two connecting links about an axis extending in this direction (i.e. the common axis of the two opposed cylinders). The two connecting links can then be secured together by screws 35.

In both variants mentioned above, the guide surfaces 124, 224 and the ribs and the grooves may all be formed in a single broaching operation or by appropriate grinding and machining operations.

## Claims

1. Apparatus for converting reciprocating motion to rotary motion and vice-versa comprising a reciprocatory assembly guided for reciprocation in a first direction and comprising first and second reciprocating members each terminating in a planar guide surface transverse to the direction of reciprocation, and spacing tie means (19,119,219) interconnecting the two reciprocatory members at opposite ends of the guide surfaces to maintain the guide surfaces parallel, spaced apart and facing each other, a drive block (28) having opposed guide faces each slidably engaged with a respective one of the guide surfaces of the reciprocatory members, and a rotary member (16) mounted for rotation about an axis transverse to the said direction of reciprocation and having an eccentric portion rotatably engaged in the drive block, characterised in that the spacing tie means comprises, at each end of the guide surfaces, two ties (19,119,219) positioned one on each side of the end part of the travel of the outer portion of the drive block (28), the elements which form the spacing tie means at one end of the guide surfaces being separate from those at the other end.
2. Apparatus for converting reciprocating motion to rotary motion and vice-versa comprising a reciprocatory assembly guided for reciprocation in a first direction and comprising first and second reciprocating members each terminating in a planar guide surface transverse to the direction of reciprocation, and spacing tie means (119,19,219) interconnecting the two reciprocatory members at opposite ends of the guide surfaces to maintain the guide surfaces parallel, spaced apart and facing each other, a drive block (28) having opposed guide faces each slidably engaged with a respective one of the guide surfaces of the reciprocatory members, and a rotary member (16) mounted for rotation about an axis transverse



- to the said direction of reciprocation and having an eccentric portion rotatably engaged in the drive block, characterised in that the spacing tie means (19,119,219) comprises two pairs of side plates arranged so that at each end of the guide surfaces, two side plates are positioned one on each side of the reciprocatory members and secured to the two reciprocatory members at least at intervals along the outer portions of the guide surfaces, each side plate having a reentrant providing clearance for the eccentric portion of the rotary member (16) as it moves relatively to the reciprocatory members parallel to the guide surfaces.
3. Apparatus according to claim 2, wherein the reentrant is formed by a parallel-sided and curved-ended slot of width sufficient to clear the said eccentric portion.
  4. Apparatus according to claim 3, wherein the width of the said slot is less than the distance between the opposed guide surfaces.
  5. Apparatus according to claim 2 or 3, wherein the portions of the side plates, beyond the reentrants, which form the tie means, are thickened to reinforce the end portion of the reciprocatory members forming the guide surfaces.
  6. Apparatus according to any of claims 2 to 5, wherein the side plates and the adjacent portions of the reciprocatory members have load-transmitting interfitting formations therealong.
  7. Apparatus according to claim 6, wherein the portions of the side plates beyond the reentrants are positioned on each side of the end part of the travel of the outer portion of the drive block.
  8. Apparatus according to claim 2, wherein each side plate is made integral with one of two members forming the two said portions of the reciprocatory assembly.
  9. Apparatus according to claim 8, wherein two side plates are integral with one said member and the other two with the other said member.
  10. Apparatus according to claim 9, wherein each member is formed integrally with one side plate on one side thereof at one end of its guide surfaces and with its further side plate on the other side and at the other end of this guide surface.
  11. Apparatus according to claim 9, wherein the two said portions and the two side plates at one end of the transverse guideway are formed integrally

as one component and the other two side plates, at the other end of the guideway are secured to this component at least at intervals.

12. Apparatus according to any of claims 1 to 11, wherein the eccentric portion is formed by a crankpin connected to the remainder of the rotary member by webs, and the radially outer portions of the webs terminate at a smaller distance from the crankshaft axis than the radially outer part of the crankpin so that the latter projects beyond the webs.
13. An eight-cylinder internal combustion engine having a crankshaft with four crankpins and two cylinder banks each of four cylinders the two banks being on opposite sides of the crankshaft axis with their cylinder axes in a common plane through the crankshaft axis, and connecting means connecting each crankpin to a corresponding piston in each bank, characterised in that each of the four connecting means is in accordance with any of claims 1 to 11.

#### Patentansprüche

1. Vorrichtung zur Umwandlung einer hin- und hergehenden Bewegung in eine rotierende Bewegung und umgekehrt mit einer hin- und hergehenden Baugruppe, die für die Hin- und Herbewegung in einer ersten Richtung geführt ist und erste und zweite hin- und hergehende Teile, die jeweils in einer ebenen, quer zur Richtung der Hin- und Herbewegung angeordneten Führungsfläche enden, und als Abstandhalter wirkende Verbindungsmittel (19, 119, 219) enthält, die die beiden hin- und hergehenden Teile an entgegengesetzten Enden der Führungsflächen miteinander verbinden, wobei sie die Führungsflächen parallel, im Abstand voneinander und einander zugewandt halten, mit einem Antriebsblock (28), der gegenüberliegende Führungsflächen aufweist, die jeweils gleitend mit einer entsprechenden Führungsfläche der hin- und hergehenden Teile im Eingriff sind, und mit einem Rotationsteil (16), das zur Drehung um eine quer zur Richtung der Hin- und Herbewegung angeordnete Achse gelagert ist und ein exzentrisches Teil aufweist, das drehbar in den Antriebsblock eingreift, dadurch gekennzeichnet, daß die als Abstandhalter wirkenden Verbindungsmittel an jedem Ende der Führungsflächen zwei Verbindungselemente (19, 119, 219) umfassen, von denen jeweils eines an einem Ende der Bahn des äußeren Teils des Antriebsblocks (28) angeordnet ist, wobei die Elemente, welche die Abstandhalter an einem Ende der Führungsflächen bilden, von denjeni-



gen am anderen Ende getrennt sind.

2. Vorrichtung zur Umwandlung einer hin- und hergehenden Bewegung in eine rotierende Bewegung und umgekehrt mit einer hin- und hergehenden Baugruppe, die für die Hin- und Herbewegung in einer ersten Richtung geführt ist und erste und zweite hin- und hergehende Teile, die jeweils in einer ebenen, quer zur Richtung der Hin- und Herbewegung angeordneten Führungsfläche enden, und als Abstandhalter wirkende Verbindungsmittel (19, 119, 219) enthält, die die beiden hin- und hergehenden Teile an entgegengesetzten Enden der Führungsflächen miteinander verbinden, wobei sie die Führungsflächen parallel, im Abstand voneinander und einander zugewandt halten, mit einem Antriebsblock (28), der gegenüberliegende Führungsoberflächen aufweist, die jeweils gleitend mit einer entsprechenden Führungsfläche der hin- und hergehenden Teile im Eingriff sind, und mit einem Rotationsteil (16), das zur Drehung um eine quer zur Richtung der Hin- und Herbewegung angeordnete Achse gelagert ist und ein exzentrisches Teil aufweist, das drehbar in den Antriebsblock eingreift, dadurch gekennzeichnet, daß die als Abstandhalter wirkenden Verbindungselemente (19, 119, 219) zwei Paare von Seitenplatten enthalten, die derart an jedem Ende der Führungsflächen angeordnet sind, daß von jeweils zwei Seitenplatten eine an jeder Seite der hin- und hergehenden Teile angeordnet und an beiden hin- und hergehenden Teilen zumindest in Abständen längs der Außenabschnitte der Führungsflächen befestigt ist, wobei jede Seitenplatte eine Durchlaßöffnung aufweist, die einen Freiraum für den exzentrischen Teil des Rotationsteils (16) läßt, wenn dieser sich relativ zu den hin- und hergehenden Teilen parallel zu den Führungsflächen bewegt.
3. Vorrichtung nach Anspruch 2, bei der die Durchlaßöffnung von einem Schlitz mit parallelen Seiten und gekrümmten Enden gebildet ist, dessen Breite ausreicht, um Platz für den exzentrischen Teil zu schaffen.
4. Vorrichtung nach Anspruch 3, bei der die Breite des Schlitzes kleiner als der Abstand zwischen den gegenüberliegenden Führungsflächen ist.
5. Vorrichtung nach Anspruch 2 oder 3, bei denen die über die Durchlaßöffnungen hinausgehenden und die Verbindungselemente bildenden Abschnitte der Seitenplatten dicker ausgebildet sind, um die Endbereiche der hin- und hergehenden Teile, die die Führungsflächen bilden, zu verstärken.
6. Vorrichtung nach einem der Ansprüche 2 bis 5, bei der die Seitenplatten und die angrenzenden Bereiche der hin- und hergehenden Teile längsverlaufende lastübertragende, ineinandergreifende Gestaltungen aufweisen.
7. Vorrichtung nach Anspruch 6, bei der die über die Durchlaßöffnungen hinausgehenden Abschnitte der Seitenplatten auf jeder Seite des Endbereiches der Bahn des äußeren Teils des Antriebsblocks angeordnet sind.
8. Vorrichtung nach Anspruch 2, bei der jede Seitenplatte einstückig mit einem der beiden Teile ausgebildet ist, die die beiden Teile der hin- und hergehende Baugruppe bilden.
9. Vorrichtung nach Anspruch 8, bei der zwei Seitenplatten einstückig mit einem der Teile und die beiden anderen einstückig mit dem anderen Teil ausgebildet sind.
10. Vorrichtung nach Anspruch 9, bei der jedes Teil an einer Seite und an einem Ende seiner Führungsfläche mit einer Seitenplatte und an der anderen Seite und am anderen Ende mit der anderen Seitenplatte einstückig ausgebildet ist.
11. Vorrichtung nach Anspruch 9, bei der die beiden Teile und die beiden Seitenplatten an einem Ende der Querverführung einstückig als ein Bauteil ausgeführt sind und die beiden anderen Seitenplatten am anderen Ende der Führung an diesem Bauteil zumindest in Abständen befestigt sind.
12. Vorrichtung nach einem der Ansprüche 1 bis 11, bei der das exzentrische Teil durch einen Kurbelzapfen gebildet ist, der mit dem Rest des Rotationsteils durch Schenkel verbunden ist, wobei die radial außen liegenden Bereiche der Schenkel mit einem geringeren Abstand von der Kurbelwellenachse als die radial äußeren Bereiche des Kurbelzapfens enden, so daß letztere über die Schenkel hinausragen.
13. Ein Achtzylinder-Verbrennungsmotor mit einer vier Kurbelzapfen aufweisenden Kurbelwelle, mit zwei Zylinderreihen zu je vier Zylindern, wobei die beiden Reihen auf entgegengesetzten Seiten der Kurbelwellenachse und mit ihren Zylinderachsen in einer gemeinsamen, durch die Kurbelwellenachse verlaufenden Ebene angeordnet sind, und mit Verbindungsmitteln, die jeden Kurbelzapfen mit einem entsprechenden Zylinder in jeder Reihe verbinden, dadurch gekennzeichnet, daß jedes der vier Verbindungsmittel einem der Ansprüche 1 bis 11 entspricht.



## Revendications

1. Appareil pour convertir un mouvement alternatif en mouvement rotatif et vice-versa, comportant un montage alternatif guidé pour un mouvement alternatif dans une première direction et comportant un premier et un second organes alternatifs se terminant chacun en une surface de guidage plane transversale à la direction du mouvement alternatif, et des organes de liaison formant entretoise (19, 119, 219) qui interconnectent les deux organes alternatifs, aux extrémités opposées des surfaces de guidage, destinés à maintenir les surfaces de guidage parallèles, espacées et face à face entre elles, un bloc d'entraînement (28) présentant des faces de guidage opposées chacune en contact coulissant avec une des surfaces de guidage des organes alternatifs, et un organe rotatif (16) monté pour tourner autour d'un axe transversal à ladite direction de mouvement alternatif et comportant une partie excentrique s'engageant de façon rotative dans le bloc d'entraînement,

caractérisé en ce que le moyen de liaison formant entretoise comporte, à chaque extrémité des surfaces de guide, deux liaisons (19, 119, 219), placées de chaque côté de la partie d'extrémité du trajet de la partie externe du bloc d'entraînement (28), les éléments qui constituent le moyen de liaison formant entretoise situé à une extrémité des surfaces de guidage étant séparés de ceux qui sont situés à l'autre extrémité.

2. Appareil pour convertir un mouvement alternatif en mouvement rotatif et vice-versa, comportant un montage alternatif guidé pour un mouvement alternatif dans une première direction et comportant un premier et un second organes alternatifs se terminant chacun en une surface de guidage plane, transversale à la direction du mouvement alternatif, et des organes de liaison formant entretoise (19, 119, 219) qui interconnectent les deux organes alternatifs aux extrémités opposées des surfaces de guidage, afin de maintenir les surfaces de guidage parallèles, espacées et face à face entre elles, un bloc d'entraînement (28) présentant des faces de guidage opposées chacune en contact coulissant avec une des surfaces de guidage des organes alternatifs, et un organe rotatif (16) monté en vue de tourner autour d'un axe transversal à ladite direction de mouvement alternatif et comportant une partie excentrique s'engageant de façon rotative dans le bloc d'entraînement,

caractérisé en ce que le moyen de liaison formant entretoise (19, 119, 219) comporte deux paires de plaques latérales disposées de telle façon qu'à chaque extrémité des surfaces de guidage,

deux plaques latérales sont placées sur chaque côté des organes alternatifs et sont fixées aux deux organes alternatifs, au moins par intervalles le long des parties externes des surfaces de guidage, chaque plaque latérale présentant un rentrant constituant un dégagement pour la partie excentrique de l'organe rotatif (16) lorsqu'il se déplace par rapport aux organes alternatifs parallèles aux surfaces de guidage.

3. Appareil selon la revendication 2, dans lequel le rentrant est formé par une fente à côtés parallèles et à extrémités incurvées, de largeur suffisante pour dégager la partie excentrique.
4. Appareil selon la revendication 3, dans lequel la largeur de ladite fente est inférieure à la distance entre les surfaces de guidage opposées.
5. Appareil selon la revendication 2 ou 3, dans lequel les parties des plaques latérales situées au-delà des rentrants, qui forment entretoise, sont épaissies afin de renforcer la partie d'extrémité des organes alternatifs formant les surfaces de guidage.
6. Appareil selon l'une quelconque des revendications 2 à 5, dans lequel les plaques latérales et les parties adjacentes des organes alternatifs possèdent sur leur longueur des formations d'interadaptation servant à la transmission de charge.
7. Appareil selon la revendication 6, dans lequel les parties des plaques latérales situées au-delà des rentrants sont placées de chaque côté de la partie d'extrémité du trajet de la partie externe du bloc de commande.
8. Appareil selon la revendication 2, dans lequel chaque plaque latérale est réalisée d'une seule pièce avec l'un des deux organes formant lesdites deux parties du montage alternatif.
9. Appareil selon la revendication 8, dans lequel deux plaques latérales font partie intégrante de l'un desdits organes, et les deux autres plaques latérales de l'autre desdits organes.
10. Appareil selon la revendication 9, dans lequel chaque organe est réalisé d'une seule pièce avec une plaque latérale sur un de ses côtés à une extrémité de ses surfaces de guidage, et avec son autre plaque latérale sur l'autre côté, à l'autre extrémité de cette surface de guidage.
11. Appareil selon la revendication 9, dans lequel lesdites deux parties et les deux plaques latérales situées à une extrémité du trajet de guidage



transversal sont constituées d'une seule pièce en un composant, et les deux autres plaques latérales situées à l'autre extrémité du chemin de guide sont fixées à ce composant au moins par intervalles.

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12. Appareil selon l'une quelconque des revendications 1 à 11, dans lequel la partie excentrique est constituée par un maneton connecté au restant de l'organe rotatif par des flasques, et les parties radialement externes des flasques se terminent à une distance plus faible de l'axe du vilebrequin que les parties radialement externes du maneton, de sorte que ce dernier avance au-delà des flasques.

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13. Moteur à combustion interne à huit cylindres comportant un vilebrequin avec quatre manetons et deux ensembles de cylindres, chacun des quatre cylindres des deux ensembles se trouvant sur un des côtés opposés de l'axe du vilebrequin, les axes de cylindres se trouvant dans un plan commun passant par l'axe du vilebrequin, et un moyen de connexion connectant chaque maneton à un piston correspondant dans chaque ensemble, caractérisé en ce que chacun des quatre moyens de connexion est en accord avec l'une quelconque des revendications 1 à 11.

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