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(54) **SELF-CENTERING GEAR PUMP**

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(57) **ABSTRACT**

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The invention relates to a self-centering gear pump, in particular for conveying and metering free-flowing paste and liquids, but operating within various temperature ranges during the conveying process by means of a drive gear mounted axially on a central smooth motor shaft without a positive-fit connection and an eccentrically located hollow gear that meshes on its interior face and rotates within a cylindrical housing. Said housing is closed on both sides by lateral walls.

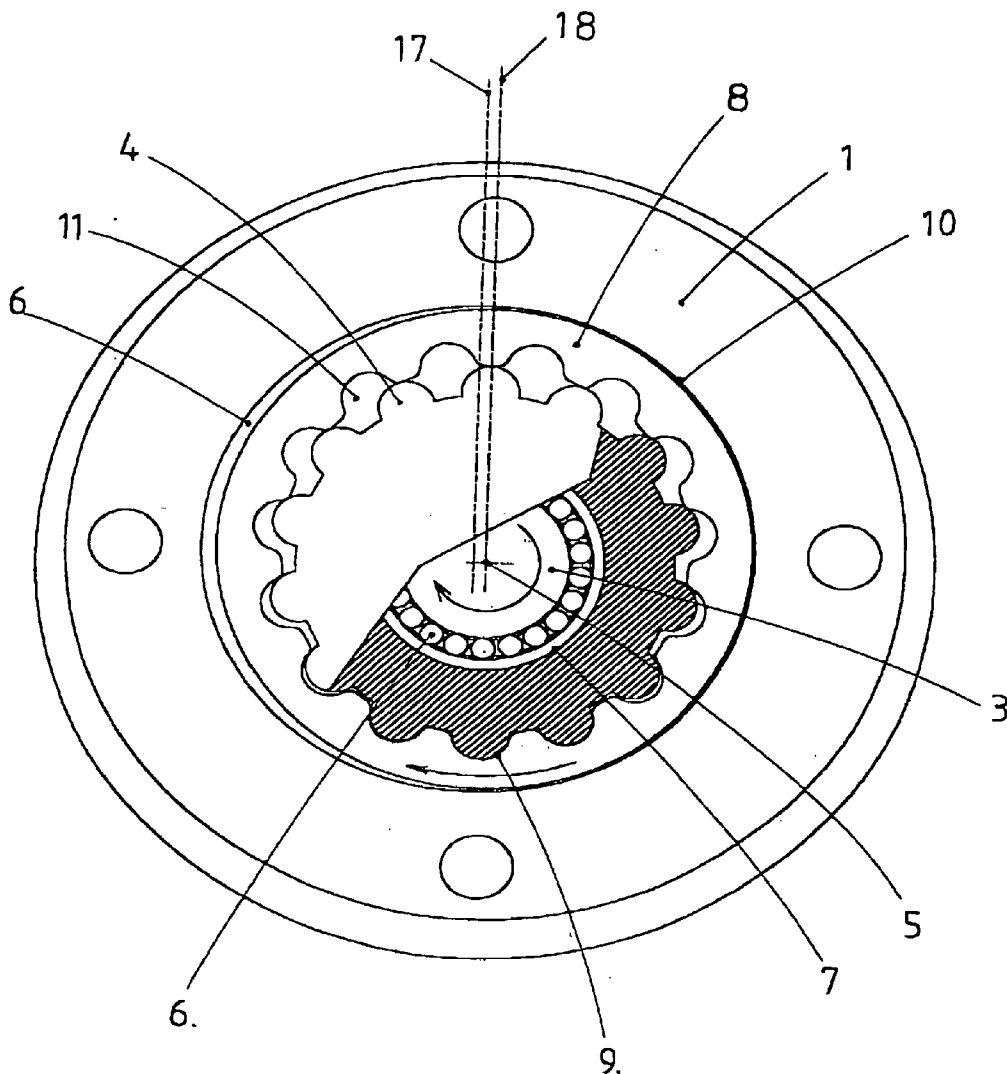


Fig. 1

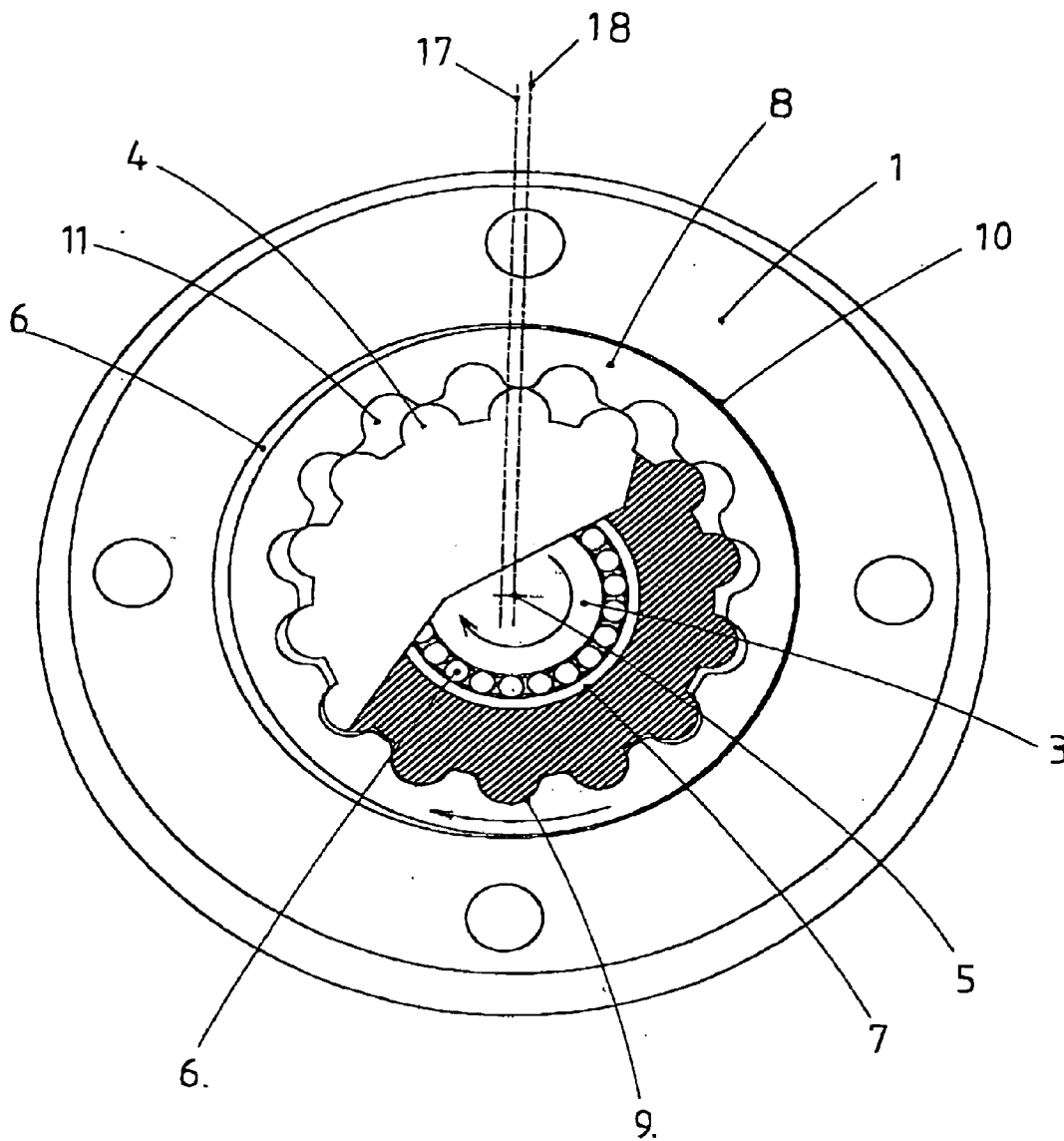


Fig. 2

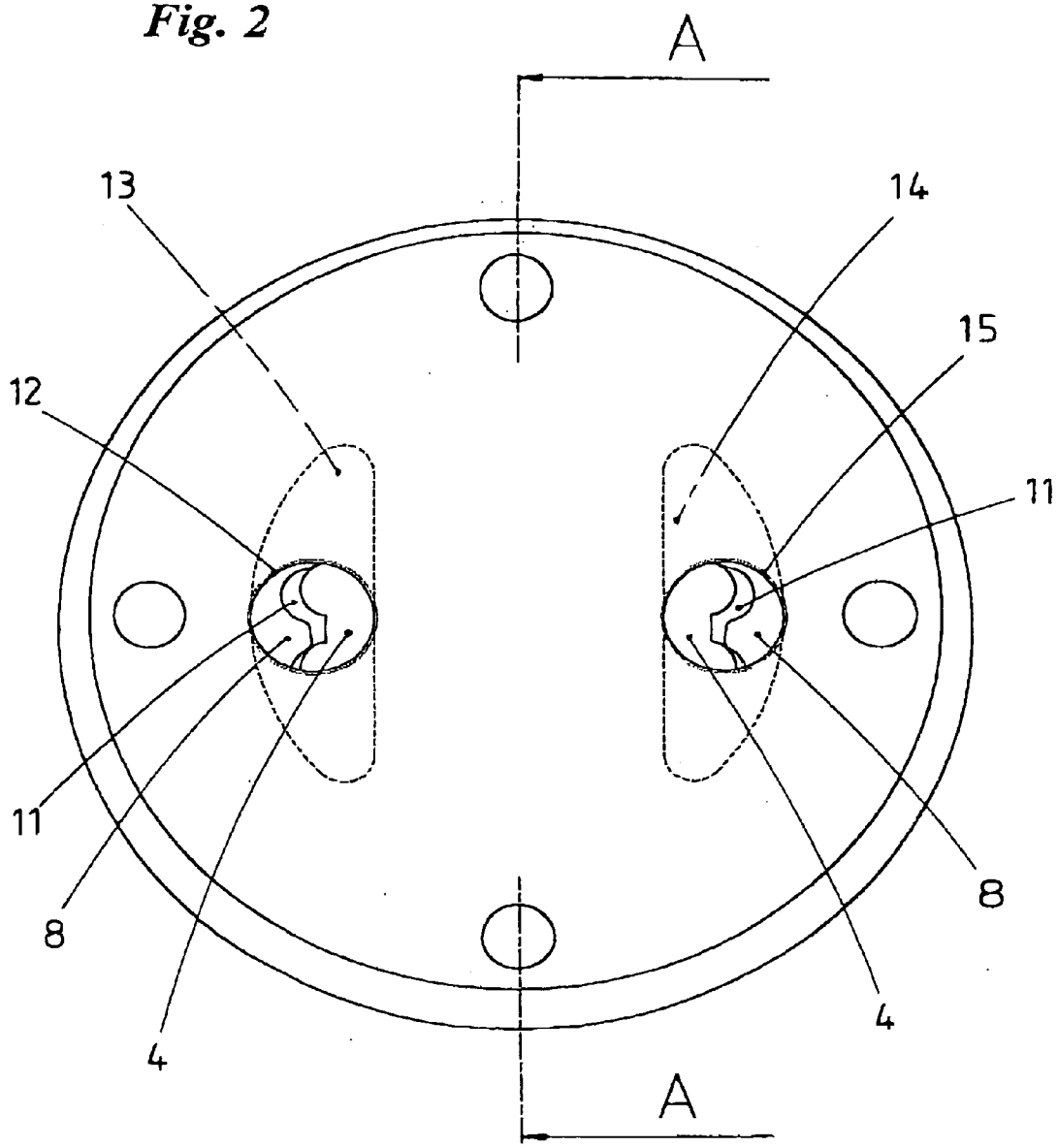
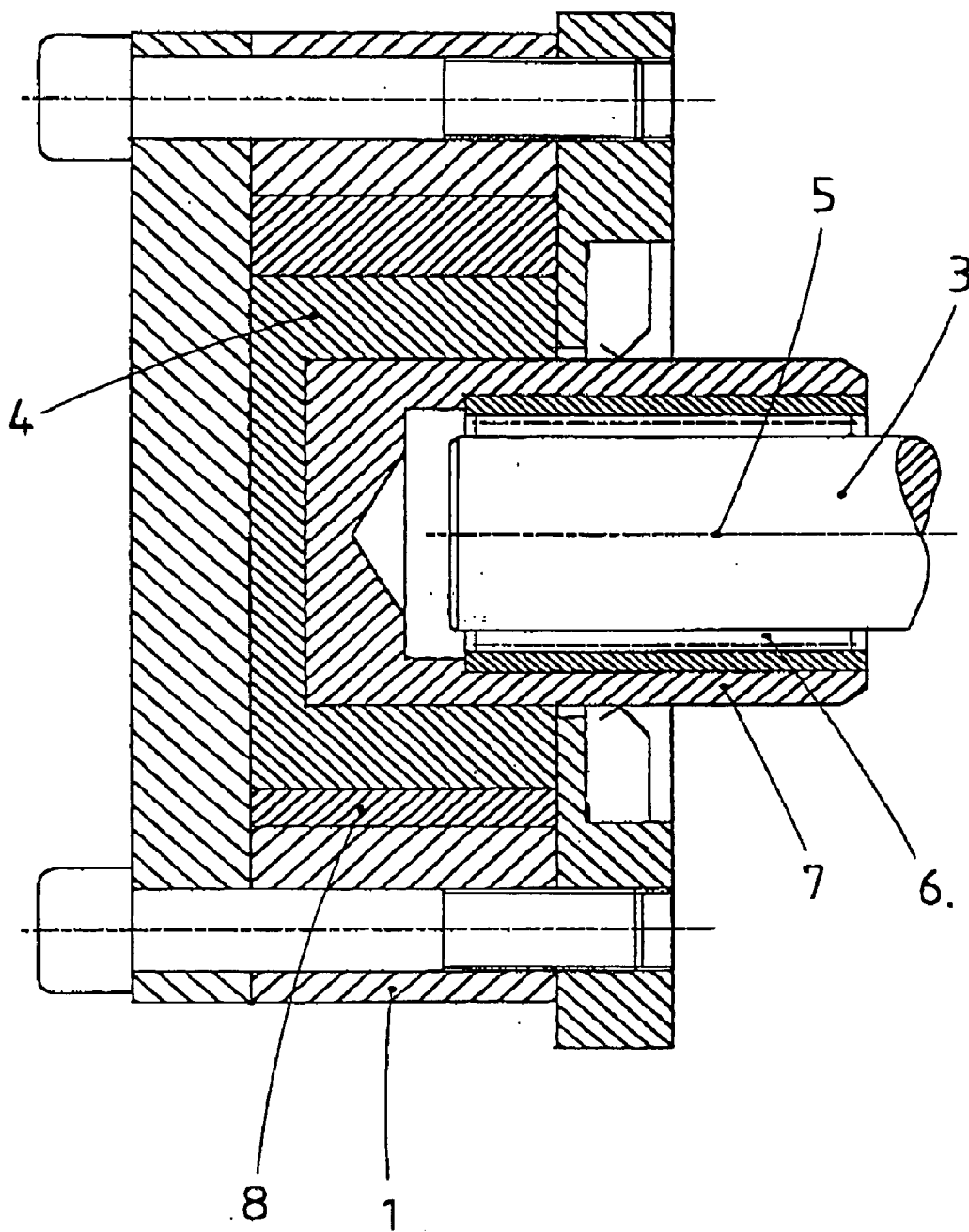


Fig. 3

Schnitt A - A



SELF-CENTERING GEAR PUMP

[0001] The invention relates to a self-centering gear pump, in particular for conveying and metering free-flowing pastes and liquids, but operating within various temperature ranges during the conveying process, by means of an externally toothed plastic drive gear inserted axially on a central smooth motor shaft without a positive-fit connection and a hollow gear which is disposed eccentrically to the motor shaft and meshes on its interior face and rotates within a cylindrical housing which is closed off on both sides by lateral walls, but rests laterally with the inner wall in a sliding manner on the hollow gear and on the drive gear with little running play, with the side wall averted from the motor comprising an inlet and outlet opening for the passage of the liquids through the pump.

[0002] Special means and preparations are necessary in this kind of machine with over-mounted hollow gear and stationary revolving drive gear in order to achieve optimal conveying precision.

[0003] It is known for example that the hollow gear and the drive gear seal off by means of stone walls which are pressurized laterally with spring force (DE 451 437 C). In other machines with vertical installation the own load of the rotating rotor performs the sealing (U.S. Pat. No. 1,631, 592).

[0004] Since the rotating displacement elements should rotate for the purpose of easier mobility also for non-lubricating liquids and in the case of larger thermal expansion, a special grading of pumps for different temperature ranges is mandatory.

[0005] The invention stated in claim 1 is based on the object of providing a self-centering gear pump that can evenly convey and meter in a regenerative manner free-flowing pastes and non-lubricating liquids even when used at a large variety of temperature ranges.

[0006] This object is achieved by the features of claim 1.

[0007] A preferred embodiment of the invention can be obtained from the features of claim 2.

[0008] Claim 1 of the invention allows consistent functionality with materially similar coefficients of expansion at growing thermal expansion even with larger temperature differences, with an axial thrust in the case of thermal elongation of the drive shaft 3 not being transmitted onto the drive gear 4 which is carried by the same. Any radial thermal expansion of the drive gear 4 and the over-mounted revolving hollow gear 8 is absorbed and compensated by the free space 16 which is present on the suction side within the oblong-shaped inner space of the housing. The rotating gearing elements can level out and position itself in a sliding fashion in its optimal position both axially as well as radially during the work process for every temperature range.

[0009] The self-centering gear pump consists of a circular inner space of the housing which is arranged slightly as an oblong hole between the central axis 17 and 18 in which a rotatable, smooth drive shaft 3 which is held in a central manner without any positive-fit connection carries an axially displaceable drive gear 4 made of plastic. When the smooth drive shaft 3 is rotated in the direction of the arrow about the stationary central point 5, the arising torque is used by means of a roller free-wheel in a sudden way for the

non-positive connection between the drive shaft 3 and the gear hub 7 within the drive gear 4 and entrains the same in its rotary movement according to the direction of rotation.

[0010] The drive gear 4 which is continually in meshing engagement 9 with the over-mounted, internally geared hollow gear 8 which has one tooth more performs a circular revolving movement about the stationary central point 5, whereas simultaneously the hollow gear 8 slides in a revolving manner on the inner side along the wall of the semi-circle 10 in the inner wall of the housing.

[0011] The difference 1 in the number of teeth between the drive gear 4 and the hollow gear 8 produces a relative movement between the two, as a result of which continuously changing hollow spaces 11 are formed which extend on the suction side from zero to the largest expansion and decrease again back to zero on the pressure side, which ensures that the liquid to be conveyed is sucked into the interior of the pump via the pump entrance 12 and the overflow channel 13 and is displaced on the pressure side through the overflow channel 14 to the pump output 15.

[0012] The invention is explained below in closer detail by reference to an embodiment shown in the drawings, wherein:

[0013] FIG. 1 shows a sectional representation of the front view of a self-centering gear pump;

[0014] FIG. 2 shows a front view of a self-centering gear pump with a housing cover placed thereon;

[0015] FIG. 3 shows a sectional view along A-A according to FIG. 2 in a self-centering gear pump.

[0016] As a result of the drive of the smooth drive shaft 3 in the direction of the arrow about the stationary central point 5, the arising torque abruptly produces the non-positive connection between the drive shaft 3 and the gear hub 7 by means of the roller free-wheel 6 and the axially inserted drive gear 4 and makes the drive gear 4 perform a rotary movement. Through the continual gear meshing 9, the internally toothed hollow gear 8 which has one tooth more is also made to rotate in a sliding manner along the inner-wall semi-circle 10 of the housing 1. The difference 1 in the number of teeth between the drive gear 4 and the hollow gear 8 produces a relative movement between the two and forms hollow spaces 11 which extend their volume on the suction side from zero to the largest expansion and decrease again back to zero on the pressure side, which ensures that the liquid to be conveyed is sucked into the interior of the pump via the pump entrance 12 and the overflow channel 13 and is pushed on the pressure side through the overflow channel 14 to the pump output 15.

What is claimed is:

1. A self-centering gear pump with the following features:

- a) a drive gear (4) which is made of plastic and can be mounted axially with the gear hub (7) is held in a cylindrical housing (1) by a smooth, circular, rotatably held drive shaft (3);
- b) the drive gear (4) is rigidly connected in a non-detachable way by means of a non-positive connection to the gear hub (7);
- c) by driving the drive shaft (3) about the stationary center point (5) an arising torque abruptly produces the non-

positive connection between drive shaft (3) and gear hub (7) by means of a roller free-wheel (6), with the rollers of the roller free-wheel (6) clamping over the entire circumference on the smooth surface of the drive shaft (3), but detaching again upon standstill of the drive shaft (3);

- d) through continual gear meshing (9) the hollow gear (8) which has one tooth more is made to perform a relative rotary movement towards the driving drive gear in a manner sliding along the inner-wall semi-circle (10) within the housing (1);
- e) the cylindrical housing (1) has a circular inner space of the housing which is slightly arranged as an oblong hole and in which the inner wall is arranged as a short straight line between the central axes (17) and 18);
- f) in the case of operationally induced heating of the material, any radial heat expansions of the elastic hollow gear (8) or drive gear (4) are displaced into and compensated in the available free space (16);
- g) when using the roller free-wheel (6) and in the case of an axial thermal elongation of the drive shaft (3), said roller free-wheel is used for compensating the thermal elongation through the axial displacement possibility of the drive gear (4) on the smooth drive shaft (3).

2. A self-centering gear pump with the following features:

- a) a drive gear (4) which is made of plastic and can be mounted axially with the gear hub (7) is held in a cylindrical housing (1) by a smooth, circular, rotatably held drive shaft (3);
- b) the drive gear (4) is rigidly connected in a non-detachable way by means of a non-positive connection to the gear hub (7);
- c) by driving the drive shaft (3) about the stationary center point (5) in the direction of the arrow an arising torque abruptly produces the non-positive connection between drive shaft (3) and gear hub (7) by means of a roller free-wheel (6), with the rollers of the roller free-wheel (6) clamping over the entire circumference on the smooth surface of the drive shaft (3), but detaching again upon standstill of the drive shaft (3);
- d) through continual gear meshing (9) the elastic hollow gear (8) which has one tooth more is made to perform

a relative rotary movement towards the driving drive gear (4) in a manner sliding along the inner-wall semi-circle (10) within the housing (1);

- e) the drive gear (4) has a difference in teeth of 1 with respect to the hollow gear (8), with the semi-circular tooth geometry of the drive gear (4) being arranged as a positive shape and that of the hollow gear (8) as a negative shape;
- f) the cylindrical housing (1) has a circular inner space of the housing which is slightly arranged as an oblong hole and in which the inner wall is arranged as a short straight line between the central axes (17) and 18);
- g) in the case of operationally induced heating of the material, any radial heat expansions of the elastic hollow gear (8) or drive gear (4) are displaced into and compensated in the available free space (16);
- h) when using the roller free-wheel (6) and in the case of an axial thermal elongation of the drive shaft (3), said roller free-wheel is used for compensating the thermal elongation through the axial displacement possibility of the drive gear (4) on the smooth drive shaft (3);
- i) the relative movement between drive gear (4) and hollow wheel (8) forms hollow spaces (11) which extend their volumes on the suction side from zero to the largest expansion and decrease the volume again back to zero on the pressure side;
- j) the enlargement of the hollow spaces (11) on the suction side ensures that the liquid to be conveyed is sucked in through the pump input (12) via the overflow channel (13) into the interior of the pump;
- k) the reduction of the hollow spaces (11) on the pressure side ensures that the liquid to be conveyed is displaced again via the pressure-side overflow channel (14) through the pump output (15).

3. A self-centering gear pump as claimed in claim 1 or claim 2, characterized in that the rotating gear parts of drive gear (4) and hollow gear (8) have the same coefficients of expansion with respect to their material as the housing (1).

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