A multi-follower compressor includes a cylinder block, a cam, plural followers, and at least one connecting rod. The cylinder block has a compression room, plural intake channels, plural exhaust channels, and plural accommodation rooms, each of which is communicative in space with the compression room and outsides of the cylinder block, and among which a clockwise pattern for arranging one intake channel, one accommodation room and one exhaust channel is applied. The cam inside the compression room sleeves a driving shaft. Each of the followers, nested in an accommodation room, has one end contacting the cam and another end performing an axial movement along the accommodation room. The connecting rod having two ends to couple different followers is displaced with the coupled followers. The followers connected with the connecting rod are located along the same axis in a parallel manner.
MULTI-FOLLOWER ROTARY COMPRESSOR
AND SECTIONAL-COMPRESSING METHOD
FOR THE SAME

CROSS REFERENCE TO RELATED
APPLICATION

[0001] The present application is based on, and claims priority from, Taiwan (International) Application Serial Number 103120051, filed on June 10, 2014, the disclosure of which is hereby incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to a multi-follower compressor and a sectional-compressing method for the multi-follower compressor, and more particularly to the rotary compressor having a symmetric follower that adopts a sectional-exhausting method to reduce the power consumption, to minimize the mechanical wears, and to extend the service life.

BACKGROUND

[0003] The compressor is the heart of an air conditioner or the like ventilation system. In particular, thanks for the development in precision machining, the rotary compressor superior in various manifolds is widely applied to the small-capacity or mini-compressing apparatuses. Generally, the majority of the small-capacity or mini rotary compressors are the rolling rotor compressors. The rolling rotor compressor has the features of:

[0004] (1) simply structuring with less components;
[0005] (2) reliable operation with less vulnerable components;
[0006] (3) no suction valve, less backlash volume, and higher coefficient of capacity;
[0007] (4) less volume occupation, less weight, and more balanced operation among various compressors under the same refrigerating capacity;
[0008] (5) less energy consumption and lower noise level during operation; and
[0009] (6) higher demand in machining precision.

[0010] Referring now to FIG. 1, structuring of a conventional rotary rolling-rotor compressor is schematically shown. In this compressor, a cylinder block 3 with a round cross section includes a compression room 9, an intake channel 7 and an exhaust channel 5, in which the intake channel 7 and the exhaust channel 7 are individually communicative in space with the compression room 9. In order to avoid reflective flows of the pressured steam during operations, an exhaust valve 6 is included in the exhaust channel 5 so as to selectively seal the channel 5. As shown, the central line of the cylinder block 3 is collinear with the axle of the compressor. A driving shaft 2 extending along the axle and located inside the compression room 9 is driven to rotate by a foreign motor (not shown in the figure). A sleeve cam 1 made of a steel shell is to sleeve the driving shaft 2. In the art, the combination of the driving shaft 2 and the sleeve cam 1 is called as a rotational rotor (the rotor hereinafter). The rotor is dynamic to contact tightly at the inner wall of the cylinder block 3. The rotor rotates inside the cylinder block 3 so as to squeeze dynamically the compression room 9 to form a moving space having a crescent-shape cross section. The cylinder block 3 further has an accommodation room G located between the intake channel 7 and the exhaust channel 5. The accommodation room G is to receive a follower 4 having one end contacting at an exterior wall of the sleeve cam 1 and another end coupling a spring member 8, in which the follower 4 can perform a reciprocating linear motion with respect to the accommodation room G.

[0011] Refer now to FIGS. 2A–2D, in which different operational stages of the conventional rotary rolling-rotor compressor of FIG. 1 are demonstrated. As the axle rotates to drive the rotor to roll along the inner wall of the cylinder block 3, the crescent-shape compression room 9 displaces but keeps the shape and volume. By having the spring member 8 to provide a persistent spring force, one end (the lower end) of the follower 4 can keep contact with the rotor, such that the compression room 9 can be divided into two pressure chambers, one intake chamber located communicative in space with the intake channel 7 and one exhaust chamber located communicative in space with the exhaust channel 5. While the rotor rolls counter-clockwise, the volume of the intake chamber increases gradually so as to reduce the pressure for forming a vacuum chamber for introducing the air. Simultaneously, the volume of the exhaust chamber shrinks gradually so as to compress the internal air for forming a high-pressured chamber to open the exhaust valve 6, at a predetermined internal pressure, and thus to expel the air through the exhaust channel 5. Such a working pattern of air-introducing, compressing, and air-expelling can be cycled by repeatedly generating comprehensive pressure differences between the high-pressure chamber and the vacuum chamber inside the compression room 9. Yet, a need of bigger torque and power output from the motor for driving the rotor to follow the aforesaid working pattern is thus inevitable.

[0012] As stated above, now refer to FIGS. 3A–3C, in which the aforesaid abnormal operations of the rotary rolling-rotor compressor of FIG. 1 are demonstrated schematically. For a pretty big pressure difference would be generated within the working pattern of the aforesaid compressor, the follower 4 to endure the pressure difference would be tilted by a lateral forcing F. The lateral forcing F can be computed by multiplying the pressure difference and the working area of the follower 4. As the pressure difference increases, the lateral forcing F would be proportionally increased. While the lateral forcing F acts at the follower 4, an anti-forcing would be formed at the opposing end of the follower 4 in the accommodation room G. The anti-forcing on the follower 4 would humble the reciprocation motion of the follower 4. After a long-term service, the wear between the follower 4 and the sleeve cam 1 would be remarkable, and thereby occasional spacing formed by accidental separation of the follower 4 and the sleeve cam 1 would leak the air, reduce the internal pressure able to be achieved, decrease the service life and degrade the working efficiency. Further, while the separated follower 4 re-lands on the sleeve cam 1 by the spring force of the spring member 5, a noise would be generated. In addition, the lateral forcing F on the follower 4 would speed up the fatigue of the spring member 8. Consequently, as the compressor keeps operated, the frequency of separation between the follower 4 and the sleeve cam 1 would be increased, the air-leakage would become significant, and the noise would become bigger and frequently. Thus, the service life and the work efficiency of the compressor would be greatly reduced.

SUMMARY

[0013] Accordingly, the primary object of the present invention is to provide a multi-follower compressor and a
sectional-compressing method for the same, in which sectional compressing and sectional exhausting are applied to an operational cycle of the rotor so as to effectively reduce the power output of the motor. The multi-follower compressor comprises:

[0014] a hollow cylinder block, further having a compression room, a plurality of intake channels, a plurality of exhaust channels and a plurality of accommodation rooms; an arrangement pattern of one intake channel, one accommodation room and one exhaust channel in a clockwise order around the cylinder block be repeatedly applied to construct the plurality of intake channels, the plurality of exhaust channels and the plurality of accommodation rooms, each of the plurality of intake channels, the plurality of exhaust channels and the plurality of accommodation rooms be communicative in space between the compression room and outside of the cylinder block, each of the plurality of exhaust channels having therein a valve for sealing the corresponding exhaust channel;

[0015] a sleeve cam, located inside the compression room, a portion of a circumferential wall of the sleeve cam being contacted with an inner wall of the cylinder block, the sleeve cam sleeveing thereinside a driving shaft having one end coupled with a foreign motor;

[0016] a plurality of followers, each of the followers being nested in a corresponding one of the plurality of the accommodation rooms, one end of the follower being contacted with another portion of the circumferential wall of the sleeve cam, each of the followers being able to perform an axial movement inside and along the corresponding accommodation room; and

[0017] at least one connecting rod, located outside the cylinder block without contacting the cylinder block, one end of the connecting rod being coupled with another end of corresponding one of the followers while another end of the connecting rod being coupled with another end of another corresponding one of the followers.

[0018] In one embodiment of the present invention, the connecting rod coupled with the followers is moved with the axial movement of the corresponding followers, and the followers coupled with the connecting rod are located along the same axis in a parallel manner. Further, the plurality of the intake channels, the plurality of the exhaust channels, the plurality of the accommodation rooms and the plurality of the followers are all have the same number.

[0019] In the present invention, the sectional-compressing method for the multi-follower compressor is able to provide at least one operational pattern of a first stage intake—a first compression—a first stage exhaust—a second stage intake—a second compression—a second stage exhaust in an operational cycle. By changing the conventional art in having a single follower and a spring for elastic movement of the follower, the rotor of the multi-follower compressor in accordance with the present invention can generate plural sectional compressing and sectional exhausting during an operational cycle, such that the output power of the motor can be reduced, the abnormal operation described in the background section can be significantly minimized for the lateral forcing force is distributed evenly to the followers, and thus the service life as well as the operational efficiency can be substantially improved.

[0020] Further scope of applicability of the present application will become more apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating exemplary embodiments of the disclosure, are given by way of illustration only, since various changes and modifications within the spirit and scope of the disclosure will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The present disclosure will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus are not limiting of the present disclosure and wherein:

[0022] FIG. 1 is a schematic view of a conventional rotary rolling-rotor compressor;

[0023] FIGS. 2A–2D demonstrate schematically different operational stages of FIG. 1;

[0024] FIGS. 3A–3C demonstrate schematically abnormal operations of FIG. 1;

[0025] FIG. 4 is a schematic view of a first embodiment of the multi-follower compressor in accordance with the present invention;

[0026] FIGS. 5A–5D demonstrate schematically different operational stages of FIG. 4;

[0027] FIG. 6 is a schematic view of a second embodiment of the multi-follower compressor in accordance with the present invention;

[0028] FIGS. 7A–7D demonstrate schematically different operational stages of FIG. 6;

DETAILED DESCRIPTION

[0029] In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

[0030] In the present invention, the multi-follower compressor and the sectional compressing method for the multi-follower compressor apply a symmetric followers to a rotary compressor, and also introduce a sectional operational pattern of intake-compression-exhaust to reduce the output power of the motor and the wears of the compressor so as to increase the service life of the compressor and to reduce the noise thereof.

[0031] Referring now to FIG. 4, a schematic view of a first embodiment of the multi-follower compressor in accordance with the present invention is shown. The multi-follower compressor is mainly applied to the rotary compressors. In the first embodiment, the multi-follower compressor includes a hollow cylinder block 30, a sleeve cam 10, a driving shaft 20, a first follower 41, a second follower 42 and a connecting rod 81 having one end coupled with the first follower 41 and another end coupled with the second follower 42.

[0032] The cylinder block 30 can have a cross section shaped as, but not limited to, a circle, a rectangle, a polygon, or any the like. In this embodiment, a circular cross section is applied. As shown, the round hollow space of the cylinder block 30 is defined as a compression room 90. The cylinder block 30 has a first intake channel 71, a second intake channel 72 located oppositely to the first intake channel 71, a first exhaust channel 51, and a second exhaust channel 52 located...
oppositely to the first exhaust channel 51. A first accommodation room G1 is located between the first intake channel 71 and the second exhaust channel 52, while a second accommodation room G2 is located between the second intake channel 72 and the first exhaust channel 51. Further, a first exhaust valve 61 and a second exhaust valve 62 are installed inside to the first exhaust channel 51 and the second exhaust channel 52, respectively.

0033] Each of the first intake channel 71, the second intake channel 72, the first exhaust channel 51, the second exhaust channel 52, the first accommodation room G1, and the second accommodation room G2 is individually communicative in space with the compression room 90 at one end and outsides of the cylinder block 30 at another end. While the internal pressure of the compression room 90 is less than a combination pressure value of the external pressure of the cylinder block 30 and a predetermined pressure difference, the first exhaust valve 61 and the second exhaust valve 62 are both at a close state for terminating any flow between the compression room 90 and the outsides of the cylinder block 30.

0034] The sleeve cam 10 mounted inside the compression room 90 has a portion of the circumferential wall to contact with the inner wall of the cylinder block 30. The driving shaft 20 located inside the sleeve cam 10 for driving the sleeve cam 10 to rotate thereof has one end extended to couple with a foreign motor (not shown in the figure). In the art, the combination of the driving shaft 20 and the sleeve cam 10 is defined as a rotor. The motor for driving the driving shaft 20 and further the sleeve cam 10 (i.e. the rotor) can be a pole-change motor. The rotor can be driven to roll at a varying rate along the inner wall of the cylinder block 30. In the present invention, the number of poles in the motor is dependent of the practical demands.

0035] The first follower 41 and the second follower 42 are individually received in the first accommodation room G1 and the second accommodation room G2, respectively. Each of the first follower 41 and the second follower 42 has one end to contact at the outer wall of the sleeve cam 10, while another end thereof is coupled with a connecting rod 80. The end of the follower 41 or 42 is a round tip to contact with the sleeve cam 10, while another end thereof can be fixed to the connecting rod 80 by screwing, pin-engaging or any the like. The first follower 41 and the second follower 42 are axially protrusive with respect to the first accommodation room G1 and the second accommodation room G2, respectively. With the first follower 41 and the second follower 42 protruding into the compression room 90 and further to touch the rotor, the compression room 90 is divided into two chambers. As shown, the connecting rod 80 located outside the cylinder block 30 is extended, but not touch, around the circumferential wall of the cylinder block 30. In the present invention, the connecting rod 80 can be structurally formed as, but not limited to, an arc, a □ shape or a U shape. Further, one end of the connecting rod 80 is connected with the first follower 41, while another end thereof is connected with the second follower 42.

0036] In the present invention, as the motor drives the rotor to roll along the inner wall of the cylinder block 30, following four operational states can be achieved as shown in FIG. 5A through FIG. 5G. At the first, when the sleeve cam 10 starts from the initial position and rolls to the left-end position, the first follower 71 protrudes into the compression room 90, while the second follower 72 is retrieved from the compression room 90. Thereupon, the volume of the upper portion of the left-side chamber is increased so as to formulate a low-pressure interior for introducing the air into the compression room 9 through the first intake channel 71. As the rotor rolls further to compress the incoming air, and as soon as the air pressure inside the lower portion of the left-side chamber reaches a predetermined high pressure, the first valve 61 is pushed to open so as to discharge the pressured air through the first exhaust channel 51. When the sleeve cam 10 is moved to the lowest position inside the accommodation room 90 from the left-end position, the operation of the first stage exhaust is completed. In the case that the operation of the first stage exhaust is finished, the internal air pressure of the left-side chamber is reduced so that the first valve 61 is returned back to the close state and the foreign air is re-introduced into the accommodation room 90 through the first intake channel 71.

0037] Then, the rotor keeps rolling along the inner wall of the cylinder block 30 so as to move the sleeve cam 10 from the lowest position to the right-end position. At this time, the volume of the upper portion of the right-side chamber is increased so as to formulate a lower pressure chamber to attract the intake of the foreign air into the compression room 90 through the second intake channel 72. The rotor keeps rolling to compress the intake air through the second intake channel 72. As soon as the internal air pressure in the lower portion of the right-side chamber is compressed to reach a predetermined high-pressure, the second valve 62 is then pushed to open so as to allow the internal pressured air to be discharged through the second exhaust channel 52. Finally, as the sleeve cam 10 rolls from the right-end position to the original initial position (the top position), the operation of the second stage exhaust is completed. When the operation of the second stage exhaust is finished, the internal air pressure of the right-side chamber is reduced so that the second valve 62 is returned back to the original close state and then the intake pathway of conveying the foreign air into the compression room 90 is thus back to the second intake channel 71. In the present invention, the aforesaid operation process of the first stage intake—the compression—the first stage exhaust—the second stage intake—the compression—the second stage exhaust is kept running, and simultaneously the connecting rod 80 would be displaced as a whole accordingly with the axial back-and-forth movement of the first follower 71 and the second follower 72. In particular, the connecting rod 80 and the followers 41, 42 are displaced as a unique piece for both the followers 41, 42 located along the same axis are always kept contact with the rolling rotor.

0038] Referring now to FIG. 6, a schematic view of a second embodiment of the multi-follower compressor in accordance with the present invention is provided. In the following description upon this second embodiment, only elements that are different to the aforementioned first embodiment are elucidated, and details for those elements that are similar to those in the first embodiment are omitted but keep the same numbers and names.

0039] In this second embodiment, a first spring member 810 is introduced to couple one end of a connecting rod 800 to the corresponding end of the first follower 41, while a second spring member 820 is used to couple another end of the connecting rod 800 to the corresponding end of the second follower 42. Both the first spring member 810 and the second spring member 820 can be compression springs.

0040] Refer now to FIGS. 7A–7D, in which different operational stages of the second embodiment of FIG. 6 are schematically demonstrated. The major difference of the
operations between the foregoing first embodiment and this embodiment is that, during an operational cycle, the compressor of the second embodiment can further ensure the contacts between the individual followers 41, 42 and the corresponding circumferential wall of the sleeve cam 10 by providing spring forcing of the first spring member 810 and the second spring member 820, respectively. In particular, the axial movements of the first follower 41 and the second follower 42 can be achieved by the tension and compression of the first spring member 810 and the second spring member 820, while the connecting rod 800 can substantially maintain a fixed structure during the operational cycle. Namely, the connecting rod 800 can be isolated from the axial up-and-down movements of the followers 41, 42. In this embodiment, the followers 41, 42 coupled with the connecting rod 800 can be selectively furnished either along the same axis or along distinct axes, and in either a parallel manner or a non-parallel manner.

[0041] In addition, the foregoing multi-follower compressors of the present invention can include more than one combination of the first follower 41, the second follower 42 and the connecting rod 800. To meet an embodiment having plural combinations, the cylinder block 30 shall include corresponding numbers of the intake channels, the exhaust channels and the accommodation rooms. In practice, the number of the combinations is dependent on the capacity requirement of the conditioning facilities. Apparently, no matter how the capacity or the number of the aforesaid combinations are, the sectional intaking and the sectional exhausting (i.e. the sectional-compressing method) cyclically compress and discharge the internal air in accordance with the present invention can respectively meet the demands.

[0042] Refer now to FIG. 8A and FIG. 8B, in which a typical scheme of a conventional sectional-compressing method and that of a sectional-compressing method in accordance with the present invention are shown, respectively. The major feature of the sectional-compressing method in accordance with the present invention is characterized on that:

[0043] while the rotor of the compressor experiences a complete operational cycle, the first stage intake, the first stage compression and the first stage exhaust can be performed in the first half (0°–180°) of the operational cycle; and the second stage intake, the second stage compression and the second stage exhaust can be performed in the second half (180°–360°) of the operational cycle. In particular, while the second half of the operational cycle is executed, the first stage intake is taking place at the same time. Specifically, in the present invention, the first stage intake and the second stage intake are performed through different intake channels, while the first stage exhaust and the second stage exhaust are also performed through different exhaust channels.

[0044] As described above, one of many features of the compressor in accordance with the present invention is that, within an operational cycle, one or more than one operational pattern of the first stage intake—the first stage compression—the first stage exhaust—the second stage intake—the second stage compression—the second stage exhaust can be included. In the example of the aforesaid two embodiments, though the stroke of each follower 41 or 42 is only half of that of the conventional follower described in the background section, yet the total compression capacity can be substantially maintained for plural sectional compressing and exhausting are performed in a single operational cycle of the rotor of the multi-follower compressor in accordance with the present invention. Further, it is also achieved that the power output of the motor for the instant compressor can be reduced, the abnormal operation described in the background section can be significantly minimized for the lateral forcing F is distributed evenly to the first follower 41 and the second follower 42, and thus the service life as well as the operational efficiency can be substantially improved.

[0045] The disclosure being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the disclosure, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

What is claimed is:

1. A multi-follower compressor, comprising:

a hollow cylinder block, further having a compression room, a plurality of intake channels, a plurality of exhaust channels and a plurality of accommodation rooms, in which a clockwise arrangement pattern around the cylinder block including in order one of the intake channels, one of the accommodation rooms and one of the exhaust channels is assigned to arrange the plurality of the intake channels, the plurality of the accommodation rooms and the plurality of the exhaust channels being communicative in space with both the compression room and outsides of the cylinder block; each of the plurality of the exhaust channels further having a valve to seal the corresponding exhaust channel;

a sleeve cam, located inside the compression room, a portion of a circumferential wall of the sleeve cam being contacted with an inner wall of the cylinder block, sleeving thereinside a driving shaft having one end coupled with a foreign motor;

a plurality of followers, each of the followers being nested in a corresponding one of the plurality of the accommodation rooms, one end of the follower being contacted with another portion of the circumferential wall of the sleeve cam, each of the followers being able to perform an axial movement inside and along the corresponding accommodation room; and

at least one connecting rod, located outside the cylinder block without contacting the cylinder block, one end of the connecting rod being coupled with another end of corresponding one of the followers while another end of the connecting rod being coupled with another end of another corresponding one of the followers.

2. The multi-follower compressor of claim 1, wherein the end of the connecting rod being coupled with the end of the corresponding one of the followers is moved with the axial movement of the corresponding follower, and the followers coupled with the connecting rod are located along the same axis in a parallel manner.

3. The multi-follower compressor of claim 1, wherein the plurality of the intake channels, the plurality of the exhaust channels, the plurality of the accommodation rooms and the plurality of the followers are all have the same number.

4. The multi-follower compressor of claim 1, wherein the follower is fixed to the connecting rod by one of screwing and pin-engaging.
5. The multi-follower compressor of claim 1, wherein the connecting rod is structurally formed as one of an arc, a C shape and a U shape.

6. A multi-follower compressor, comprising:
   a) a hollow cylinder block, further having a compression room, a plurality of intake channels, a plurality of exhaust channels and a plurality of accommodation rooms, in which a clockwise arrangement pattern around the cylinder block including in order one of the intake channels, one of the accommodation rooms and one of the exhaust channels is assigned to arrange the plurality of the intake channels, the plurality of the accommodation rooms and the plurality of the exhaust channels; each of the plurality of the intake channels, the plurality of the accommodation rooms and the plurality of the exhaust channels being communicative in space with both the compression room and outsides of the cylinder block; each of the plurality of the exhaust channels further having a valve to seal the corresponding exhaust channel;
   b) a sleeve cam, located inside the compression room, a portion of a circumferential wall of the sleeve cam being contacted with an inner wall of the cylinder block, sleeving therein a driving shaft having one end coupled with a foreign motor;
   c) a plurality of followers, each of the followers being nested in a corresponding one of the plurality of the accommodation rooms, one end of the follower being contacted with another portion of the circumferential wall of the sleeve cam, each of the followers being able to perform an axial movement inside and along the corresponding accommodation room; and
   d) at least one connecting rod, located outside the cylinder block without contacting the cylinder block, one end of the connecting rod being elastically coupled with another end of corresponding one of the followers via a spring member while another end of the connecting rod being elastically coupled with another end of another corresponding one of the followers via another spring member.

7. The multi-follower compressor of claim 6, wherein the end of the connecting rod being coupled with the end of the corresponding one of the followers is moved with the axial movement of the corresponding follower, and the followers coupled with the connecting rod are located either along the same axis or along distinct axes, and in either a parallel manner or a non-parallel manner.

8. The multi-follower compressor of claim 6, wherein the spring member is a compression spring.

9. The multi-follower compressor of claim 6, wherein the plurality of the intake channels, the plurality of the exhaust channels, the plurality of the accommodation rooms and the plurality of the followers are all having the same number.

10. The multi-follower compressor of claim 6, wherein the follower is fixed to the connecting rod by one of screwing and pin-engaging.

11. The multi-follower compressor of claim 6, wherein the connecting rod is structurally formed as one of an arc, a C shape and a U shape.

12. A sectional-compressing method, applied to a rotary compressor, comprising the steps of:
   a) providing a compressor having at least two followers, at least two intake channels and at least two exhaust channels, each of at least two followers having an end coupled with a connecting rod;
   b) while the rotor of the compressor experiences a complete operational cycle (0°~360°), a first stage intake, a first stage compression and a first stage exhaust being performed in order in the first half (0°~180°) of the operational cycle; and
   c) a second stage intake, a second stage compression and a second stage exhaust being performed in order in the second half (180°~360°) of the operational cycle;
   d) wherein the first stage intake is taking place at the same time while the second half of the operational cycle is executed, the first stage intake and the second stage intake are performed through different intake channels, and the first stage exhaust and the second stage exhaust are performed through different exhaust channels.

13. The sectional-compressing method of claim 12, wherein the connecting rod coupled with the corresponding followers is moved with axial movements of the corresponding followers, and the followers coupled with the connecting rod are located along the same axis in a parallel manner.

14. The sectional-compressing method of claim 12, wherein the followers coupled individually with the connecting rod are selectively mounted either on the same axis or on distinct axes and are arranged either in a parallel manner or a non-parallel manner.