EUROPEAN PATENT SPECIFICATION

GAUGE FOR CHECKING RADIAL DIMENSIONS OF MECHANICAL PIECES
MESSVORRICHTUNG ZUR ÜBERPRÜFUNG DER RADIALABMESSUNGEN MECHANISCHER TEILE
JAUGE POUR LE CONTROLE DE DIMENSIONS RADIALES DE PIECES MECANIQUES

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EP-A- 0 469 439
EP-A2- 0 382 336
WO-A-97/12724

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Technical Field

[0001] The present invention refers to a gauge for checking radial dimensions of a workpiece featuring a cylindrical surface, including a casing, a V-shaped reference device, coupled to the casing, adapted for cooperating with the cylindrical surface of the workpiece, a feeler adapted for touching the cylindrical surface of the workpiece and performing substantially linear displacements, a transmission element, movably arranged in the casing and carrying the feeler, a transducer adapted for providing signals indicative of the position of the feeler with respect to the V-shaped reference device, the transducer including a movable element coupled to the transmission element, and a sealing system between the transmission element and the casing.

Background Art

[0002] Gauges having the above-mentioned features are known in the art. An example is shown in International patent application published with n. WO-A-9712724 that refers to a specific apparatus, for checking the diameter of crankpins during their orbital motion about a geometric axis. The gauge - that is part of the apparatus and is shown in figures 6 and 7 of the international application - includes a V-shaped reference device that rests on the pin to be checked and a tubular guide casing. A transmission rod axially translates in the guide casing and carries a feeler that contacts the surface of the crankpin to be checked. The displacements of the rod are detected by a measuring device with an inductive transducer that includes a first part integral with the tubular casing and a second part integral to and movable with the transmission rod.

[0003] In the specific application that is shown in the above-mentioned international patent application, for checking a crankshaft being worked on a grinding machine, the fixed part of the gauge - including the tubular casing, the V-shaped reference device and a part of the inductive transducer - is coupled to a support system allowing the whole gauge to perform the displacements that are needed to keep the contact with the pin to be checked while the latter orbitally moves.

[0004] The tubular casing has an opening through which the end of the transmission rod carrying the feeler projects. A sealing device closes such opening in order to prevent coolant and other foreign matter that is present in the working environment from getting into the casing. More specifically, the sealing device is made up of a metal bellows having its ends fixed to the rod and the casing, respectively, that has also the function of preventing axial rotations between rod and casing, so preventing the feeler from undertaking improper angular positions.

[0005] As an alternative, known gauges include tubular external gaskets of different shape and/or material, e.g. made of rubber, arranged between the casing and the movable element carrying the feeler. These gaskets perform a sealing action but have no substantial role as far as anti-rotation is concerned.

[0006] The increasing demand for internal combustion engines featuring the utmost compactness leads to the production of components having smaller and smaller dimensions. One of such components is the crankshaft, that requires extremely accurate dimensional checkings.

[0007] It can be hard or impossible to use the apparatus shown in the above cited patent publication WO-A-9712724 for checking crankshafts featuring very small nominal dimensions. For instance, in case that the crankpin to be checked has extremely small length, it is necessary that consequently small be the thickness of the part of the gauge including the V-shaped reference device, the feeler, the corresponding ends of the rod and of the casing, and the sealing system. In fact such part of the gauge, during the checking operations, must be in touch with or very close to the surface of the pin, i.e. has to be arranged between the walls of the mutually facing cheeks at the ends of the pin. It is especially troublesome to reduce the dimensions of the sealing system when the available allowance is less e.g. than 8-10 mm. In fact, it is problematic to get metal bellows or different tubular gaskets featuring suitable transversal size, safe connection to both the mutually movable parts and right properties ensuring the needed characteristics as regards compliance and tightness.

Disclosure of the Invention

[0008] Object of the present invention is providing a gauge that, while guaranteeing excellent performances in checking radial dimensions of mechanical parts, features small overall dimensions, so overcoming the problems of the known gauges in applications with limited allowance to the parts to be checked.

[0009] This object is reached by a gauge as defined in claim 1, wherein the sealing system includes a pneumatic conduit through which compressed air is blown from inside the casing to outside.

[0010] In a gauge according to the invention external tubular gaskets or metal bellows can be omitted, so allowing - by properly dimensioning the other components - to perform checking operations even where the access has very small dimensions. An exemplary application is the previously described one, where an orbitally movable crankpin having limited axial dimensions is checked, and the pin’s dimensions and/or other mechanical parts of the application prevent components having transversal size bigger than 8-10 mm from being used.

[0011] A particular embodiment of the present invention features also an internal seal that is substantially fastened to either the casing or the transmission rod, and allows to guarantee a very good tightness to foreign matter even in a non-operative condition of the gauge. In this embodiment, consumption of the compressed air can be...
positively limited, since the air has not to keep flowing in the non-operative condition.

Brief Description of the Drawings

[0012] The invention is now described in detail with reference to a preferred embodiment that is shown in the enclosed drawings, to be considered illustrative and not limitative, wherein:

- figure 1 is a longitudinal cross-section of a gauge according to a preferred embodiment of the invention, where some elements are not cutaway;
- figure 2 is a transversal cross-section of the gauge of figure 1, taken along the line II- II of figure 1;
- figure 3 is a scrap longitudinal cross-section of the gauge of figures 1 and 2, taken along the line III-III of figure 2;
- figure 4 is a transversal cross-section of the gauge of figure 1, taken along the line IV-IV of figure 1;
- figures 5 and 6 are longitudinal cross-sections, according to an enlarged scale and with some components simplified for reasons of clarity, of a detail of the gauge of figure 1, at a non-operative and an operative position, respectively; and
- figure 7 is a lateral view of the gauge of figure 1, where some details are cross-sectioned, during the checking of a crankpin of a crankshaft.

Best Mode for Carrying Out the Invention

[0013] The figures show a gauge 1 for checking radial dimensions of mechanical pieces, according to the invention, more specifically a so-called "snap gauge". The gauge 1 includes a support system with a casing 2 having a long and narrow shape, and a V-shaped reference device 4 adjustable coupled to an end of the casing 2, e.g. by means of screws that, in figure 1, are schematically shown and indicated by reference number 3. The V-shaped reference device 4 includes a couple of contact surfaces forming an angle and adapted to rest on a surface of a workpiece to be checked. The casing 2 has a through axial opening 6 where a rod 8 is housed and can longitudinally translate guided by guide devices with a first bushing 12 and a second bushing 14. An end portion 10 of rod 8 has reduced diametral dimensions and projects from the casing 2 at an end of the axial opening 6 in correspondence of the V-shaped reference device 4. Towards the opposed end, the axial opening 6 defines an enlarged zone 7 featuring sections with different diametral dimensions. A feeler 20, adapted for touching the surface of a workpiece to be checked and performing substantially linear displacements, as is explained hereinafter, is fixed to the end portion 10 of rod 8, and a movable element or core 23 of an inductive transducer 22 is coupled to the opposite end of rod 8 through a stem 21. The transducer 22 also includes a fixed part 24, coupled to the casing 2 at the above-mentioned enlarged zone 7 of the axial opening 6, having windings in which core 23 can translate. The windings - that are not shown in figure 1 - are coupled, through electric wires of a cable 26, to a processing and display unit of a known type, that is schematically shown in figure 1 and indicated by number 25.

[0014] The rod 8 is a transmission element transmitting substantially linear displacements of the feeler 20 - displacements that are a consequence of the contact with a surface of the workpiece to be checked - to the core 23 of the transducer 22.

[0015] Thrust devices include a compression spring 28 applying an axial thrust between the rod 8 and surfaces of the enlarged zone 7 of the axial opening 6 by acting, in the example of figure 1, on a flange 29 fastened to rod 8 and pushing towards the outside the end portion 10 carrying the feeler 20.

[0016] The second bushing 14, arranged nearby the V-shaped reference device 4 and shown more in detail in figures 4, 5 and 6, includes a guide portion 13 guiding longitudinal translation movements of rod 8 and an enlarged portion 15 having internal surface with wider diametral dimensions, where a circular cavity 16 is defined. A sealing element includes an annular internal seal 18, e.g. a so-called "O-Ring", that is coupled to the casing 2, more specifically it is partially housed in circular cavity 16 of the second bushing 14.

[0017] The annular seal 18 protrudes from the internal surface of the second bushing 14 and cooperates with a matching surface of rod 8, substantially near a union zone 9 of the latter, adjacent to the end portion 10 having reduced diametral dimensions.

[0018] The guide portion 13 includes three additional openings, more specifically longitudinal cuts 17, angularly spaced at 120 degrees from one another, that allow the compressed air to flow.

[0019] An antirotation device with a metal bellows 30 has the ends fastened to rod 8 and casing 2 and is housed in the enlarged zone 7 of the axial opening 6. Metal bellows 30 has only the task to substantially prevent mutual axial rotation between rod 8 and casing 2.

[0020] A source of compressed air, schematically shown in the figure and referred to with number 40, is coupled through a hose 42 to a lateral through hole 44 of casing 2 putting the enlarged zone 7 of the axial opening 6 in communication with the outside. A crossing hole 46 - which can be seen in figures 2 and 3 - is defined in casing 2 between the above-mentioned enlarged zone 7 and an intermediate zone of the axial opening 6 between the first bushing 12 and the second bushing 14. The crossing hole 46 and parts of the axial opening 6 so define a pneumatic conduit for allowing the passage - within casing 2 and towards the opening at the V-shaped reference device 4 - of the compressed air provided by source 40. Through the pneumatic conduit the compressed air can be blown from inside the casing 2 to outside.

[0021] The snap gauge 1 can be fastened to an exter-
nal support, schematically shown in figure 1 and referred to by reference number 50, e.g. by means of a movable structure similar to the one that is described and shown in the above-cited patent publication WO-A-9712724, and that is part of an application for checking orbitally rotating crankpins.

[0022] In non-operative conditions the rod 8 is arranged, under the thrust of spring 28, in the position shown in figures 1 and 5. Such position is defined by limiting devices that are known and not shown in the figures and include mechanical abutments that are pushed against one another by the thrust of the spring 28. Near the union zone 9, the matching surface of rod 8 is pushed against the annular seal 18, so guaranteeing gauge 1 be sealed. In other words, the opening 6 is closed and any fluids or other foreign matter cannot access inside the casing 2.

[0023] In order to perform checking operations the gauge 1 is brought, manually or automatically, to contact a cylindrical surface of the workpiece 60 to be checked, for instance a crankpin of a crankshaft 66 that is partially and schematically shown in figure 7, laying between cheeks 62. The V-shaped reference device 4 comes into contact with the surface of workpiece 60 (figure 6) and, according to the cited example, keeps in contact with such surface during the orbital rotations of the workpiece 60, e.g. thanks to the action of the force of gravity (on this regard, reference is made to the description of the above-cited patent publication WO-A-9712724).

[0024] A thrust opposite to the one of spring 28 is applied to the feeler 20, and consequent movements of feeler 20 are transmitted by the rod 8 to the core 23 of the transducer 22. The latter provides signals indicative of the position of the feeler 20 with respect to the V-shaped reference device 4 to the processing and display unit 25 which processes the signals and provides indications about the dimensions of workpiece 60. When the gauge is applied in an “in-process” checking on a machine tool (more specifically a grinding machine), such indications can be used for controlling the grinding operation of crankshaft 66.

[0025] Compressed air that is provided by the source 40 and is blown inside the casing 2 through lateral hole 44, longitudinally crosses the casing 2 in the pneumatic conduit defined by the crossing hole 46, clearances in the axial opening 6, the longitudinal cuts 17 and enlarged portion 15 of second bushing 14. When, following the contact between feeler 20 and surface of workpiece 60, the matching surface of rod 8 moves far from seal 18, the air can get outside. The compressed air flowing outside blows off and prevents foreign matter - possibly standing near the contact area between feeler 20 and workpiece 60 - from getting inside the casing 2, so achieving a sealing system. The tightness is particularly important in “in-process” applications where the piece being worked in a machine tool is struck and covered by coolant, and would the latter get inside the casing 2, it might negatively affect the working of the gauge 1 and damage its components, among them the transducer 22.

[0026] When the gauge 1 is moved away from the workpiece 60, the spring 28 pushes back the matching surface of rod 8 against the seal 18, so sealing opening 6. As a consequence, the air coming from source 40 remains, under pressure, within casing 2. In such a way, the waste of air is advantageously limited to those phases of the checking when the feeler 20 moves. As an alternative, the provision of compressed air can be interrupted in the non-operative condition.

[0027] The gauge 1 according to the present invention can guarantee excellent tightness without external sealing devices such as rubber or metal tubular gaskets that, in order to ensure the required performances, cannot have very small size. Thanks to the possibility of omitting external gaskets, it is possible to obtain gauges where the parts that come into engagement with the workpiece to be checked have very small transversal dimensions. As a consequence, it is possible to provide applications for checking parts featuring limited accessibility, such as crankpins that are longitudinally delimited by two mechanical parts very close to each other (e.g. 8-10 mm), as schematically shown in figure 7.

[0028] Moreover, internal seal 18 guarantees the tightness in the non-operative condition of the gauge 1, when the gauge 1 stands in a retracted position with respect to the piece to be checked, or is stored, for instance, in a storage magazine. In fact, even though the non-operative condition is less critical, it would be necessary to heavily increase the consumption of compressed air in order to prevent dust or other foreign matter from settling at the entrance of the casing 2 and getting inside. Internal seal 18 allows to keep compressed air within the casing 2 and/or to interrupt the generation of air when gauge 1 must not perform any checking operations, and this does not jeopardize the proper seal of the gauge 1.

[0029] Gauges according to the present invention can feature different embodiments with respect to what is shown in the figures and is described above.

[0030] The tightness at the second bushing 14 can be carried out in a different way, where, for instance, seal 18 or an element having similar features is coupled to and movable with a suitable area of the rod 8, while the internal surface of bushing 14 is suitably shaped in order to define a matching surface matching, with the seal and providing sealing in the non-operative condition of gauge 1.

[0031] The thrust devices, too, can have different embodiments and include mechanisms having different shape and arrangement, e.g. with magnetic elements.

[0032] The guide devices can include other guiding elements, for instance a ball bushing, in the place of the first bushing 12, or include a single element, e.g. substantially corresponding to the second bushing 14, suitably dimensioned.

[0033] Embodiments of the present invention may also differ as regards the arrangement of the translation direction of the rod 8 with respect to the angle formed by
the contact surfaces of the V-shaped reference device 4. More specifically, the translation direction of the rod 8 carrying the feeler 20 may be substantially aligned along the bisecting line of the above-mentioned angle, or may be slightly inclined with respect to it.

[0034] Moreover, inductive transducer 22 can be replaced by an axial gauging head having a movable part in contact with an end surface of rod 8, substantially as shown in figures 6 and 7 of the already cited patent publication WO-A-97127724. Other known types of transducers can be employed (e.g. optical). In any case, it is advantageous to make use of a pneumatic device for obtaining the tightness, that is independent from the circuit for detecting the movements of feeler 20. Keeping the two circuits independent from each other allows on the one hand to choose the transducer on the basis of the specific application involved, in order to obtain the best metrological performances, on the other hand to get the above-mentioned pneumatic sealing circuit in an extremely simple and cheap way. In fact, this pneumatic circuit does not require, for instance, stabilizers to control the pressure value, but, on the contrary, it can make use of the air that is normally available for other tasks in the workshop environment ("factory air") .

[0035] Moreover, a gauge according to the present invention can be fastened to different types of external supports or used, e.g. manually, as a standalone apparatus.

Claims

1. A gauge (1) for checking radial dimensions of a workpiece (60) featuring a cylindrical surface, including

• a casing (2),
• a V-shaped reference device (4), coupled to the casing (2), adapted for cooperating with the cylindrical surface of the workpiece (60),
• a feeler (20) adapted for touching the cylindrical surface of the workpiece (60) and performing substantially linear displacements,
• a transmission element (8), movably arranged in the casing (2) and carrying said feeler (20),
• a transducer (22) adapted for providing signals indicative of the position of the feeler (20) with respect to the V-shaped reference device (4),
• a sealing system (18, 40-46) between the transmission element (8) and the casing (2), characterised in that said sealing system includes a pneumatic conduit (6, 42-46) through which compressed air is blown from inside the casing (2) to outside.

2. A gauge according to claim 1, wherein the sealing system (18, 40-46) includes a sealing element (18) coupled to one of said casing (2) and transmission element (8) and adapted to cooperate with a matching surface of the other of said casing (2) and transmission element (8).

3. A gauge according to claim 2, including thrust devices (28) adapted to apply an axial thrust to the transmission element (8), said axial thrust being adapted to keep mutual contact between said sealing element (18) and said matching surface.

4. A gauge according to claim 3, wherein said thrust devices include a spring (28) arranged between the casing (2) and the transmission element (8).

5. A gauge according to any one of claims 2 to 4, wherein the transmission element includes a rod (8), the casing (2) defining an axial opening (6), said rod (8) being housed and axially movable in the axial opening (6).

6. A gauge according to claim 5, wherein said pneumatic conduit includes at least a part of said axial opening (6).

7. A gauge according to claim 6, including guide devices (12, 14) adapted to guide translation movements of said rod (8) along a translation direction in the axial opening (6), the guide devices include at least a bushing (14) coupled to the casing (2) near the V-shaped reference device (4), the pneumatic conduit including openings (17) of said at least one bushing (14).

8. A gauge according to claim 7, wherein said at least one bushing (14) defines an internal surface (13, 15) and the sealing element (18) is coupled to said internal surface (13, 15), the rod (8) defining said matching surface.

9. A gauge according to any one of claims 7 to 8, wherein said V-shaped reference device (4) defines contact surfaces forming an angle, said translation direction of the rod (8) being arranged substantially aligned along a bisecting line of said angle.

10. A gauge according to any one of claims 2 to 9, wherein the sealing element includes an annular seal (18).

11. A gauge according to any one of the preceding claims, wherein the transducer (22) includes a fixed part (24) coupled to the casing (2).

12. A gauge according to claim 11, wherein the transducer (22) is an inductive transducer.

13. A gauge according to any one of the preceding
claims, including an antirotation device with a metal bellows (30) housed in the casing (2) and fixed to the transmission element (8) and the casing (2).

14. Use of a gauge according to any one of the preceding claims, wherein, during the checking operation, the mechanical workpiece (60) is orbitally rotating and the V-shaped reference device (4) keeps in contact with the cylindrical surface of the workpiece (60).

15. Use of a gauge according to claim 14, for checking a crankpin (60) of a crankshaft (66) during grinding operations on a machine tool.

Patentansprüche

1. Komparator (1) zur Überprüfung der Radialabmessungen eines Werkstückes (60), das eine zylindrische Oberfläche besitzt, mit
   • einem Gehäuse (2),
   • einer V-förmigen Bezugsvorrichtung (4), die an das Gehäuse (2) angekoppelt ist und mit der zylindrischen Oberfläche des Werkstücks (60) zusammenwirken kann,
   • einem Fühler (20), der die zylindrische Oberfläche des Werkstücks (60) berühren und wesentlich lineare Verschiebungen vornehmen kann,
   • einem Sendeelement (8), das im Gehäuse (2) beweglich angeordnet ist und den Fühler (20) trägt,
   • einem Signalumformer (22) der Signalen, die die Position des Fühlers in Bezug auf die V-förmigen Bezugsvorrichtung (4) wiedergeben, ausliefern kann, wobei der Signalumformer (22) ein bewegliches Element (23), das an das Sendeelement (8) angekoppelt ist, aufnimmt;
   • einem Dichtungssystem (18, 40-46) zwischen dem Sendeelement (8) und dem Gehäuse (2),
   • einem Dichtungselement (18) und der Anschlagfläche aufrechterhalten kann.

2. Komparator nach Anspruch 1, bei dem die Druckeinrichtungen eine zwischen dem Gehäuse (2) und dem Sendeelement (8) angeordnete Feder (28) umfassen.

3. Komparator nach Anspruch 2, der Druckeinrichtungen (28), die auf das Sendeelement (8) einen Längsdruck aufbringen können, aufnimmt, wobei der Längsdruck den wechselseitigen Kontakt zwischen dem Dichtungselement (18) und der Anschlagfläche festlegt.

4. Komparator nach Anspruch 3, bei dem die Druckeinrichtungen eine zwischen dem Gehäuse (2) und dem Sendeelement (8) angeordnete Feder (28) umfassen.

5. Komparator nach einem der Ansprüche von 2 bis 4, bei dem das Sendeelement eine Stange (8) umfasst, und das Gehäuse (2) eine axiale Öffnung (6) festlegt, wobei die Stange (2) in der axialen Öffnung (8) angeordnet ist und darin axial bewegbar ist.


7. Komparator nach Anspruch 6, der Führungsrichtungen (12,14), die Translationsbewegungen der Stange (8) entlang einer Translationsrichtung in der axialen Öffnung (6) führen können, umfassen, bei dem die Führungsrichtungen mindestens eine an das Gehäuse (2) in der Nähe von der V-förmigen Bezugsvorrichtung (4) angekoppelte Buchse (14) umfassen, wobei die Pneumatikleitung Öffnungen (17) der mindestens einen Buchse (14) aufnimmt.

8. Komparator nach Anspruch 7, bei dem die mindestens eine Buchse (14) eine Innenfläche (13,15) festlegt und das Dichtungselement (18) an die Innenfläche (13,15) angekoppelt ist, wobei die Stange (8) die Anschlagfläche festlegt.

9. Komparator nach einem der Ansprüche von 7 bis 8, bei dem die V-förmige Bezugsvorrichtung (4) einen Winkel bildende Kontaktflächen festlegt, wobei die Translationsrichtung der Stange (8) so angeordnet ist, dass die wesentlich entlang der Mittellinie ausgerichtet ist.

10. Komparator nach einem der Ansprüche von 2 bis 9, bei dem das Dichtungselement eine ringförmige Dichtung (18) umfasst.

11. Komparator nach einem der vorangehenden Ansprüche, bei dem der Signalumformer (22) einen ortsfesten Teil (24), der an das Gehäuse (2) angekoppelt ist, aufnimmt.

12. Komparator nach Anspruch 11, bei dem der Signalumformer (22) ein induktiver Signalumformer ist.

13. KomPARATOR nach einem der vorangehenden Ansprüche, der eine Drehspule mit einem Metallballg (30), der im Gehäuse (2) angeordnet und am Sendelement (8) und am Gehäuse (2) befestigt ist, umfasst.
14. Anwendung eines Komparators nach einem der vor-
angehenden Ansprüche, bei der, im Verlauf der
Überprüfung, das mechanische Werkstück (60) sich
orbital dreht, und die V-förmige Bezugsvorrichtung
(4) in Kontakt mit der zylindrischen Oberfläche des
Werkstücks (60) bleibt.

15. Anwendung eines Komparators Anspruch 14,
zur Prüfung von einem Kurbelzapfen (60) einer Kur-
belwelle (66) im Verlauf der Schleifoperationen bei
einer Werkzeugmaschine.

Revendications

1. Comparateur (1) destiné à vérifier les dimensions
radiales d'une pièce mécanique (60) qui présente
une surface cylindrique, comportant

- un boîtier (2),
- un dispositif de référence en forme de V (4),
couplé au boîtier (2), adapté pour coopérer avec
la surface cylindrique de la pièce mécanique
(60),
- un palpeur (20) adapté pour toucher la surface
cylindrique de la pièce mécanique (60) et pour
effectuer des déplacements essentiellement li-
néaires,
- un élément de transmission (8), qui est agencé
mobile dans le boîtier (2) et porte ledit palpeur
(20),
- un transducteur (22) adapté pour produire des
signaux indiquant la position du palpeur (20),
par rapport au dispositif de référence en forme
de V (4), le transducteur (22) incluant un élément
mobile couplé à l'élément de transmission (8), et
- un système d'étanchéité (18, 40-46) entre l'élé-
ment de transmission (8) et le boîtier (2),
caractérisé en ce que
ledit système d'étanchéité inclut une conduite pneu-
matique (6, 42-46) par laquelle de l'air comprimé est
soufflé de l'intérieur du boîtier (2) vers l'extérieur.

2. Comparateur selon la revendication 1, dans lequel
le système d'étanchéité (18, 40-46) inclut un élément
d'étanchéité (18) qui est couplé à l'un desdits boîtier
(2) et élément de transmission (8) et adapté pour
coopérer avec une surface de butée de l'autre des-
dits boîtier (2) et élément de transmission (8).

3. Comparateur selon la revendication 2, comportant
des dispositifs de poussée (28) adaptés pour appli-
quer une poussée axiale à l'élément de transmission
(8), ladite poussée axiale étant adaptée pour main-
tenir le contact entre ledit élément d'étanchéité (18)

4. Comparateur selon la revendication 3, dans lequel
ledit dispositif de poussée inclut un ressort (28) dis-
posé entre le boîtier (2) et l'élément de transmission
(8).

5. Comparateur selon l'une quelconque des revendi-
cations 2 à 4, dans lequel l'élément de transmission
inclut une tige (8), le boîtier (2) définissant une ouver-
ture axiale (6), ladite tige (8) étant logée dans l'ouver-
ture axiale (6) et étant mobile axialement dans celle-
ci.

6. Comparateur selon la revendication 5, dans lequel
ladite conduite pneumatique inclut au moins une par-
tie de ladite ouverture axiale (6).

7. Comparateur selon la revendication 6, comportant
des dispositifs de guidage (12, 14) adaptés pour gui-
der des mouvements de translation de ladite tige (8)
de l'un à l'autre desdits boîtier (2) et élément de trans-
mission (8) et par rapport au dispositif de référence en forme
de V (4), le transducteur (22) incluant un élément
mobile couplé à l'élément de transmission (8), et
un système d'étanchéité (18, 40-46) entre l'élé-
ment de transmission (8) et le boîtier (2),
caractérisé en ce que
ledit système d'étanchéité inclut une conduite pneu-
matique (6, 42-46) par laquelle de l'air comprimé est
soufflé de l'intérieur du boîtier (2) vers l'extérieur.

8. Comparateur selon la revendication 7, dans lequel
ladite tige (8) est agencée de manière à être essen-
tiellement alignée le long d'une bissectrice dudit an-
gle.

9. Comparateur selon l'une quelconque des revendi-
cations 7 à 8, dans lequel ledit dispositif de référence
en forme de V (4) définit des surfaces de contact qui
forment un angle, ladite direction de translation de
la tige (8) étant agencée de manière à être essen-
tiellement alignée le long d'une bissectrice dudit an-
gle.

10. Comparateur selon l'une quelconque des revendi-
cations 2 à 9, dans lequel ledit dispositif de poussée
inclut un ressort (28) adaptés pour appliquer une
poussée axiale à l'un desdits boîtier (2) et élément
de transmission (8), et ladite conduite pneumatique
inclut au moins une partie de ladite ouverture axiale (6).

11. Comparateur selon l'une quelconque des revendi-
cations précédentes, dans lequel le transducteur
(22) inclut une partie fixée (24) couplée au boîtier (2).

12. Comparateur selon la revendication 11, dans lequel
le transducteur (22) est un transducteur inductif.

13. Comparateur selon l'une quelconque des revendi-
cations précédentes, incluant un dispositif anti-rota-
tion comportant un soufflet métallique (30) qui est
logé dans le boîtier (2) et fixé à l'élément de trans-
mission (8) et au boîtier (2).

14. Usage d'un comparateur selon l'une quelconque des
revendications précédentes, dans lequel, au cours de l'opération de vérification, la pièce mécanique (60) tourne de façon orbitale et le dispositif de référence en forme de V (4) reste en contact avec la surface cylindrique de la pièce mécanique (60).

15. Usage d'un comparateur selon la revendication 14 pour vérifier un maneton (60) d'un vilebrequin (66) au cours d'opérations de rectification sur une machine-outil.
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 9712724 A [0002] [0007] [0021] [0023] [0034]