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- (71) Applicant and
(72) Inventor: GROSU, Ioan [RO/RO]; Str. Ciurchi nr. 125,
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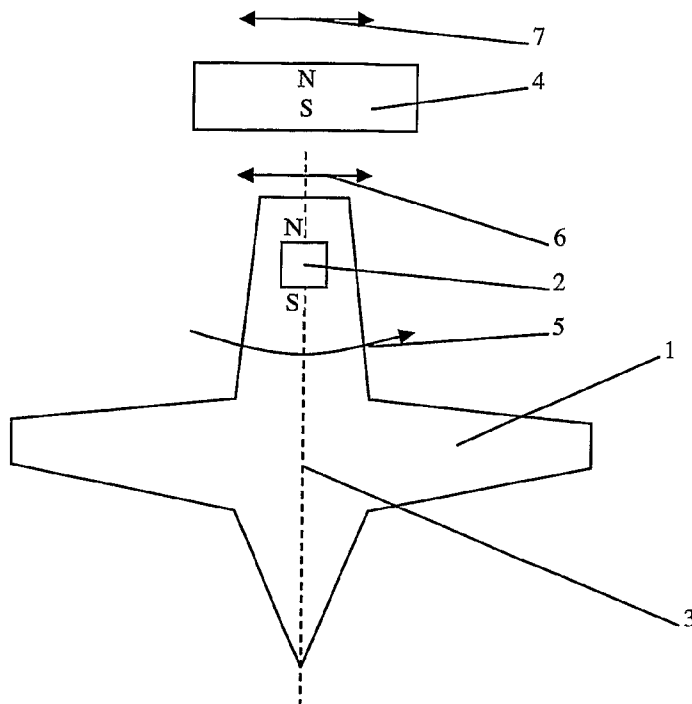
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LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MY,
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DRIVEN SPINNING TOP



(57) Abstract: A modified classical spinning top (1) and its horizontal driving (6) without mechanical restraining elements are disclosed. The modified classical spinning top has a small permanent magnet (2) on the rotation axis (3), at its upper part and coaxial with it. A second permanent magnet (4) with the opposite polarity to the first one, it means in an attraction configuration, is manually moved horizontally (7) above the top of the spinning top. The interaction of attraction of the two permanent magnets determines a horizontal driving (6) of the spinning top without modification of the rotation movement. The new toy is more interesting, interactive and attractive than the classical one.

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DRIVEN SPINNING TOP

FIELD OF INVENTION

The present invention relates to a modified classical spinning top (using permanent magnets and no mechanical restraints) that can be horizontally driven without the modification of the rotation movement.

BACKGROUND OF THE INVENTION

It is well known that people like the classical toys :spinning tops, gyroscopes and permanent magnets.

Spinning tops are old toys . They are built from wood , metals, or plastics in different shapes , colors and dimensions. Recently some of them produce a sound or/and light. Not much has been changed since the beginning. Once it is put into rotation we just look at its movement . No possibility to change the movement, to interact with it.

Gyroscopes are well known toys and devices. They fascinate how the direction is kept constant.

Permanent magnets are used to obtain different configurations using balls , nails, ferromagnetic powder , magnetic fluids. Once the configuration is achieved nothing can happen more , no more fun.

The idea of combining the rotation movement of a gyroscope and permanent magnets has been advanced by I. Grosu in Romania Patent No. 91 857 from 28 Feb. 1987. A classical gyroscope is modified by using two permanent magnets on the rotation axis , coaxial with it. So the gyroscope has an angular momentum and a magnetic moment . A uniform external magnetic field generated by a coil determines a rotation that is the Larmor precession. This device is didactic and can show how the Larmor precession is obtained. Such a gyroscope simulates the spin of the electron with angular momentum and magnetic moment.

An interesting use of permanent magnets in spinning tops is the Levitron : US Pat 4 382 245 and US Pat 5 404 062 . The disk of the spinning top is a permanent magnet above a second permanent magnet in the repulsion configuration . The spinning top can levitate if some conditions are fulfilled . The levitation is not so easy to be obtained . Levitron is produced by : www.supermagnete.de .

Another toy – Magnetic UFO Spinning Top - has a small permanent magnet at the bottom that is in contact with a ferromagnetic planar piece. During rotation the bottom of the spinning top moves the planar piece in an interesting manner.

Using the site www.espacenet.com with the keywords toy AND top AND magnet there are selected the patents : US 2004198152,US 2003064660,GB2389321,CN1326800 that presents tops with permanent magnets. It should be emphasized that all patents refer to tops with uncontrollable dynamics.

SUMMARY OF THE INVENTION

The present invention is directed to a spinning top with a controllable horizontal motion. The dynamics of the classical spinning top can not be changed because any action on it is equivalent with a torque N that will modify the rotation motion according to the angular momentum theorem :

$$dL/dt=N$$

where L , N are the angular momentum and torque respectively. To move the top horizontally it is necessary to act on it with a force that passes the rotation axis (to have a torque equal with zero). This can be realized by the interaction of attraction of the two permanent magnets ; one on the axis of rotation , coaxial with it and another one above the top. Everything will be better understood following the drawings , detailed description and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1. A general view of the modified spinning top.

FIG. 2. Detailed view of the permanent magnet at the upper part of the top

FIG. 3. The collision of two cylindrical shaped tops.

FIG. 4. The suspended top into rotation.

FIG. 5. The collision between two tops :one with a hexagonal shape and another one with a cylindrical shape.

FIG. 6. The collision between a top with a hexagonal shape and a ball.

DETAILED DESCRIPTION OF THE INVENTION

As it was mentioned above all combinations top and permanent magnets did not achieve a controllable dynamics for tops. The dynamics of a modified gyroscope (I.Grosu, Romania Patent No. 91 857) is controllable by using an external magnetic field. This idea , in a modified version , is used here . The key idea is to modify a classical spinning top by using a permanent magnet on the rotation axis , at its upper part , coaxial with it . An external permanent magnet , manually moved above the top , attracts the first magnet moving the top horizontally. The rotation motion is not changed because the torque of the attraction force between two permanent magnets is zero. This happens because the direction of this force passes the rotation axis. So the horizontal translation motion of the top can be controlled by the motion of the external permanent magnet. The top with a controllable dynamics has much more interest and fun and educational and scientific achievements.

Following Fig. 1 and Fig. 2 a classical spinning top 1 is modified by using a small permanent magnet 2 on the rotation axis 3 , coaxial with it , at its upper part. A second permanent magnet 4 is above the top into rotation 5. The top moves horizontally 6

following the horizontal motion 7 of the permanent magnet 4. The motion 6 is obtained only if the motion 7 is slow. At rapid movement 7 the top is not able to follow it.

The top with controllable dynamics can be used to realize several games. I propose here 3 variants.

First one refers to the dynamics of the top. It can be experimented how quick should be the motion 7 in order to obtain a movement 6. A too quick move 7 fails to obtain a movement 6. Two tops can collide 8 when they are close enough(Fig.3). It is interesting that after the collision they can collide again because of the Bernoulli law. Also if the permanent magnet 4 is close enough then the top jumps in contact with it. The rotation continues.(Fig. 4). If the magnet 4 is vertically shaken the top falls on the table on the table and continues to rotate and it can be attracted again to magnet 4. Here can be observed how the vertical direction is conserved. This can not be done with the classical spinning top.

Secondly a collision can be obtained between a hexagonal shaped top 9 and a cylindrical shaped one 1(Fig. 5). Here the collision is more violent because of the shape of the hexagonal shaped top 9.

Thirdly a competition game can be realized by using a hexagonal shaped top 9 and a ball 10. The ball 10 moves horizontally. Two players each having a hexagonal shaped top 9 hit the ball(Fig. 6) in order to move it in the others gate. I call this game TOPBALL in analogy with football, handball, basketball.

Others games can be imagined using the driven spinning top with a controllable dynamics.

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I claim:

1. A modified classical spinning top comprising:
 - a small permanent magnet on the rotation axis , at its upper part , coaxial with it
 - a second permanent magnet movable by hand above the spinning top with opposite polarity ,it means in the attraction configuration
- 2.The device of claim 1 has a controllable horizontal dynamics by moving said second permanent magnet and this device is called driven spinning top. The tops can have a cylindrical , hexagonal or square shape .
- 3.By using the said driven spinning top with the said controllable horizontal dynamics several games can be imagined and proposed.
- 4.Three said games are suggested :
 - a game by driving the top : who drives the top a certain distance in a shorter time. Some skills are necessary to be achieved concerning the optimum distance between the said driven spinning top and the said second permanent magnet. If the distance is too small then the top jumps to the said second permanent magnet. It continues to rotate when suspended. By shaking vertically the said second permanent magnet the top falls on the table and continues to rotate. If the distance between said permanent magnets is too large the movement of the said driven spinning top is too slow. Two cylindrical shaped tops can collide several times.
 - one or two players with a said hexagonal shaped top and a said cylindrical shaped top can play the collision between them.
 - two players each of them with a said hexagonal shaped top can hit a ball to move it in the others gate. In analogy with football , handball , basketball I call this game TOPBALL.

AMENDED CLAIMS**received by the International Bureau on 27 September 2007 (27.09.2007)**

- 1/ I claim that using the last generation of commercially available permanent magnets (based on Neodimium with small dimensions and strong interactions at distances up to 40 mm) a horizontally driven spinning top can be realized . The horizontal driving is more than 5 mm/sec and up to 15 mm/sec in a desired direction without any mechanical contact .

- 2/ The said driven spinning top uses the interaction between a small permanent magnet on the rotation axis , at its upper end and a second bigger permanent magnet manually moved horizontally above the top of the spinning top at a distance more than 10 mm and up to 40 mm. We call this configuration two permanent magnets configuration .

- 3/ In the said two permanent magnets configuration it is essential to be used two permanent magnets and not a permanent magnet and a magnetizable body. In the second case the interaction is noticeable at much smaller distances and the driving is hard or impossible to be obtained because the two bodies stick together (pick up) ending the horizontal driving.

- 4/ The said driven spinning top using the said two permanent magnets configuration is interactive and has a richer dynamics (possible with a chaotic component) that rises the interest for fun and curiosity and educational and didactic and scientific investigation at different levels of understanding of different ages. The new dynamics should be deeply investigated both experimentally and theoretically by using numerical methods for solving the equations of motion adapted to the new said two permanent magnets configuration .

Statement under article 19(1)

Firstly , I mention that some slips of the pen are in the Abstract (Box No IV , Text of Abstract ,EPO ,PB 5818 , Patentlaan 2, NL 2280 HV Rijswijk). The mistakes are in connection with the figures/numbers from Fig. 1. An amended Abstract has been sent to the Authority on Sept. 12th (one month since Aug. 14th ,2007).

Secondly , I found out about the document D1 :WO 2004/043561A (P.E. Rafael [MX]) 25 May 2004. It is true that D1 relates about a permanent magnet (7, with the notation of D1) on the rotation axis of the spinning top. Incidentally , a permanet magnet (2, in Fig. 1 of the present Application) is used for a modified spinning top. So this piece of information is not new but it should be mentioned when the driving is disclosed in order to be understood. In Abstract of D1 , second sentence is written : “.....support elements, such as conical points or spheres which are made from metal “. So it is clear that what is meant “...a second permanent magnet (5) movable by hand above....” (as is written in the Written Opinion, 2.2 it is not a permanent magnet but a metal that can be magnetized.This is a hidden detail that makes the difference.This is explained in Claim 3.

The claims 1 and 2 state that the main contribution of the Application is the Driving of a Spinning Top. It is true that this is realized with a modified Spinning Top that incidentally is presented in D1. The horizontal driving is not contained in D1. A permanet magnet and a magnetizable metal have a noticable interaction at a very small distance up to 5 mm. At such a distance the two bodies stick together (pick up) and the driving is lost. The chain of (2 or 3) spindles from D1 can have a limited dynamics just a bending that is much different from the horizontal driving up to 15 mm/sec of the present Application. What is meant by “movable by hand above ...” reffers to the rotation of of the second spindle but once it is relased on the top of the first spinning top it could not be influenced any more.The bending is not controllable , at least it can not be predicted in which direction will go. The driving from the present Application is done in a desired direction , toward chosen targets in horizontal direction and no mechanical contact.

Concerning 3.1 from the Written Opinion : “ The spinning top disclosed in D1 is also cylindrical and by moving the second spindle (...) this can control the horizontal movement of the device defined in claim 1 “ .Once the second spindle is released into rotation on the top of the first spindle it can not be influenced any more.So it can influence (not control) in an unknown direction the dynamics of the first spindle. Two or three spindles of D1 are in mechanical interaction and they influence (not control)

each others dynamics but this is done in an unknown manner. So this is a mutual , restricted influence that is much different from a driving of 900 mm during one minute or 2700 mm in 3 minutes as our prototype does.

The claims 1 and 2 present the driving. The claim 3 relates the difference between the interaction of two permanent magnets and that one of a permanent magnet and a magnetizable body. This difference is essential in the present matters.

The claim 4 states the new dynamics of the driven spinning top and its use as a new toy and a didactic and educational and scientific tool.

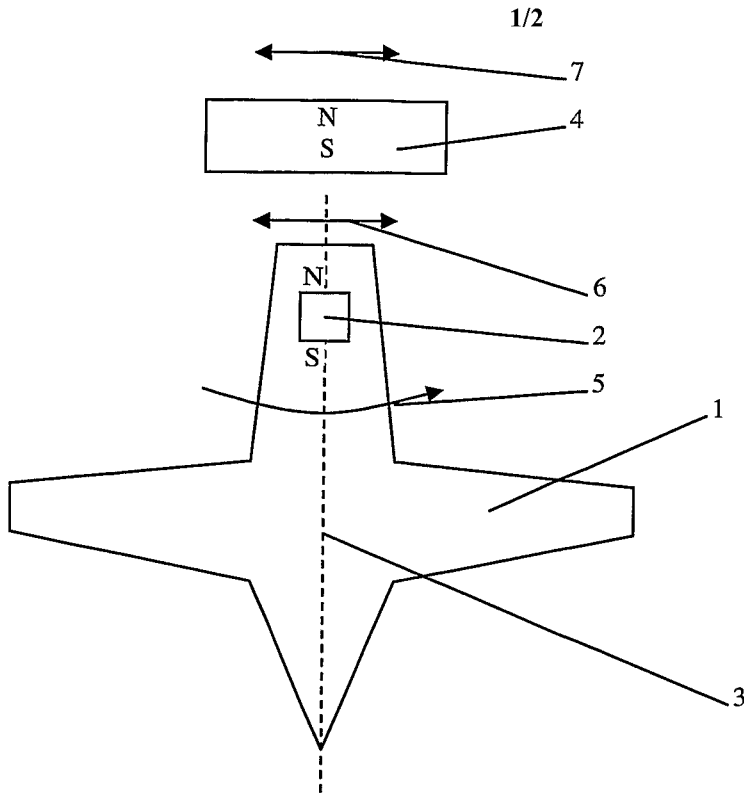


Fig. 1

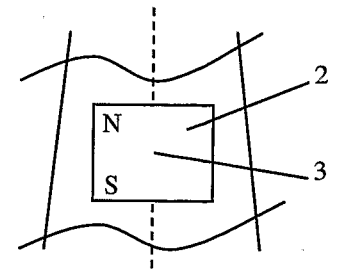


Fig. 2

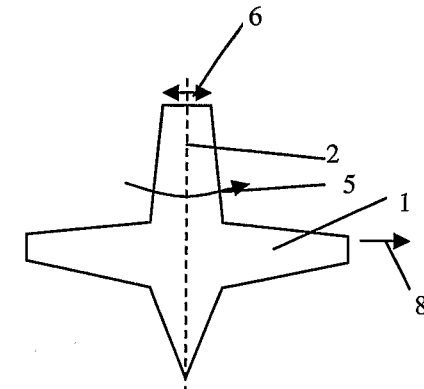
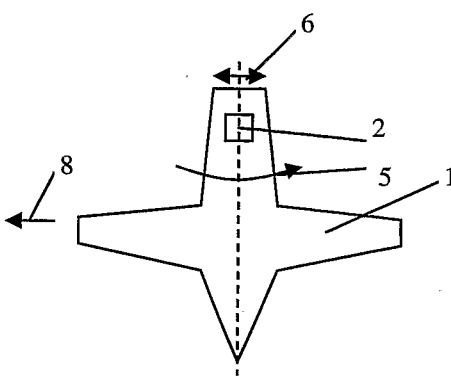


Fig. 3

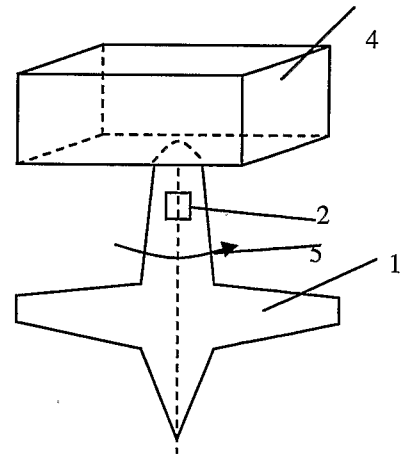


Fig. 4

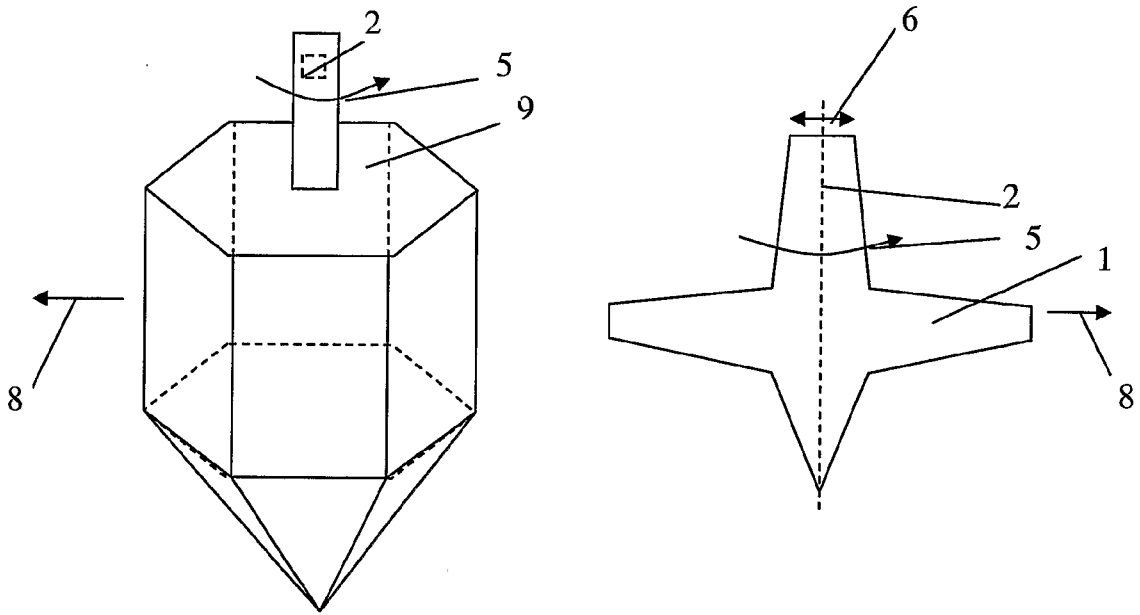


Fig. 5

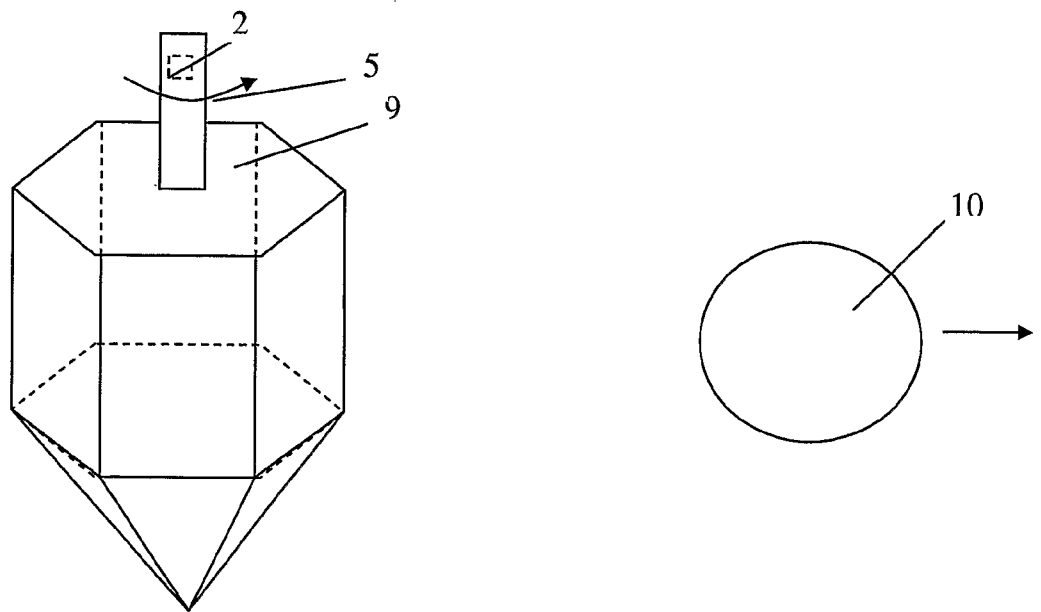


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/R02006/000023

A. CLASSIFICATION OF SUBJECT MATTER INV. A63H1/18 ADD. A63F3/00		
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) A63H A63F		
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) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/043561 A (PEREZ ENRIQUEZ RAFAEL [MX]) 27 May 2004 (2004-05-27) line 18 - page 5, line 8; figure 1 -----	1,2
A	GB 1 015 000 A (ALFRED ELEONHARD PAULSEN) 31 December 1965 (1965-12-31) the whole document -----	1,2
A	US 3 906 660 A (VOTH HARRY A) 23 September 1975 (1975-09-23) the whole document -----	1,2
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family	
Date of the actual completion of the international search 29 June 2007	Date of mailing of the international search report 14. 08. 2007	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Brumme, Ion	

INTERNATIONAL SEARCH REPORT

International application No.
PCT/R02006/000023

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.: **3,4**
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iii) PCT - Scheme, rules and method for playing games

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/R02006/000023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004043561	A	27-05-2004	NONE
GB 1015000	A	31-12-1965	DE 1912423 U 18-03-1965 DE 1265634 B 04-04-1968
US 3906660	A	23-09-1975	NONE