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(54) Process and device for dosing and extrusion of bicomponent sealant

(57) The present application relates to a procedure and a device for extruding, according to a variable volumetric ratio, liquid components, including very high viscosity components, called the base product and the catalyst, of a dual-component sealant (or in any case a dual-component product) and pumping them into other devices such as a mixer and an extrusion gun.

The device is made up of two dosing cylinders, (the base product cylinder that functions as the 'master' cylinder and the catalyst cylinder that functions as the 'slave' cylinder), whose pistons are driven by rods placed parallel between themselves. The piston stroke of the 'master' cylinder is driven by the pressure of the base product obtained by means of a pump that suctions the product out of a drum, while the movement of the 'slave' cylinder rod is driven by a mechanical transmission which is set in motion by the 'master' cylinder rod. The pump that suctions the catalyst therefore only feeds the 'slave' cylinder. The mechanical transmission between the movement of the 'master' cylinder rod and the 'slave' cylinder rod, is variable due to the substitution of the components of the kinematic movement but is strictly constant during piston strokes. Appropriate valves, such as slide valves, enable the device to function continuously insofar as they invert the piston strokes when the base product piston comes to its stroke end.

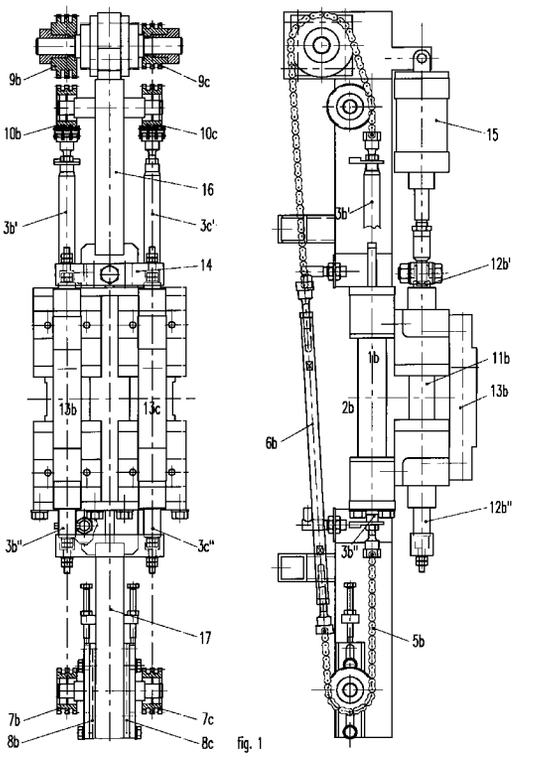

fig. 1

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Description

The present application relates to a procedure and a device for extruding, according to a variable volumetric ratio, liquid components, including very high viscosity components, called the base product and the catalyst, of a dual-component sealant (or in any case a dual-component product) and pumping them into other devices such as a mixer and an extrusion gun.

In the specific sector of machines that process the components which make up insulating glass panes, comprised of at least two glass plates with at least one spacer frame between them, which usually features a hollow aluminium profile, the principle manufacturers have developed and constructed specific machine components. These machines are either manual, semiautomatic or automatic and carry out perimeter sealing (known as the second sealing) for joining purposes, with adhesive and cohesive properties, mechanical and chemical resistance and as far as possible, impermeability to gas and vapours, of the above components (panes and spacer frame/s).

Another sector that uses machines to dose/mix/pump dual-component sealants is the automobile industry where, either manual, semi-automatic or automatic procedures apply the sealant, made up of two components, which has been previously dosed and mixed, to the structural parts or simply to the body parts that are to be sealed together.

An additional sector that uses the same machines (or very similar ones) is the painting sector that makes use of dual-component products.

Generally the volumetric dosing ratio of the two components, the first called the base product and the second called the catalyst, varies from 13.1 to 7.1, according to the type of products used (polysulphuric-, polyurethane-, silicone-based products etc.) and to the manufacturers of these same products (at the same time not excluding other possible proportions in function to future developments in sealing product technologies).

The machines employed in the aforementioned sectors (but not necessarily limited to those sectors), utilise, for the correlation of the movements of the pistons for the base product and the catalyst product respectively, in order to achieve a proportion of the volumes pumped, a lever system which carries out angular and non-linear movements, which entail an error inherent to kinematic movement. In other words, the theoretic volumetric dosing ratio is respected only when infinitesimal angular movements are carried out, whereas, when the angular movement becomes finite, the effective dosing diverges, even greatly, from the theoretic value.

In order to avoid this error, which is due to kinematic movement based on angular movements, a theoretic attempt was made with success. This was achieved by Capponi & Lesina, by joining the base product and catalyst pistons respectively with a single rod and therefore aligning the proportion of movements (actually making the movements identical). However, the machine created by Capponi & Lesina has the inconvenience of not allowing modification to the dosing ratio, unless the two cylinder/piston units are replaced, and these make up the most costly part of the machine and replacement of such components calls for very onerous manual work.

Generally recognised and put to use (EP 0 471 247 A1) is the dosing of two components that make up the dual-component sealant in a machine which operates in manual mode (for limited, or special-shaped insulating pane production) as well as automatic mode (for mass-produced insulating panes, even in small quantities) by using two dosing gear pumps. These pumps are electronically controlled by gearmotors so that, by co-ordinating the speed of the 'master' pump and the 'slave' pump respectively, and applying proper pumping load (cubic centimetre per revolution) it is possible to dose the two components in the desired proportion. This is a valid system, but is costly and is especially onerous for manual mode, moreover, due to the abrasiveness of the products, the gear pumps are subjected to harder wear than piston pumps.

Generally recognized and put to use (in an automatic machine belonging to the applicant) is the dosing of two components in automatic mode by means of employing two 'syringes' whose section ratio makes up the volumetric dosing ratio. These syringes are equipped with positive dosing runs and negative reloading runs. Specific valves switch over in correspondence to the run limit of the syringes so that the products may be discharged during the dosing phase and added during the reloading phase. The movement of the syringes is obtained by means of a screw/nut-screw mechanism driven by a gearmotor, whose variable speed motor has an electronic drive that also controls the movements of the glass pane and the sealing head according to the standard parameters of the insulating glass pane, in order to apply the pre-dosed and pre-mixed sealant in correspondence to the perimeter of the insulating glass pane.

This procedure and relative device, even though valid from a constructional and functional point of view (in fact, no dosing errors inherent to traditional crank mechanisms are present), are limited, in that they cannot vary the dosing ratio of the two components unless the syringe diameter ratios are changed. This entails long hours of work and costly replacement of the components. Furthermore, the principle applied brings about a positive dosing run and negative reloading run and, unless big syringes are used for large insulating glass panes and/or panes with thick spacer frames, the sealing process will have to be stopped so that the components can be re-loaded.

The aim of the present invention is to realise a procedure and a device that enable the precise dosing of the two components needed to make up the dual-component sealant, insofar as the two dosing pistons are correlated to linear kinematic movement (and therefore without the errors inherent to angular kinematic move-

ment), and at the same time that allow the possibility of varying the dosing ratio according to the type of products (polysulphuric-, polyurethane-, silicone-based products etc.) and to the manufacturers of these same products. Lastly, but no less important, is the possibility of not stopping the dosing process in order to re-load the dosing devices, in other words, to achieve a procedure and a device that can function in continuous mode. Another aim is to find a solution which is reliable, safe to use and competitive, owing to the simplicity and modularity of its components.

Finally, another important aim is to enable easy maintenance and cleaning of the device, insofar as the machines used to date, besides being mechanically and hydraulically complex, make use of high pressure tubes which need to be flexible as they have to follow kinematic movements which makes maintenance very onerous, even for simple cleaning or for removal of a component or components or mixtures that become hardened (catalyzed), or when manoeuvre errors are made or when there is a change in the physical chemistry of the products.

All the above aims are conveniently and industrially achieved by a device which is the object of this paper, according to the following descriptions, the initial summary and the second detailed description.

The device is made up of two dosing cylinders, (the base product cylinder that functions as the 'master' cylinder and the catalyst cylinder that functions as the 'slave' cylinder), whose pistons are driven by rods placed parallel between themselves. The piston stroke of the 'master' cylinder is driven by the pressure of the base product obtained by means of a pump that suctions the product out of a drum, while the movement of the 'slave' cylinder rod is driven by a mechanical transmission which is set in motion by the 'master' cylinder rod. The pump that suctions the catalyst therefore only feeds the 'slave' cylinder. The mechanical transmission between the movement of the 'master' cylinder rod and the 'slave' cylinder rod, is variable. Appropriate valves, such as slide valves, enable the device to function continuously insofar as they invert the piston strokes when the base product piston comes to its stroke end.

More in detail, the device is made up according to only one of the possible construction methods, as other solutions could be mechanical-hydraulic based on the same principle, of the essential components as indicated in figure 1.

The base product side (master) includes a cylinder (1b) inside of which is lodged a piston (2b), connected to the rods (3b' and 3b") whose ends are correlated to a kinematic mechanism (4b) essentially made up of a chain (5b) a tightener (6b), an idle pinion (7b) mounted on an adjustment slide (8b), a drive pinion (9b), an alignment pinion (10b). The following are placed parallel to the dosing cylinder and are appropriately connected to: a distributor, for example a slide valve (11b) from which the rods extend (12b' and 12b"), a union block (13b).

The side of the catalyst product (slave) includes a cylinder (1c) inside of which is lodged a piston (2c), connected to the rods (3c' and 3c") whose ends are correlated to a kinematic mechanism (4c) essentially made up of a chain (5c) a tightener (6c), an idle pinion (7c) mounted on an adjustment slide (8c), a drive pinion (9c), an alignment pinion (10c). The following are placed parallel to the dosing cylinder, and are appropriately connected to: a distributor, for example a slide valve (11c) from which the rods extend (12c' and 12c"), a union block (13c).

The upper part of the rods (12b' and 12c') of the two distributors are joined by a plate (14) connected to an inverting movement cylinder (15), and the lower part of the rods (12b" and 12c") are joined, only for connecting purposes, by a plate.

All these components are adequately mounted on structural work, composed of an upper part (16) and of a lower part (17).

The section, represented in figure 2 (referring to the part relative to the base product, however, the same principle is also valid for the part relative to the catalyst product), better clarifies the continuous functioning mode of the device, and therefore, by means of the distributors (11b and 11c), for example slide valves, the cylinders automatically invert their run insofar as the entry of the cylinders is exchanged with the exit each time the piston reaches its stroke end which is detected by a sensor that transmits the inversion signal to the distributors (11b and 11c) by means of the pneumatic cylinder (15). To better illustrate this inversion mechanism, figure 3 displays the two functioning modes; namely, in figure 3a, the dosing cylinder works with infeed from below and delivery from above; in figure 3b, the dosing cylinder's work mode is inverted (the fluid being loaded is represented in grey and the fluid being delivered is represented in black). Again this is the dosing cylinder of the base product, however, the same principle is also valid for the cylinder relative to the catalyst product.

The dosing ratio (volumetric) of the two components (base product and catalyst) is achieved at the value desired and kept constant throughout the development of the dosing runs by correlation of the movements of the two cylinders and is adjustable simply by replacing the drive pinions (9b and 9c). In this way the correlation of the movement of the two pistons is linear, which is a basic concept for a uniform dosing ratio; this is achieved, regardless of the position of the pistons of the dosing cylinders (something which does not take place with any other adjustable ratio dosing system currently found on the market).

This solution therefore, in its original version, and also in all the other possible variants, within the concept of equivalence, and other combinations, achieves the predetermined purposes as described herein, and principally in the fact of having invented a procedure and a device that enable a volumetric dosing ratio which is adjustable yet absolutely constant throughout all the strokes of the dosing pistons, of liquid components

including very high viscosity components, called the base product and the catalyst, of a dual-component sealant (or in any case of a duel-component product) and pumping them into other devices such as a mixer and an extrusion gun.

Furthermore, the device is structurally simple and therefore can be constructed at low cost.

The device referred to in this application can of course be subject to numerous modifications and changes, all within the ambience of the same invention concept.

Consequently, on the basis of specific requirements, even the materials making up the individual components would be the most pertinent.

Claims

1. A procedure for dosing, in the required volumetric ratio, liquid components, including very high viscosity liquid components, called the base product and the catalyst, of a dual-component sealant (or in any case a dual-component product) and pumping them into other devices such as a mixer and an extrusion gun, characterised by the use of two dosing cylinders whose pistons are connected to each other by a linear mechanical transmission, in other words, a transmission which maintains a proportional correlation of movements during all the piston strokes, so as to achieve a strictly constant volumetric dosing ratio and this ratio may be chosen according to the value desired by the substitution of one or more of the components of the kinematic transmission.

2. A device for dosing, in the required volumetric ratio, liquid components, including very high viscosity liquid components, called the base product and the catalyst, of a dual-component sealant (or in any case a dual-component product) and pumping them into other devices such as a mixer and an extrusion gun, characterised by the use of two dosing cylinders whose pistons are connected to each other by a linear mechanical transmission, in other words, a transmission which maintains a proportional correlation of movements during all the piston strokes, so as to achieve a strictly constant volumetric dosing ratio and this ratio may be chosen according to the value desired by the substitution of one or more of the components of the kinematic transmission.

3. The device as referred to in claim 2 characterised by the fact that the correlating mechanical transmission of the movements of the two pistons is achieved by kinematic mechanisms such as pinion gears/crown gears/chains or gear wheels and racks or bolts and nut screws or similar kinematic mechanisms, all having the exclusive capacity of creating a linear correlation between the piston movements of theÊ'master' and 'slave' products respectively.

4. The device as referred to in claim 2, characterised by the fact that the inversion of the piston strokes is achieved by valves, for example slide valves, carrying out the simultaneous inversion of the piston strokes insofar as the control of the valves is also carried out simultaneously.

5. The device as referred to in claim 2, characterised by the fact that the rods of the pistons go through the entire length of the cylinder so that the volumetric displacement of the forward stroke is identical to the backward stroke.

6. The device as referred to in claim 2, characterised by the fact that any variations in pressure that may occur during transient strokes, for example during the inversion of the piston strokes, or any imperfect pressure stability and load of the product infeeding pumps, are compensated by one or more devices such as a cylinder with a membrane which is subjected to pressure by gas.

7. The procedure and the machine according to one, or more than one, of the above claims, characterised as described and illustrated in the enclosed tables and diagrams.

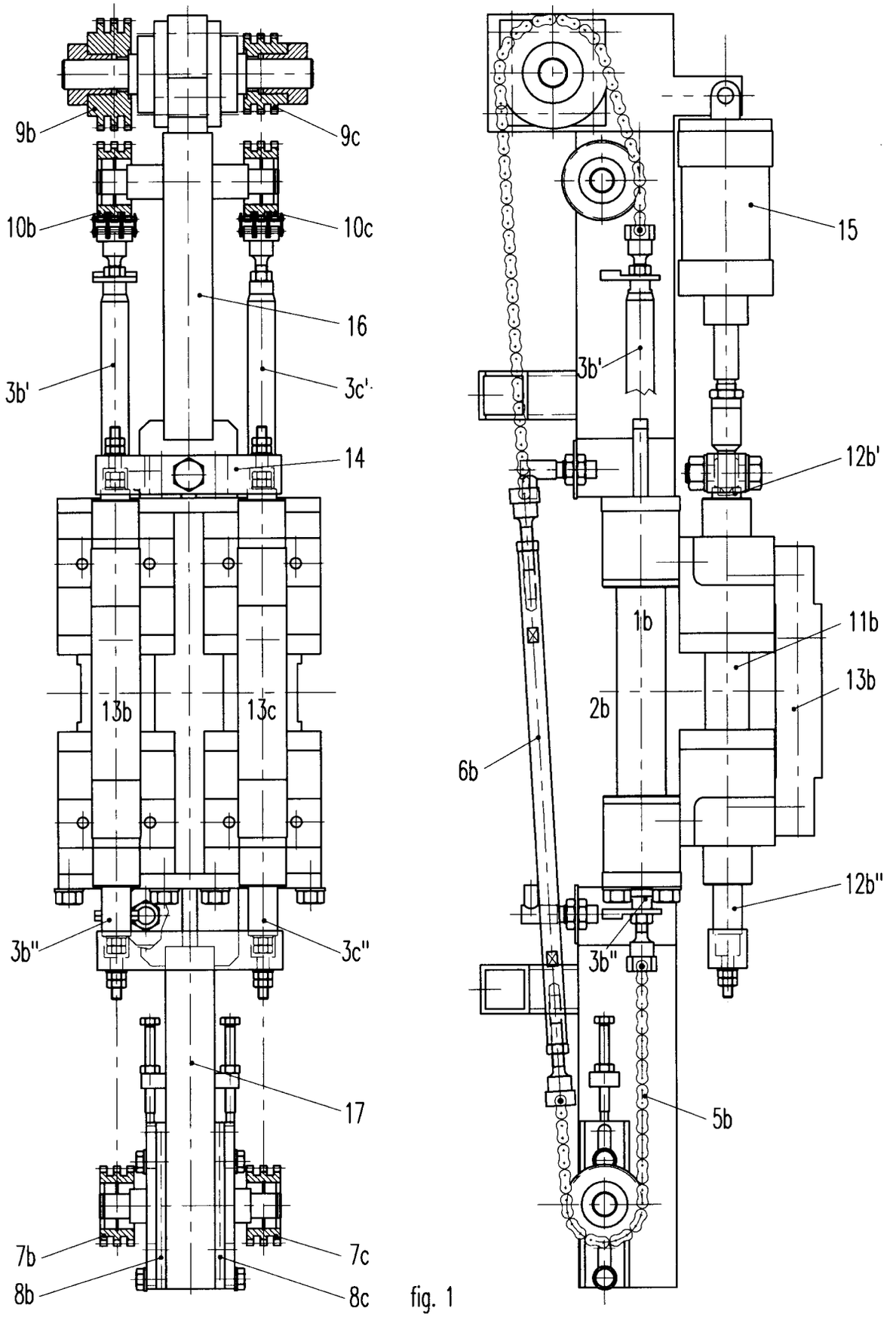
9b
9c
10b
10c
16
3b'
3c'
14
13b
13c
3b"
3c"
17
7b
7c
8b
8c
15
3b'
12b'
1b
11b
13b
2b
6b
12b"
3b"
5b

fig. 1

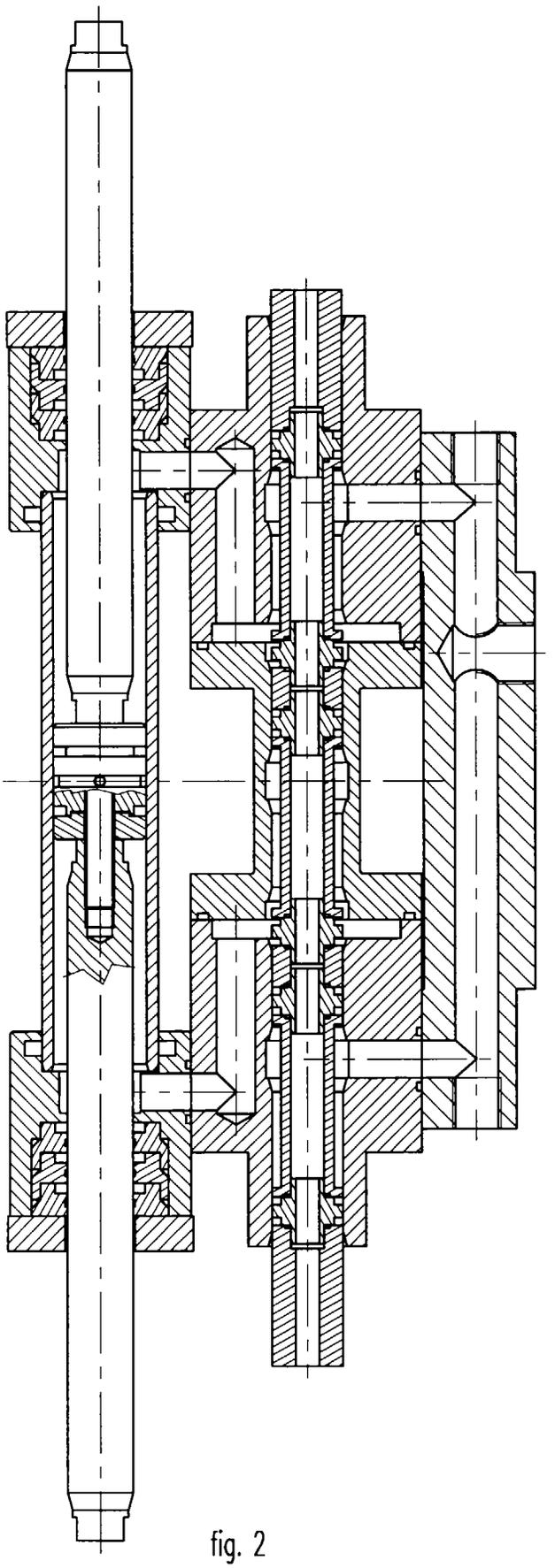

fig. 2

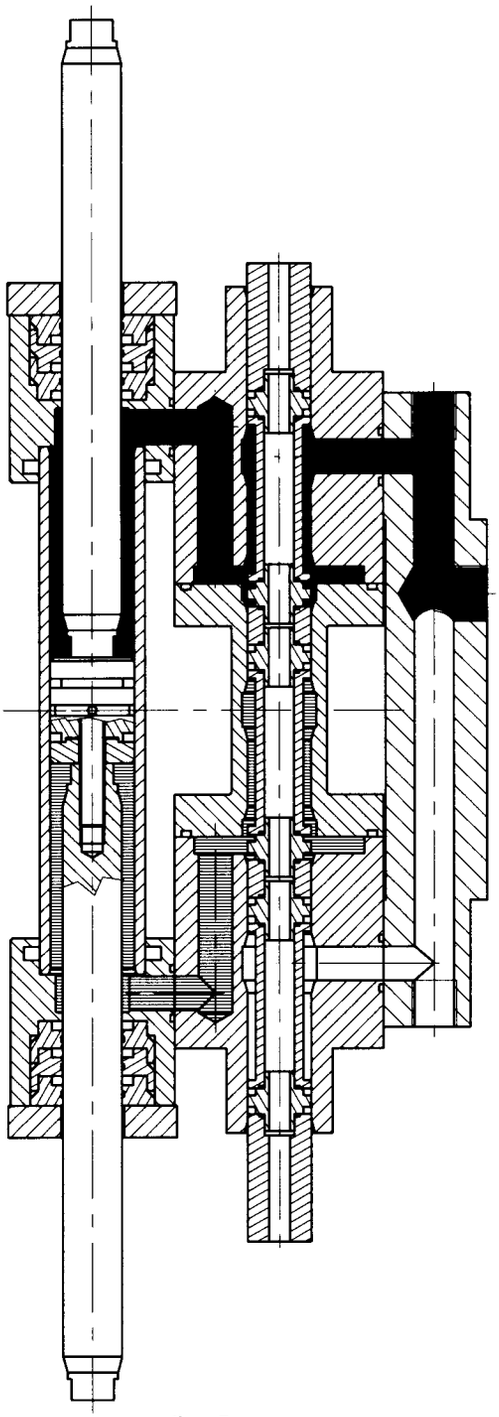

fig. 3a

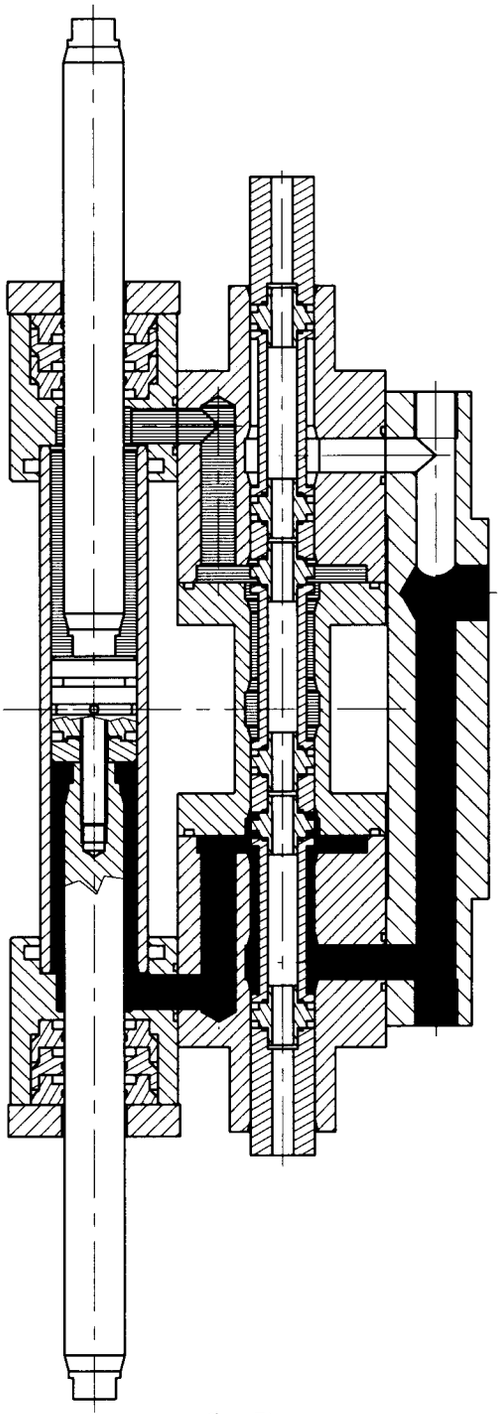

fig. 3b

fig. 3