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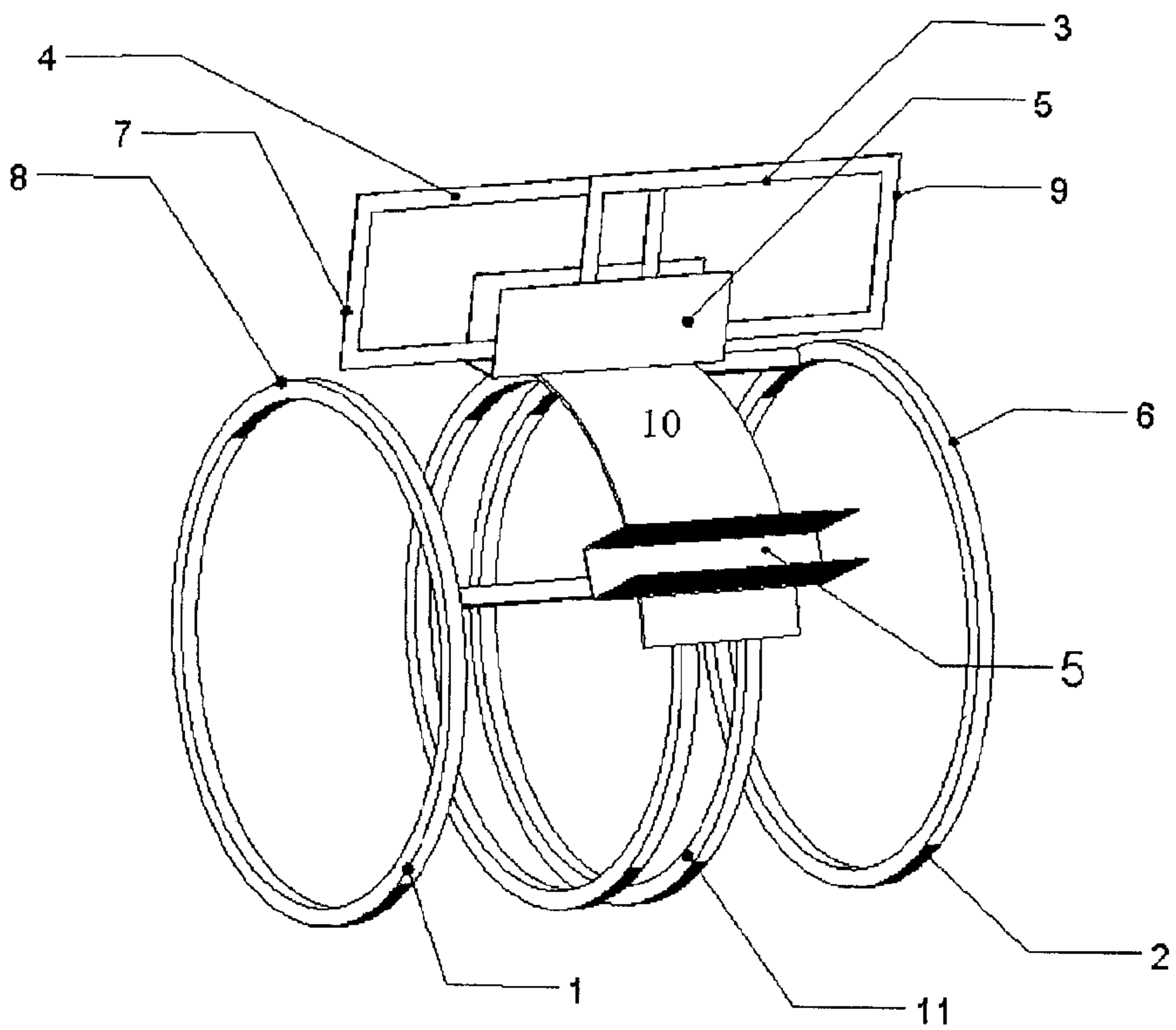
(54) **Titre : SYSTEME D'ETANCHEITE POUR LE PISTON DE MACHINES A PISTON ROTATIF**
(54) **Title: PRINCIPLE AND SYSTEM OF SEALING THE PISTON OF ROTARY PISTON ENGINES**



(57) **Abrégé/Abstract:**
Sealing system of rotary piston engines marked by the fact that the rotor consists of rotor discs arranged next to each other, sitting on a common rotor axis and pressed apart by acting spring and/or gas forces in the grooves between the discs so that the face ends of the discs pointing towards the walls of the casing are tightly sealing thus preventing any access of the medium to the axles. In the part grooves between the discs, piles of movable formed lamellae are arranged which adapt to the changing groove widths and prevent an internal flow around the rotor.

ABSTRACT

Sealing system of rotary piston engines marked by the fact that the rotor consists of rotor discs arranged next to each other, sitting on a common rotor axis and pressed apart by acting spring and/or gas forces in the grooves between the discs so that the face ends of the discs pointing towards the walls of the casing are tightly sealing thus preventing any access of the medium to the axles. In the part grooves between the discs, piles of movable formed lamellae are arranged which adapt to the changing groove widths and prevent an internal flow around the rotor.

PRINCIPLE AND SYSTEM OF SEALING THE PISTON OF ROTARY PISTON ENGINES

[0001] Subject of the invention is a principle and system of sealing rotary pistons against the enclosing casing wall of rotary compression and expansion engines

State of the art

[0002] For rotary piston engines, different solutions of achieving tightness of the piston against the enclosing casing wall during the course of movement are known. So-called rotor segment engines achieve an almost good tightness due to the high accuracy to size of the components rotor, casing and blades which surround the operating space and yield the smallest possible gap between the construction components. In certain cases of application the tightness can even be improved by entering a suitable fluid into the engine and causing a small fluid film to act as a sealing body between the components. When doing compression work with such engines the remaining gap losses are taken into account. They result in a reduction of the delivery output which can be balanced by increasing the driving power of the compressor. In expansion engines the gap losses may lead to a loss in functioning, especially when a damaging expansion takes place via the gaps mainly and does not result in an effective rotary power of the rotor.

[0003] On the other hand, expanding media in high temperature ranges such as are present in thermal engines can lead to a destruction of the engine when the passing hot gases cause material erosion at these parts thereby increasing the gaps.

[0004] In his fundamental examinations F. Wankel found that especially rotary combustion engines having more than three components moving in relation to each other such as rotor, movable piston parts fitted at the rotor and casing cannot function as the sealing elements cannot be arranged in such a way that during the course of motion of the engine a unified spatial system of sealing lines with the same geometrical shape can be achieved. This defect is clearly visible in rotor segment engines. It may be possible to achieve a radial and axial tightness against the casing wall by spring sealing strips along the blade edges but the sealing line is interrupted in the area of the rotor hub by a remaining unsteadiness and will lead to an untightness of the engine. Resulting from this experience, the only functioning rotary piston engine with internal combustion engine developed so far by F. Wankel was an engine type having only 2 components moving in relation to each other and enclosing the working space: a casing with a trochoidal running way and a rotary piston also derived from a trochoid as internal enclosing body of the casing running way. Sealing strips can be fitted on this piston fulfilling the conditions of an unchanged geometrical shape. This type of engine has become known as Wankel engine.

[0005] In spite of the advantages and the successful development of this type of engine, certain technological targets could not be reached. One of this is the geometrically determined change in volume with the trochoid used which does not allow carrying out a traditional Diesel process. It also concerns, though less important, the lubrication of the sealing strips and, connected with it, the heat dissipation from the piston to the casing wall.

Presentation of the invention

[0006] The aim of the invention is to create a sealing system for rotary piston engines which uses the principle of an similar geometrical shape of the sealing line according to Wankel so that other types of rotary piston engines for expansion and compression processes in higher temperature ranges and with improved properties concerning change in volumes, lubrication and heat dissipation can be realised.

[0007] Forming one aspect of the invention is a sealing system for rotary piston machines with a rotor consisting of two or more parallel rotor discs whose outer surfaces are pushed against the front faces of a casing by spring/medium forces, wherein sliding vanes with vane elements are arranged in radially positioned guide nuts said vanes formed by shaped lamellae; characterized in that the vane elements are enclosed by vane cassettes, inside which they are slid against each other in such a way that they bear against the front faces of the casing, sealing it off and forming continuous sealing surfaces together with the rotor discs thus preventing the medium from entering.

[0008] According to another aspect, the vane elements can feature inner bevelled edges and a shaft key can be provided inside the inner space formed by the vane elements, said shaft key arranged in such a way that it interacts with the inner bevelled edges by using spring force and/or centrifugal force to push the mutually overlapping shaped lamellae apart, while at the same time pushing the package of shaped lamellae radially against the casing path.

[0009] According to another aspect, a pressure spring can be arranged between the shaft key and the floor of the vane cassette.

[0010] According to another aspect, the rotor discs can feature laminar-milled grooves in the area of the external edge on the front ends facing the casing wall, so that the pressure of the medium produces forces that counteract the medium and spring forces in the joints between the rotor discs, thus reducing the friction at the front ends facing the casing wall to the degree necessary to achieve a sealing effect.

Short description of the drawings

[0015] The invention is described using the following examples. The designations mean:

[0016] Figure 1 Principle of the adaptable sealing line at the segment rotor

1, 2 Rotor discs

3, 4 vane elements

5 Guiding groove for vanes

6, 8 Surface of the rotor discs against the side planes of the rotary piston engine

7, 9 Surface of the vanes against the side planes of the rotary piston engine

10 Cover ring for the gap 11 between the rotor discs

11 Gap between the rotor discs

[0017] Figure 2a: Rotor disc

12, 13 Rotor disc

14 Compression springs between the rotor discs

15 Drill holes in the rotor discs for the reception of the compression springs 14

16 Reception drill hole for the hub at the rotor disc

17 Hub at the rotor disc

18 Slot in the rotor discs to receive the vanes

19Gap between the rotor discs

[0018] Figure 2b Vane Cassette

20 Vane Cassette

21, 22 Vane element with inside chamfer

23 Inside chamfer

24 Compression wedge

25 Compression springs

26 hull for the reception of the vane elements 22, 23, 24, 25

27 Box

Way(s) for an implementation of the invention

[0024] Figure 1: The principle of sealing is described by means of Figure 1. The rotor of the engine is divided into the two rotor discs 1 and 2 which are pressed with their outer areas/surfaces 6 and 8 against the face sides of the casing 6 and 8 by spring/media forces and thus are sealing the rotor against the casing. The gap 11 between the rotor discs is pressed inward against the rotor shaft by means of a rotating cover 10. Cover 10 is connected to guiding grooves 5 wherein the blades 3, 4 sit forming one blade of the rotor disc. The vane elements 3, 4 are formed by shaped lamellae which can adapt to geometric changes.

[0025] The implementation of this sealing principle is described by means of figures 2a, 2b and 2c, 3a, 3b, 3c and 3d, 4a, 4b and 4c.

[0026] Figure 2a: The rotor consists of rotor discs 12 and 13 which are pressed apart by springs 14 and thereby seal-press against the face sides of the casing. The springs are located in the (not through) bores 15 in both segment discs. Dividing groove 15 is located between the rotor discs. The hub17 of rotor disc 12 fits into the reception 16 of rotor disc 13 and closes the dividing gap 19 according to the cover 10 in Figure 1. The slots 18 in the rotor discs 12 and 13 correspond to the guiding grooves 5 in Figure 1.

[0027] Figure 2b: In the slots 18 of the rotor, the vane cassettes 20 are situated, wherefrom they because of the internal spring forces adapt in radial direction onto the face side of the casing and in axial direction onto the face side of the casing and, at the same time, reach into the corners between both running ways of the casing and there are sealing them.

[0028] A vane cassette contains the two similar vane elements 21 and 22 which are put on top of each other in such a way that they can be displaced against each other and thereby are pressed against the face side of the casing to form a sealing. In this position they, together with the rotor discs 12 and 13, form through sealing surfaces against the passing of the medium. The pressing force of the vane elements 21 and 22 is obtained for this unit by the inside chamfers 23 and the compression wedges 24 sitting on the compression spring 25. The compression wedge 24 is situated in the inner space formed by the vane elements 21 and 22. The compression spring 25 sits on the bottom of hull 27. The radially sealing movement of the vane elements 21 and 22 in the course of rotation of the rotor is additionally obtained by the springs 26.

[0029] Figure 2c: Figure 2c shows the interlocking rotor discs 12 and 13 with a vane cassette 20 in slot 18 in the rotor.

Claims

1. Sealing system for rotary piston machines with a rotor consisting of two or more parallel rotor discs (1, 2, 12, 13) whose outer surfaces are pushed against the front faces of a casing by spring/medium forces, wherein sliding vanes with vane elements (3, 4, 21, 22) are arranged in radially positioned guide nuts (5, 18), said vanes formed by shaped lamellae; characterized in that the vane elements (3, 4, 21, 22) are enclosed by vane cassettes (20), inside which they are slid against each other in such a way that they bear against the front faces of the casing, sealing it off and forming continuous sealing surfaces together with the rotor discs (1, 2, 12, 13), thus preventing the medium from entering.

2. Sealing system according to Claim 1, characterized in that the vane elements (21, 22) feature inner bevelled edges (23) and a shaft key (24) is provided inside the inner space formed by the vane elements (21, 22), said shaft key arranged in such a way that it interacts with the inner bevelled edges (23) by using spring force and/or centrifugal force to push the mutually overlapping shaped lamellae apart, while at the same time pushing the package of shaped lamellae radially against the casing path.

3. Sealing system according to Claim 1 or 2, characterized in that a pressure spring (25) is arranged between the shaft key (24) and the floor of the vane cassette (20).

4. Sealing system for rotary piston machines according to any one of Claims 1 to 3, characterized in that the rotor discs (1, 2, 12, 13) feature laminar-milled grooves in the area of the external edge on the front ends facing the casing wall, so that the pressure of the medium produces forces that counteract the medium and spring forces in the joints (11, 19) between the rotor discs (1, 2, 12, 13), thus reducing the friction at the front ends facing the casing wall to the degree necessary to achieve a sealing effect.

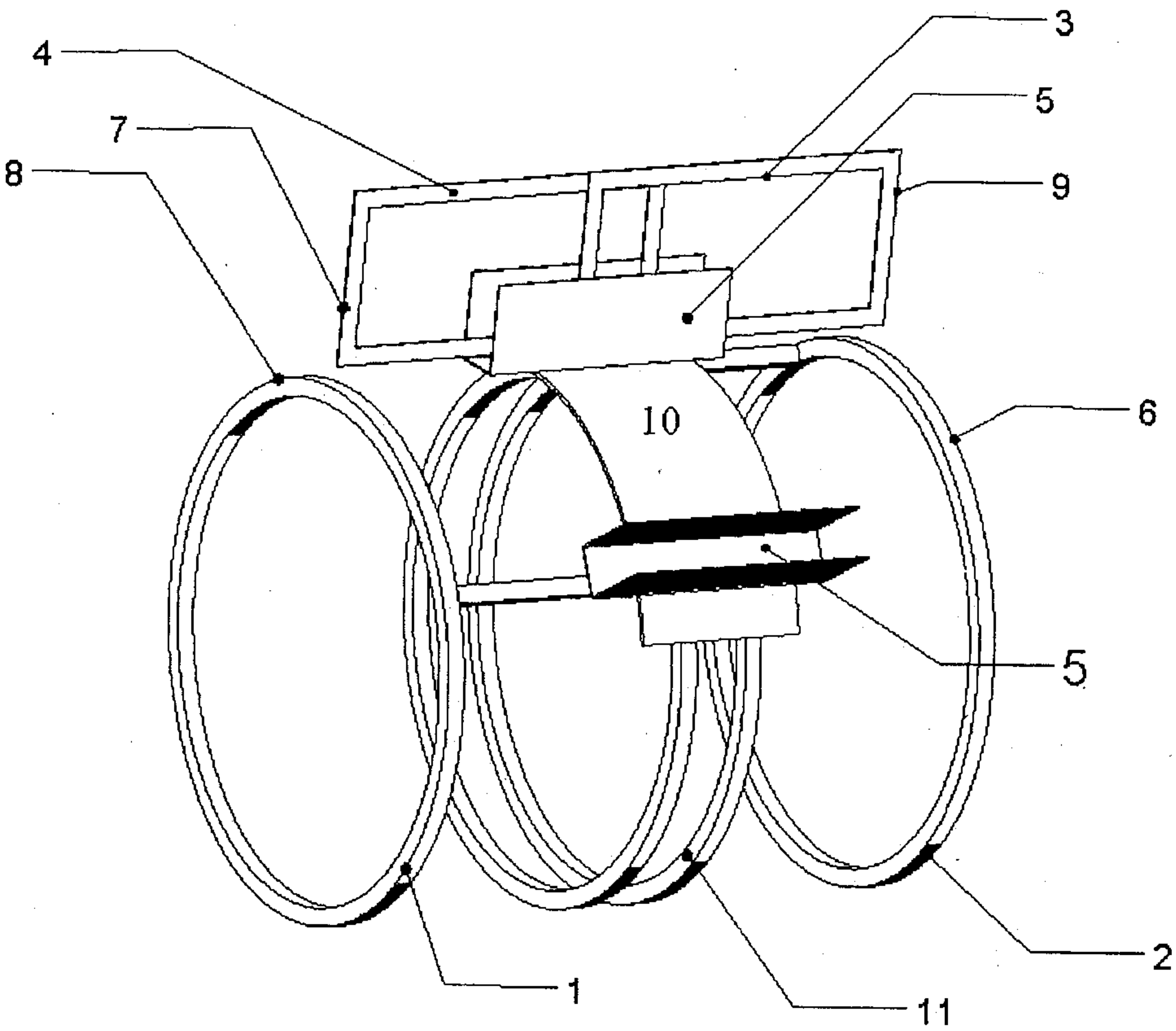


Figure 1

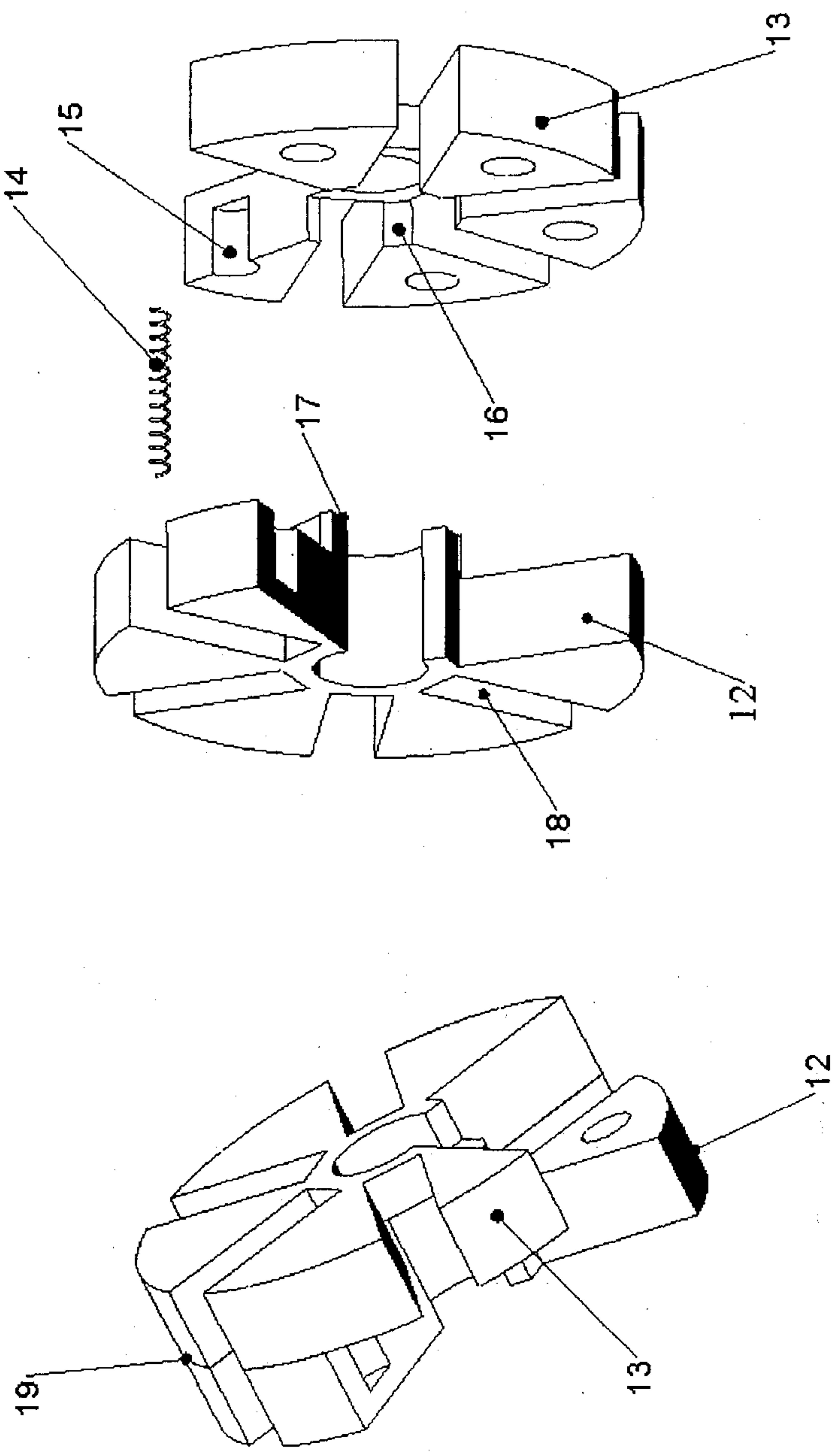


Figure 2a

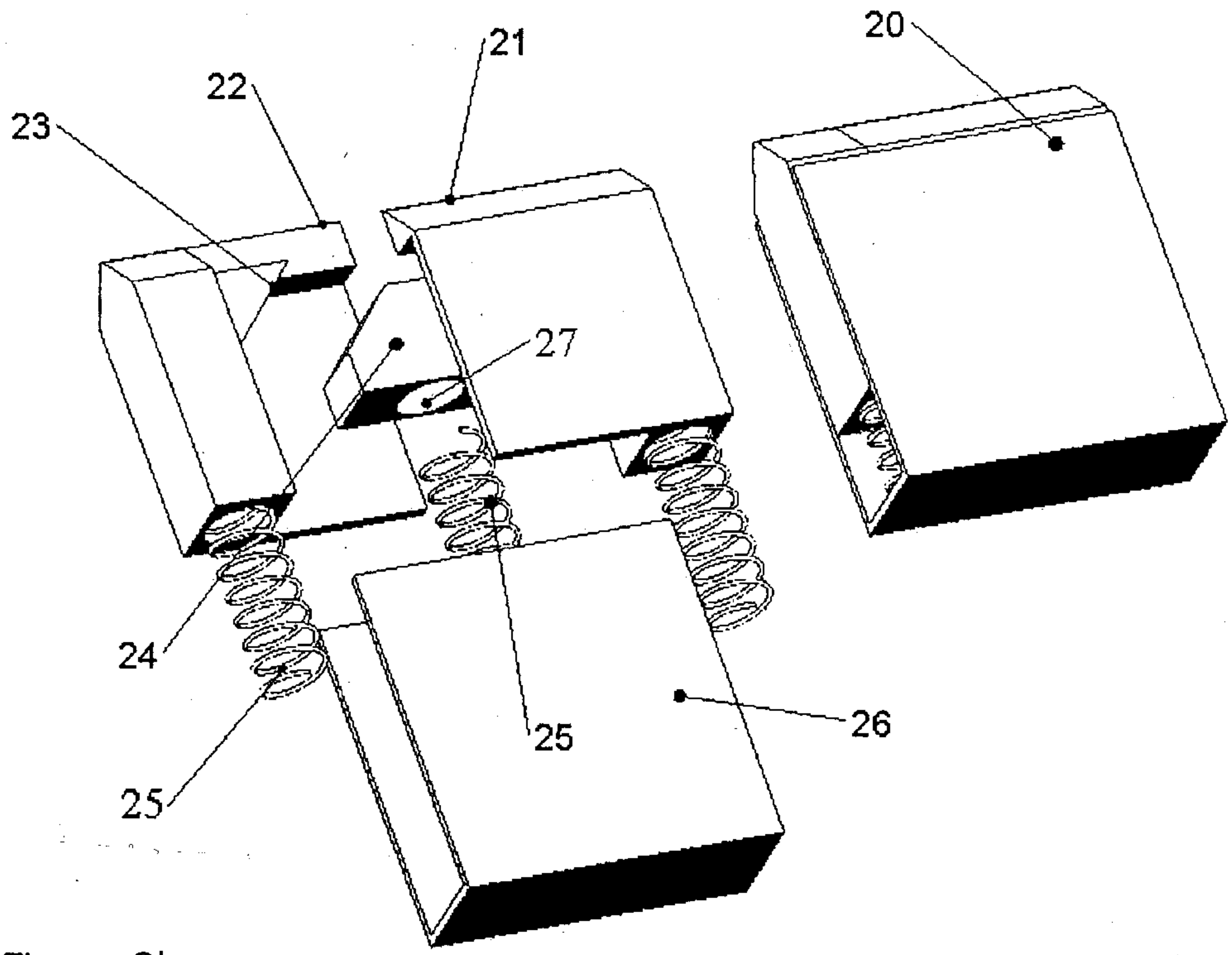


Figure 2b

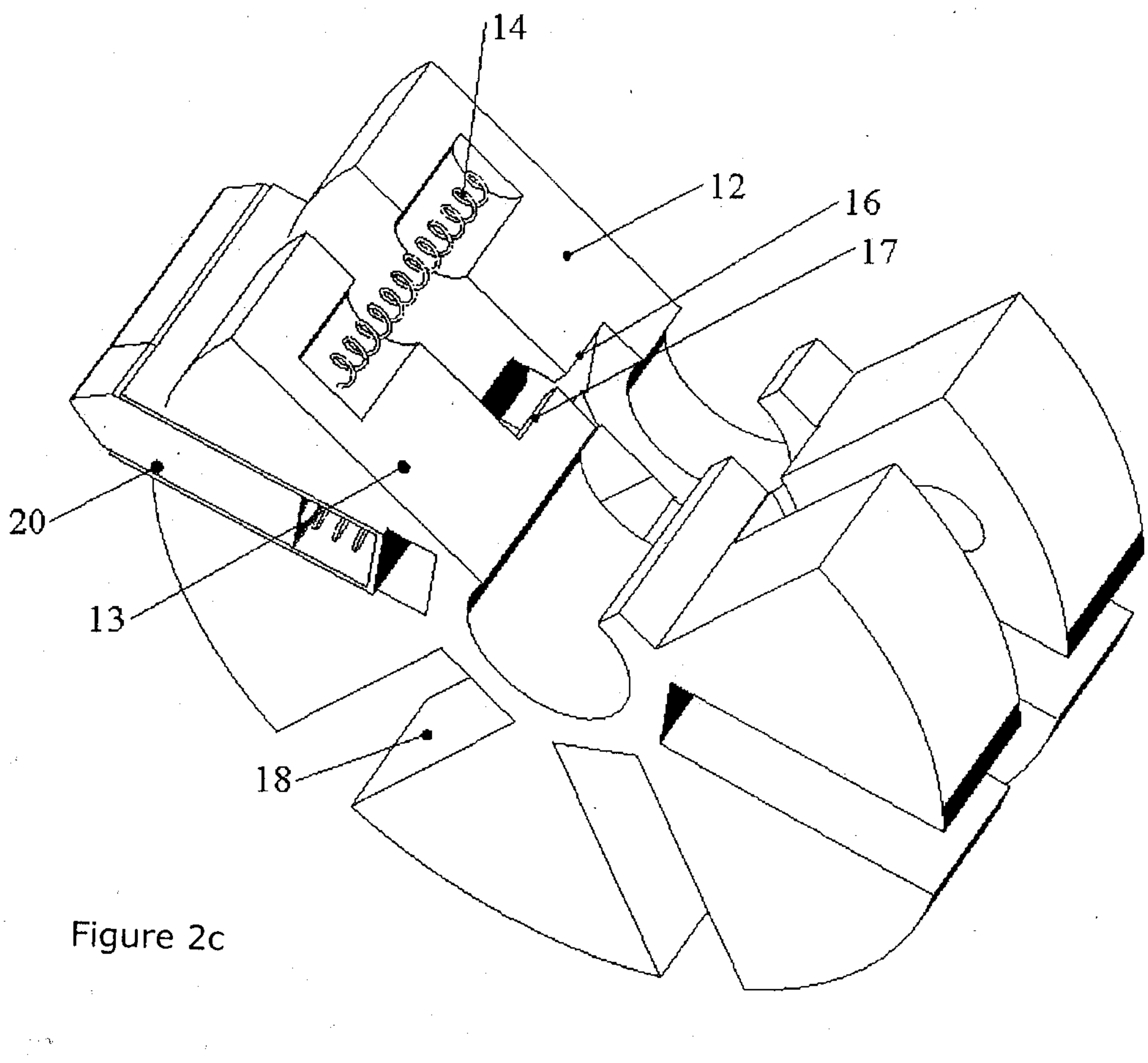
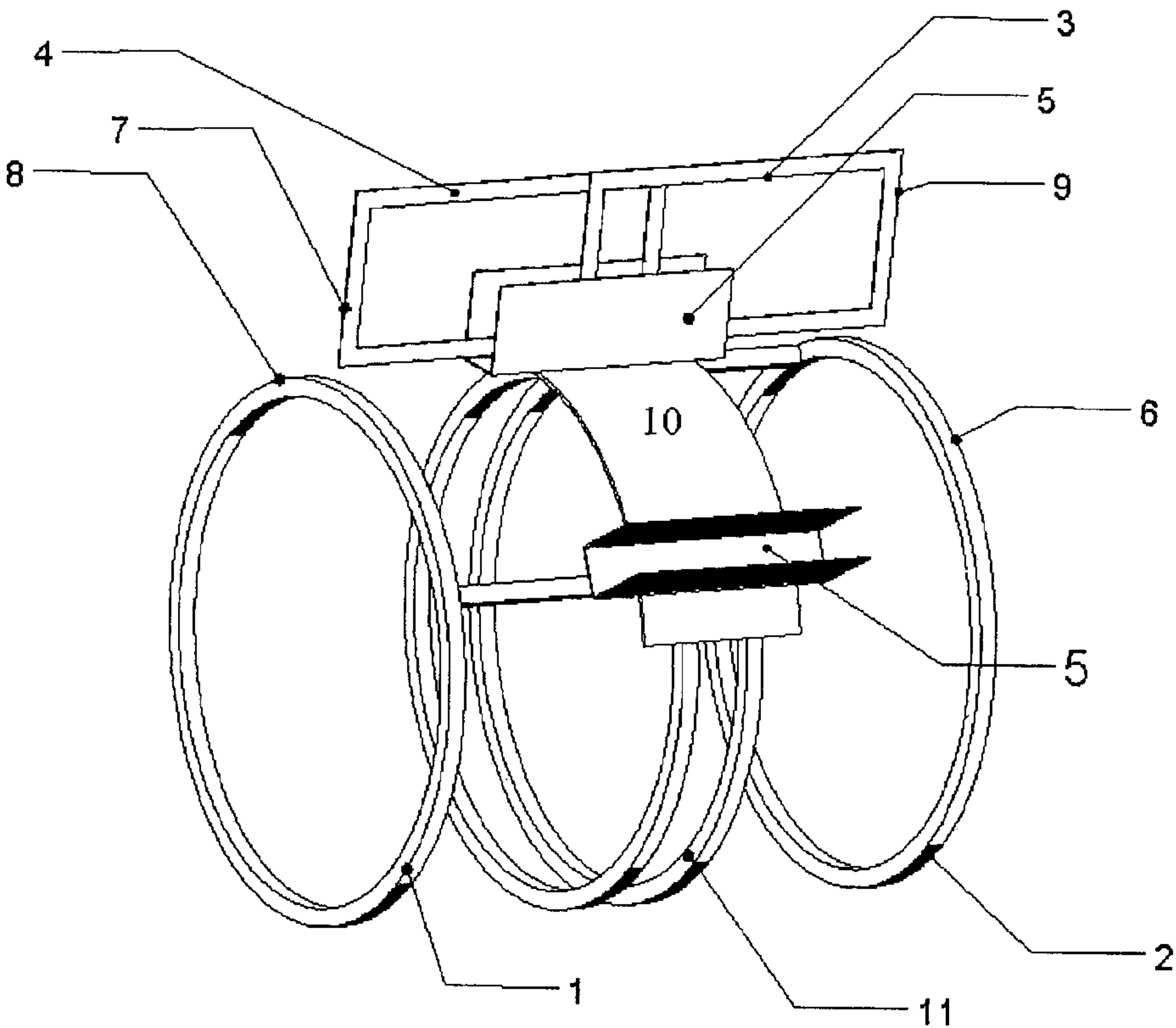


Figure 2c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