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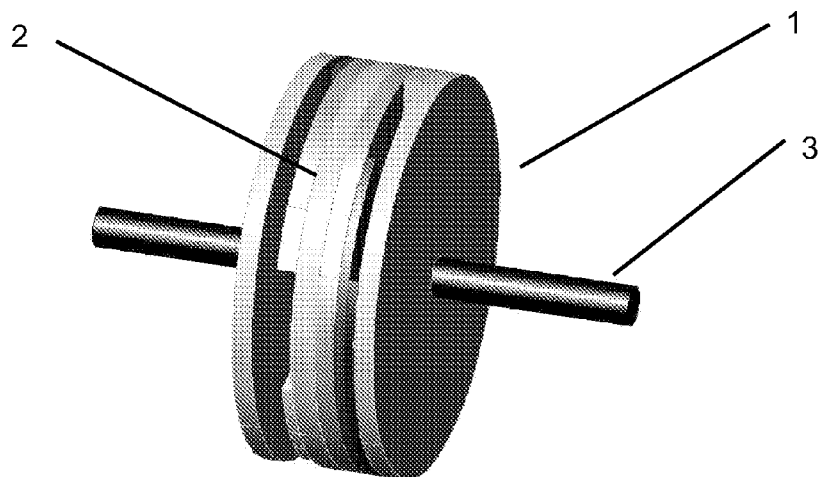


Fig.1

(57) Abstract: Improved flywheel comprising a disc (2), housed at the end of a shaft (3), with a plurality of sectors (4) arranged on a plane, with axis passing through the centre of rotation (5) of the disc (2) of equal base area, characterized in that said sectors (4) have a mass difference equal to at least a sample mass unit, defined as the minimum mass difference of two sectors (4) of the disc (2) as well as the greatest common denominator between the masses of the same sectors (4). In addition said disc (2) comprises a couple of opposite sectors (4), arranged on a plane with axis passing through the centre of rotation (5) of the disc (2) with a mass difference equal to a multiple of sample unit greater than one.



IMPROVED FLYWHEEL

Object of the present invention is a flywheel improved in its features of mechanical energy storage.

In the state of art, few similar products are known. A flywheel usually has the shape of a wheel or disc, suitably shaped to increase the moment of inertia of the shaft to which it is applied. It tends to contrast every attempt of change in its angular speed, thus stabilizing the rotation of a shaft when a periodical torque is applied, as in the piston engines, or when the applied load is intermittent, as for example in the piston pumps or hammers.

When for example the rotation of the crank shaft is not uniform since useful and passive phases follow to one another in the cylinders in order to make rotation the most possible uniform (that is to reduce accelerations and decelerations), it is used the flywheel fixed to an end of the driving shaft, which stores mechanical energy during the useful phases to release it during the passive ones.

In addition, the flywheel is used to store mechanical energy produced by a low-power engines in a long time to release it with high power in a short time.

The flywheels usually have a large diameter (as it is particularly clear in the old steam engines) and most of the mass arranged on the periphery, which is connected to the hub by means of the spokes. In this way their weight is limited, while their moment of inertia remains the desired one.

The kinetic energy stored by a flywheel is $E = 0,5 I \omega^2$ where I is the moment of inertia of the mass about the centre of rotation and ω is the angular speed. Since the moment of inertia of a system of particles is proportional to the mass of the particles and to their distance from the centre of rotation, it results that besides with the increasing of the speed of rotation, the capacity of storage of energy in a flywheel increases with the increase of the mass and distance of this one from the centre.

The use of the flywheel to store energy in vehicles provides a better energetic capacity/mass relation with respect to storage batteries. In particular, the flywheel is used in trams, where weight and volume limitations are less stringent than in cars. Its function is to store kinetic energy produced during braking and in more developed applications, the energy produced by fuel cells to use it during acceleration. In addition, theoretical studies of

trams with flywheel free of engines are known, where the flywheel is frequently recharged at suitable stations.

Object of the present invention is to provide a solution for the technical problem concerning the reduced efficiency of small flywheels.

The present invention provides the pursued aims since it is a flywheel improved in its features of accumulator of mechanical energy comprising a disc housed at the end of a shaft with the features described in claim 1.

These and other advantages will be highlighted in the following detailed description of the invention with specific reference to drawing 1/1 which shows a preferred, absolutely not limiting embodiment of the present invention.

Fig. 1 shows the side view of the invention:

Fig. 2 represents the exploded side view of the invention of fig. 1, with the distribution of load highlighted;

Fig. 3 shows an embodiment of distributed load of the flywheel;

Fig. 4 shows a summary scheme of possible sections of the flywheel with a variable number of sectors and applied loads;

Fig. 5 represents the scheme of an embodiment of a flywheel with twenty sectors with the features of load applied when the flywheel is in function;

Figs. 6' and 6'' represent respectively schemes for embodiments of a flywheel with forty sectors, the first one being an example of flywheel sectioned in forty sectors (fig. 6'), while the second one defines the load applied when the flywheel is in function (fig. 6'').

Referring to said figures, the improved flywheel according to the utility model is generally indicated with 1. It comprises a disc 2, housed at the end of a shaft 3, with a plurality of sectors 4 arranged on a plane, with axis passing through the centre of rotation 5 of the disc 2, of equal base area, characterized in that said sectors 4 have a mass difference equal to at least a sample mass unit, defined as the minimum mass difference of two sectors 4 of the disc 2 as well as the greatest common denominator between the masses of the same sectors (4).

In addition, said disc 2 is characterized in that a couple of opposite sectors 4, arranged on a plane with axis passing through the centre of rotation 5 of the disc 2, has a mass difference equal to a multiple of sample unit greater than 1.

Each sector 4 has an uniformly distributed mass.

Said disc 2 is housed by means of means for reducing friction, as for example bushes, bearings, bushings on fixed or movable elements and rotates on the shaft 3 in both the directions as indicated in fig. 2.

In a particular embodiment, the disc 2 is a component of a complex kinematic system comprising a plurality of discs 2 in series and/or in parallel.

Referring to the integrated system of fig. 3, said improved flywheel 1, in a particular embodiment, is characterized in that it comprises 10 circular sectors, of which opposed sectors with unitary load respectively 9-5, 5-6, 4-5. A couple of opposed sectors 4 has a mass difference equal to 4 sample unit greater than one unit, resulting from the difference between 9 and 5, while the remaining couples of sectors have a difference of sample mass unit equal to one unit resulting from the difference between 5 and 6 and 4 and 5.

The dimensioning of the system varies in function of requirements to be satisfied. In particular, the choose of the quantity of sections suits the need for optimization of the system. The quantity of sectors varies to the infinitesimal level. Fig. 4

shows possible solutions of sections in sectors 10 to 180. From clear experimental analysis, by increasing the quantity of sectors, the stability of the system is automatically increased since the centre of gravity and the centre of rotation tend to coincide; the retrieved energy which feeds the flywheel while in function is instead reduced.

Another embodiment of said flywheel with twenty sectors is shown in fig. 5, when the flywheel is in function, whose load applied for each semi-circular sector in balance is 150 units.

Finally, an embodiment of a flywheel sectioned in 40 sectors (fig. 6') with load applied to the flywheel in function in the two semi-sectors has a difference of more or less twenty with respect to the position of balance in which the semi-sectors have an applied load of 600 units (fig. 6'').

Obviously the above described embodiments are only not limiting examples of the invention.

The aim of the invention is therefore to store kinetic energy.

The advantages of the invention are clear: first of all to increase the efficiency of the flywheel and in particular of the small ones by means of the distribution of load; flexible usage in different fields of mechanics; it is very simple to use; and finally it is simple to be produced and operated.

CLAIMS

1. Improved flywheel comprising a disc (2), housed at the end of a shaft (3), with a plurality of sectors (4) arranged on a plane, with axis passing through the centre of rotation (5) of the disc (2), of equal base area, characterized in that:

- said sectors (4) have a mass difference equal to at least a sample mass unit, defined as the minimum mass difference of two sectors (4) of the disc (2) as well as the greatest common denominator between the masses of the same sectors (4).

- said disc 2 comprises a couple of opposite sectors (4), arranged on a plane with axis passing through the centre of rotation (5) of the disc (2) with a mass difference equal to a multiple of sample unit greater than one.

2. Flywheel according to claim 1, characterized in that said sector (4) has an uniformly distributed mass.

3. Flywheel according to any one of the preceding claims, characterized in that said disc (2) rotates in both directions.

4. Flywheel according to any one of the preceding claims, characterized in that said disc (2) is housed on fixed or movable elements.

5. Flywheel according to any one of the preceding claims, characterized in that said disc (2) is a component of a complex kinematic system made up of a plurality of discs (2) in series.'

6. Flywheel according to any one of claims 1 to 4, characterized in that said disc (2) is a component of a complex kinematic system made up of a plurality of discs (2) in parallel.

7. Flywheel according to any one of the preceding claims, characterized in that said disc (2) is housed in the shaft by means of elements for reducing friction, as for example bushes, bearings, bushings.

8. Flywheel according to any one of the preceding claims, to be used in order to store kinetic energy in every field of mechanics.

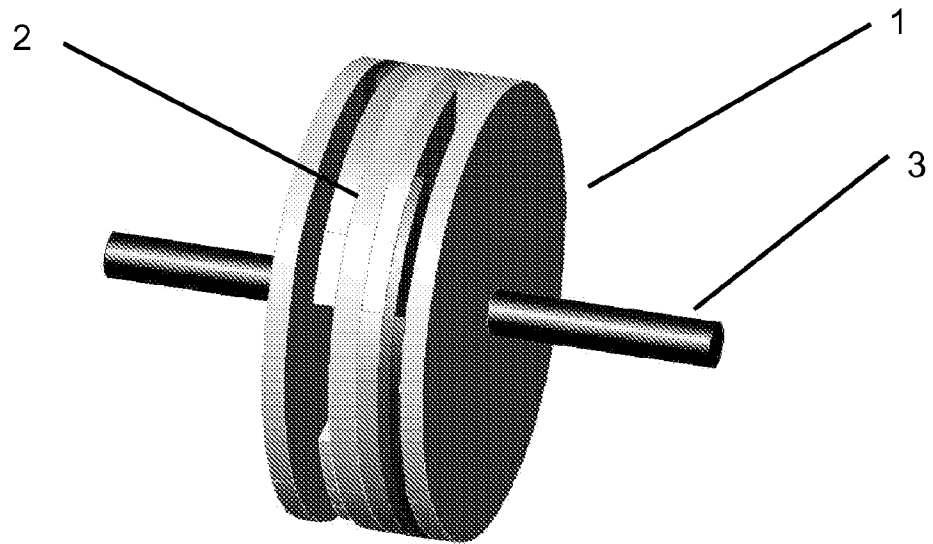


Fig.1

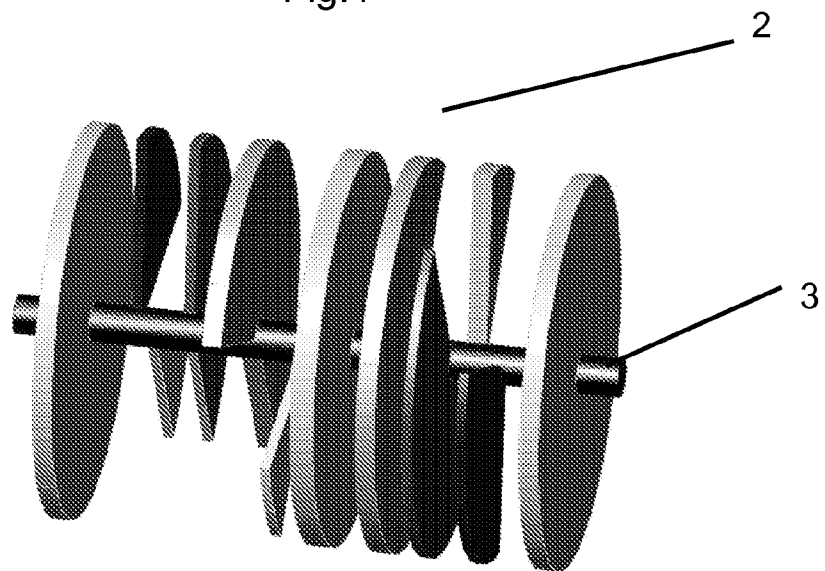


Fig.2

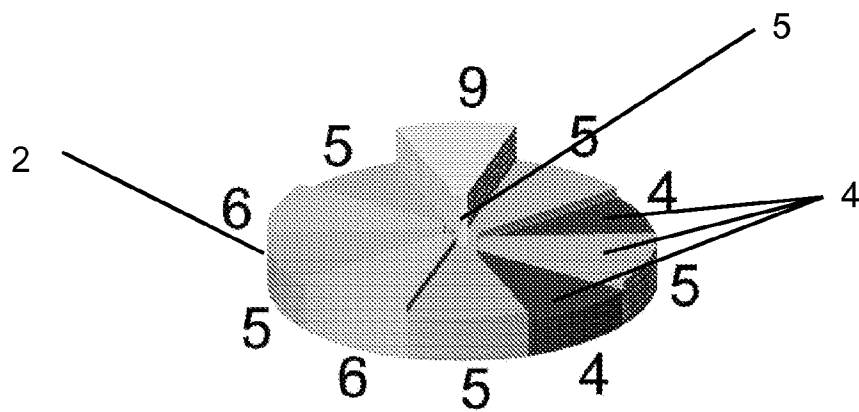


Fig.3

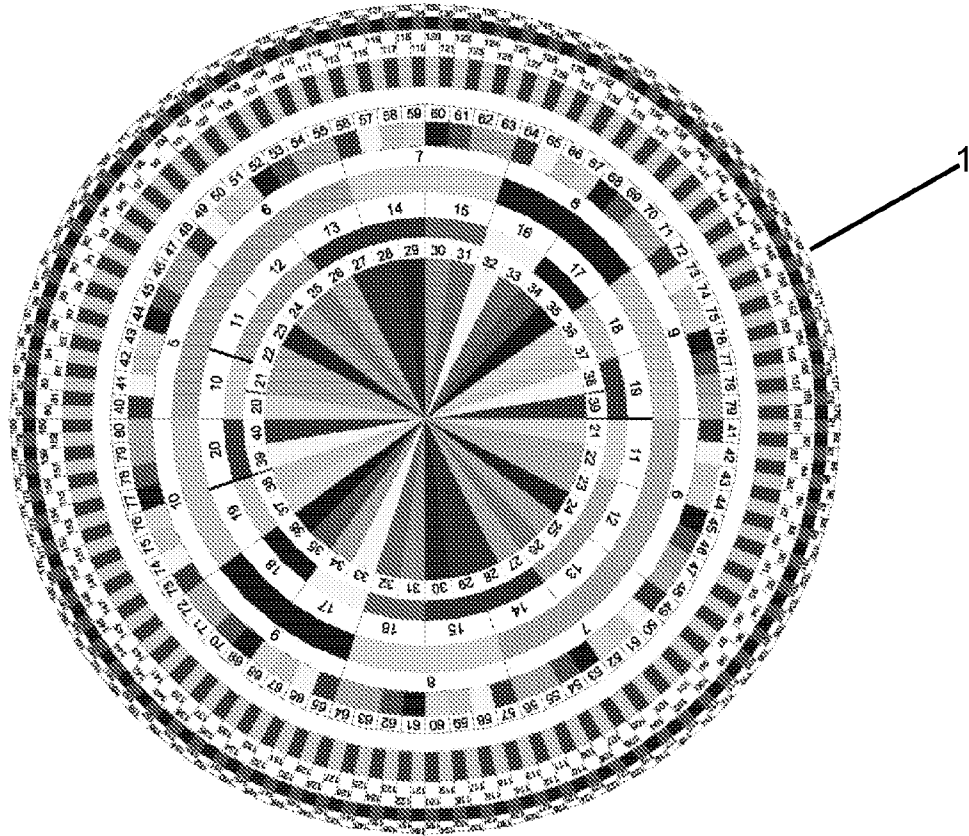


Fig. 4

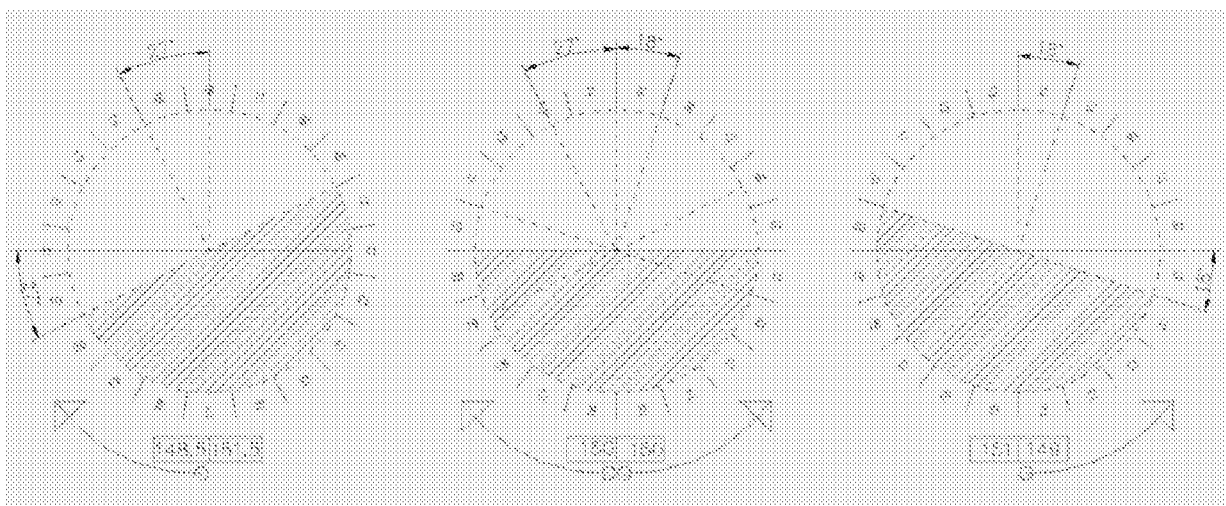


Fig. 5

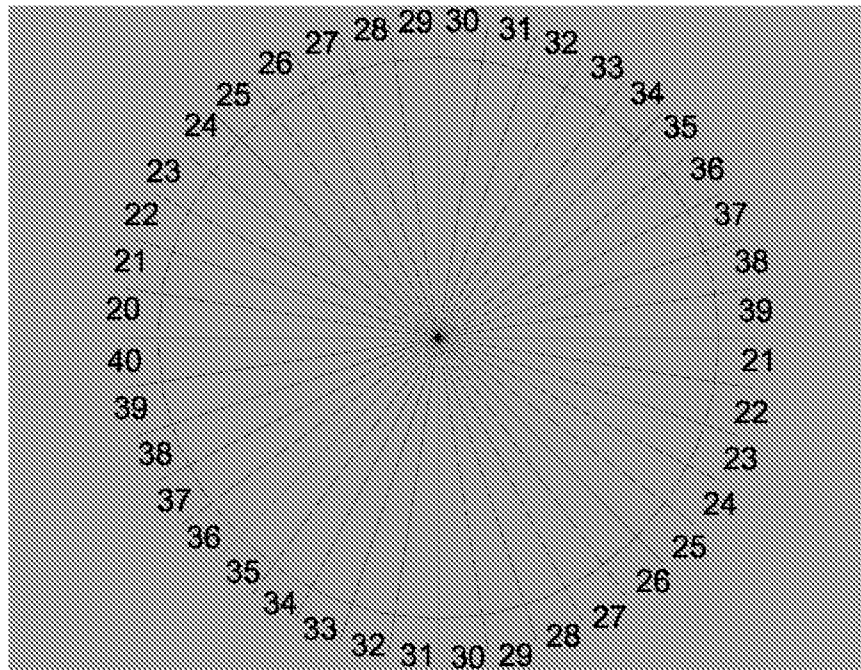
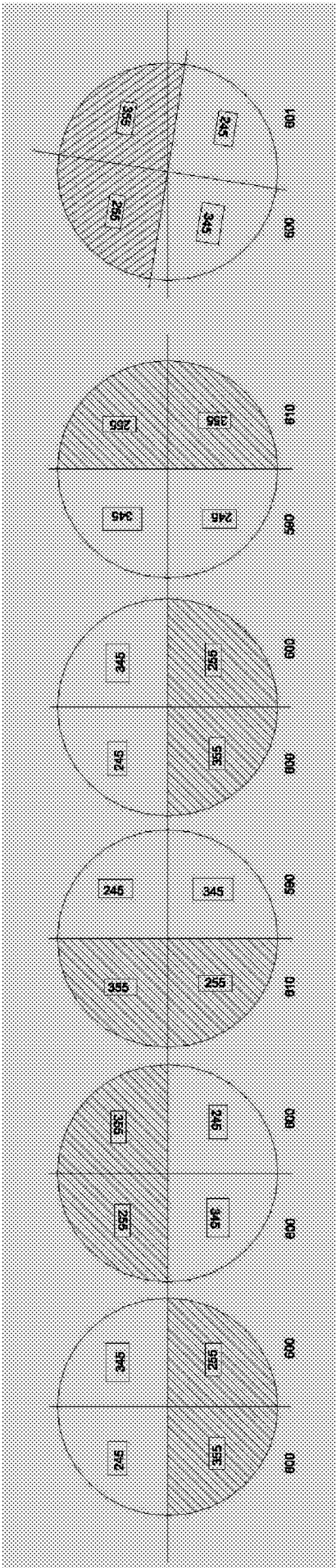


Fig.6'

Fig.6”



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F16F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 10 2005 036347 A1 (KLEIN SCHANZLIN & BECKER AG [DE]) 1 February 2007 (2007-02-01) the whole document -----	1-8
A	US 4 052 913 A (SCHULTZ FREDERICK E ET AL) 11 October 1977 (1977-10-11) * abstract; figures -----	1-8
A	GB 248 699 A (NESTOR LEONARD) 13 May 1926 (1926-05-13) the whole document -----	1-8
A	WO 2005/001311 A1 (PLANETENERGY LTD [LI]; SCHROETTER JOHANNES [LI]) 6 January 2005 (2005-01-06) figures ----- -/-	1-8

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	DE 297 05 327 U1 (THOENE HERMANN [DE]) 3 July 1997 (1997-07-03) * abstract; figures -----	1-8
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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