(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 December 2006 (14.12.2006)

PCT

(10) International Publication Number
WO 2006/131818 A2

(51) International Patent Classification:
B64G 1/10 (2006.01)

(21) International Application Number:
PCT/IB2006/001504

(22) International Filing Date: 7 June 2006 (07.06.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/687,863 9 June 2005 (09.06.2005) US

(71) Applicant *(for all designated States except US)*: **ICON ORBITAL TECHNOLOGIES CORPORATION** [CA/CA]; #501-65 Harbour Square, Toronto, Ontario M5J 2L4 (CA).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **BEDZIOUK, Serguei** [CA/CA]; 201 Chemin du Club-Marin, PH#2001, Ile des Soeurs, Québec H3E 1T4 (CA). **SINDALOVSKY, Dmitry** [CA/CA]; 65 Harbour Sq., Unit 501, Toronto, Ontario M5J 2L4 (CA).

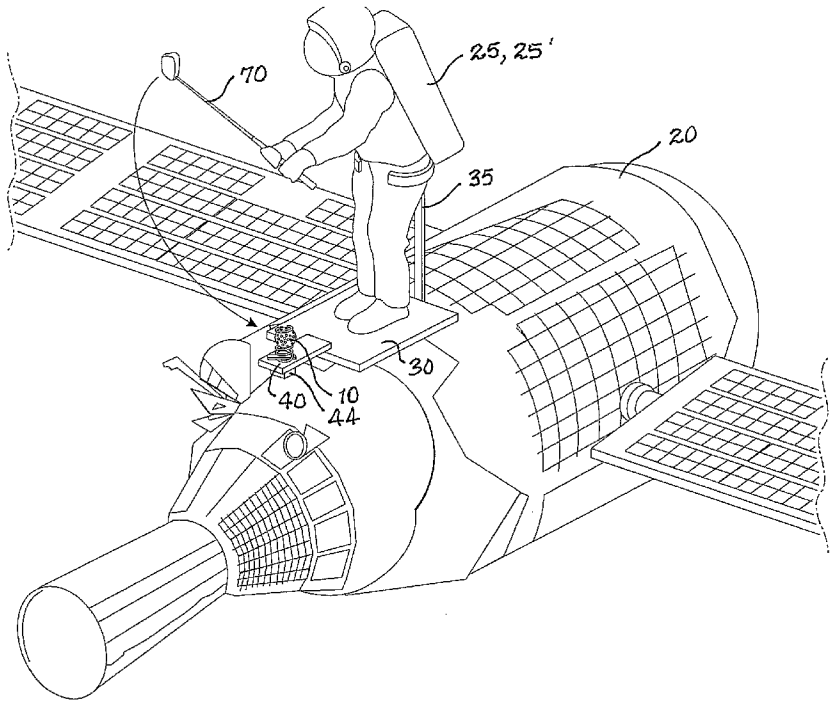
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

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:** HUMAN-PROPELLED METHOD AND APPARATUS FOR LAUNCHING A SATELLITE



(57) **Abstract:** A manual method of launching a satellite from space borne vehicle includes fixing a launching platform onto a space vehicle and fixing a satellite holder on the launching platform. A Space suited person is fastened to the launching platform and a satellite is engaged with the satellite holder adjacent to the person. The person throws or strikes the satellite to dislodge it from the holder and to direct it in a path away from the vehicle.

WO 2006/131818 A2

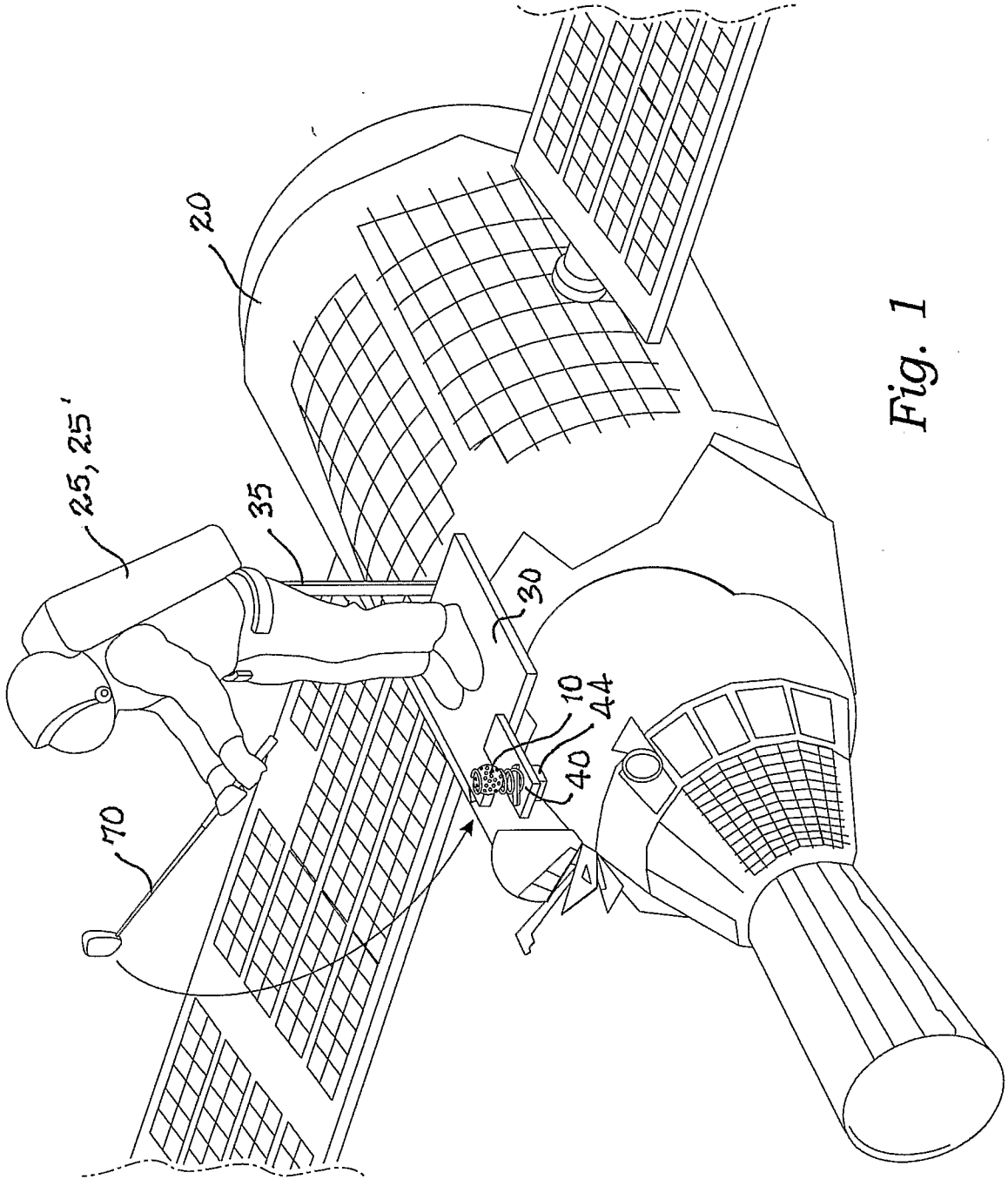


Fig. 1

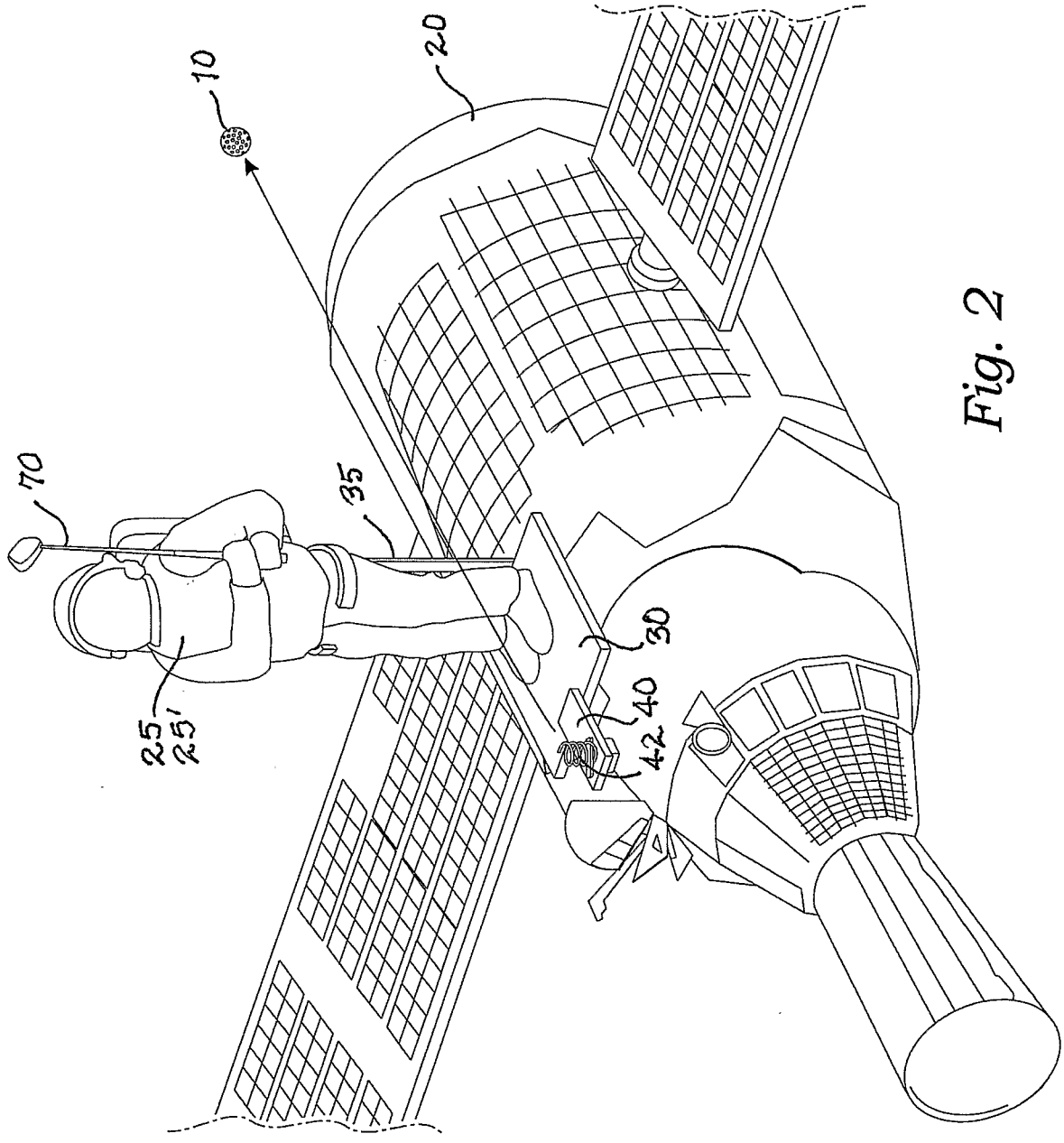


Fig. 2

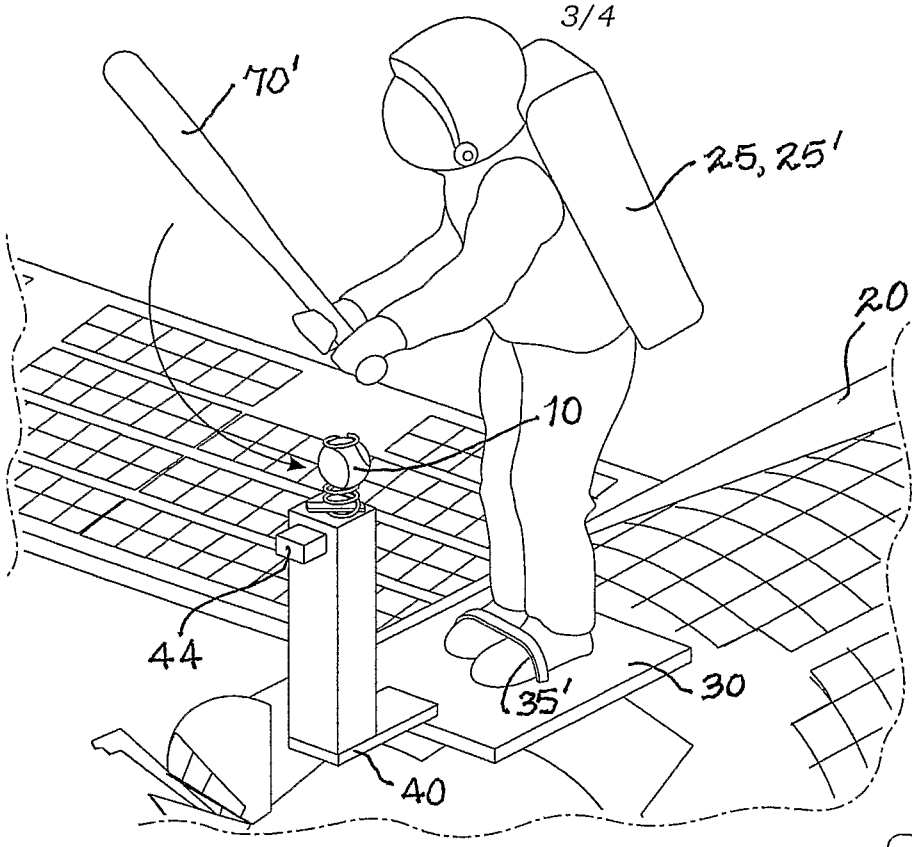


Fig. 3

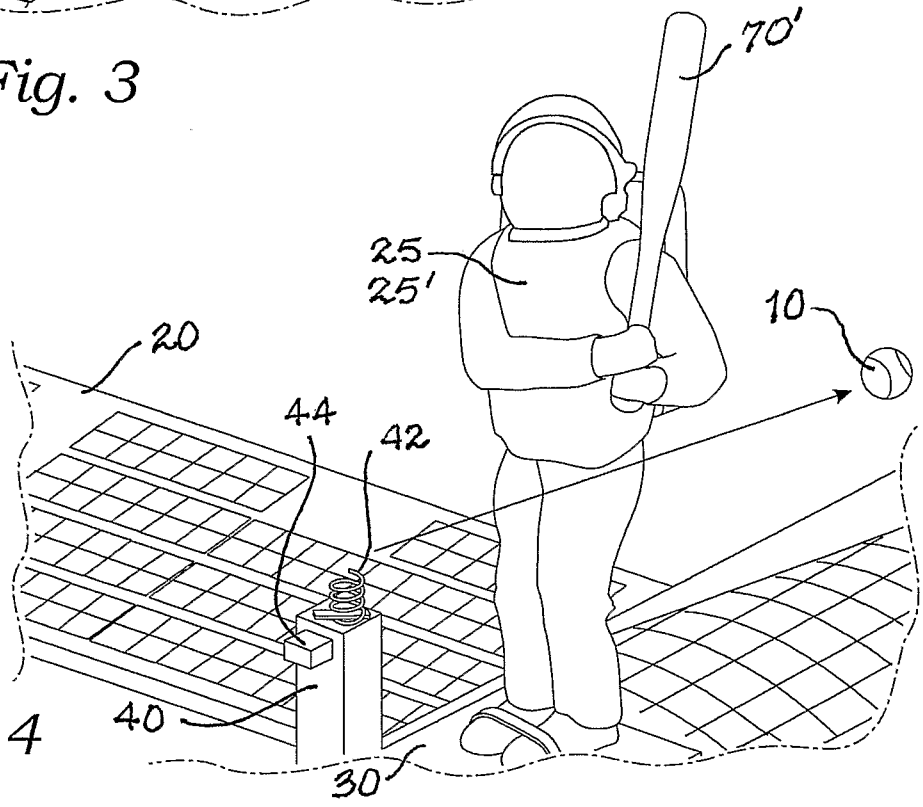


Fig. 4

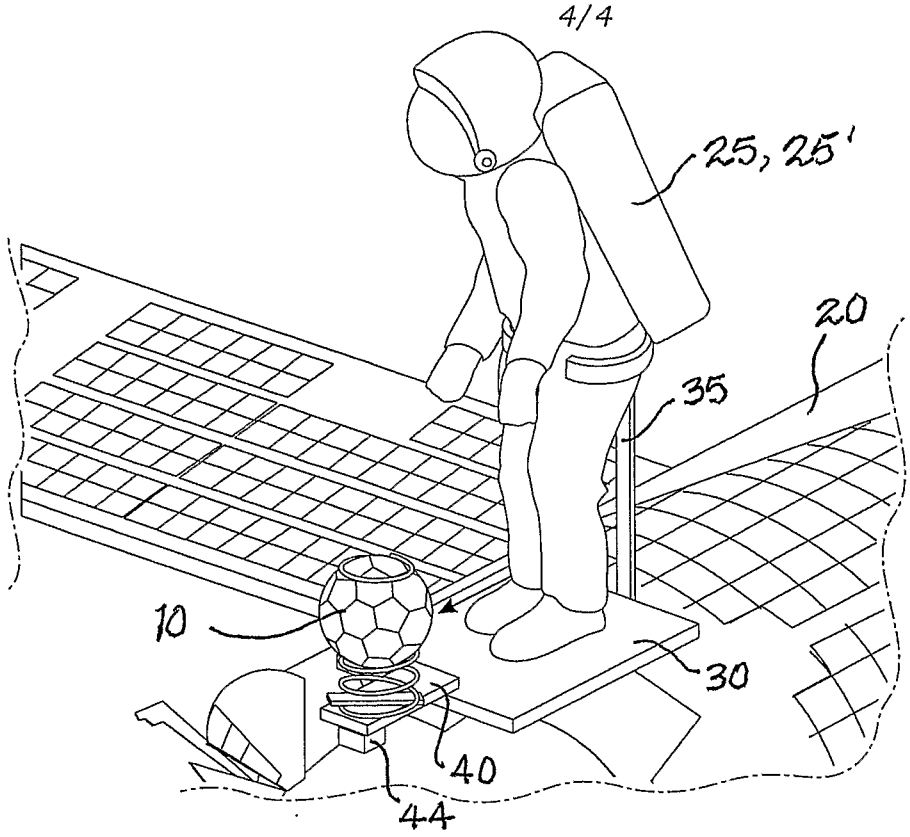


Fig. 5

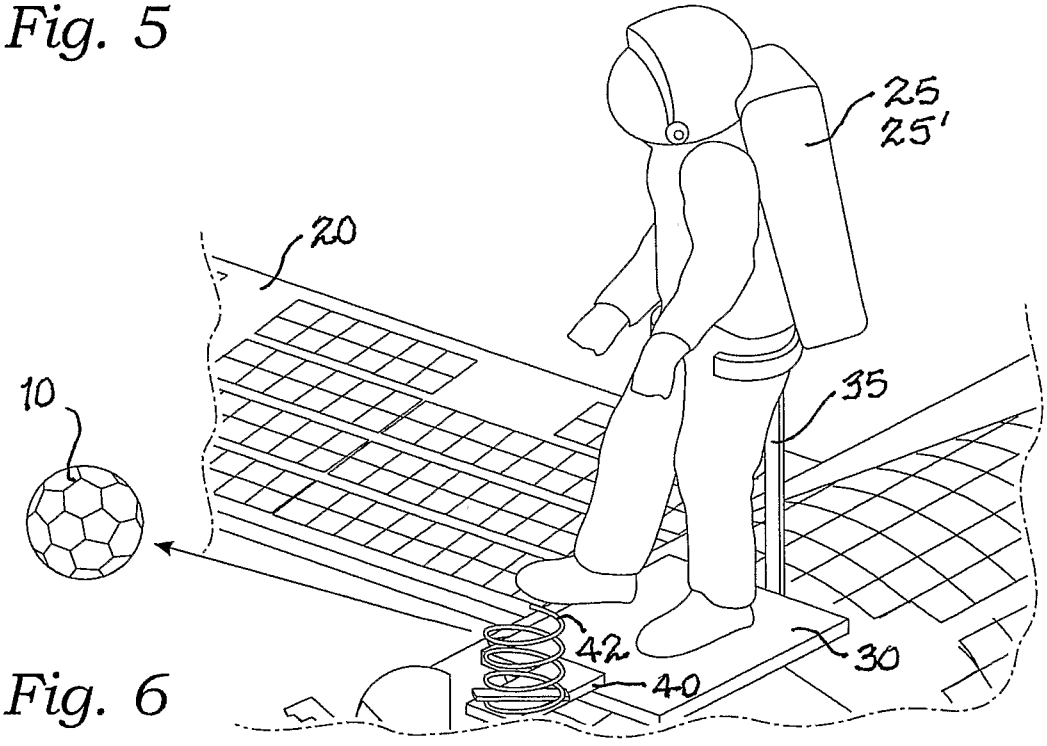


Fig. 6

TITLE OF THE INVENTION

HUMAN-PROPELLED METHOD AND APPARATUS FOR LAUNCHING A SATELLITE

CROSS-REFERENCE TO RELATED APPLICATIONS

[1] This application relates to, and claims the priority date of a US Provisional application, serial number 60/687,863 filed on June 7, 2005, and entitled, "Human-Propelled Method and Apparatus for Launching a Satellite" and which is incorporated herein by reference.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[2] Not applicable.

THE NAMES OF THE PARTIES TO A JOINT RESEARCH AGREEMENT

[3] Not applicable.

INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTTED ON A COMPACT DISC

[4] Not applicable.

REFERENCE TO A "MICROFICHE APPENDIX"

[5] Not applicable.

BACKGROUND OF THE INVENTION

Field of the Present Disclosure

[6] This disclosure relates generally to the process of launching a satellite from a space vehicle and more particularly to a manual method of such launching.

Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98

[7] **Mueller, et al., U.S. 6789767**, discloses an active satellite dispenser that is preferably attachable to a reusable launch vehicle for deployment of one or more satellites into one or more desired orbits. The active satellite dispenser includes a center mast that releasably receives the satellite(s), a liquid propellant rocket, and an orbital control system on an avionics pallet. In the preferred embodiment, a pressurized gas selectively pressurizes the propellant tanks (which may include fuel and oxidizer tanks), to provide propellant to the rocket. In operation, the launch vehicle releases the satellite dispenser in a first deployment orbit. The active dispenser rocket and orbital control system then transport the active dispenser and satellite(s) into the final deployment orbit. In the preferred embodiment the active dispenser can operate multiple times to place individual satellites in different orbits. **DeVerde, et al., U.S. 6416018**, discloses a satellite dispenser adapted to be coupled to a launch vehicle. The dispenser includes a single-piece, integrally formed tubular shell for supporting a plurality of independent satellites thereon. The tubular shell is significantly lighter than multi-piece dispenser shells that require a connecting ring for coupling the post portion and base portion of the shell together. The single piece shell also significantly reduces the cost and simplifies the manufacture of the dispenser shell. The dispenser shell, in certain preferred embodiments, includes a tapered post portion which enables satellites being carried on the upper portion of the post portion to extend further into a fairing disposed over the

satellites and dispenser shell during flight, thus making more efficient use of the envelope defined by the interior area of the fairing. A frusto-conical base portion integrally formed with the post portion enables the load supported by the dispenser shell to be evenly distributed throughout the base portion. The single-piece design also significantly improves the bending stress resistance of the dispenser and its overall structural rigidity. The various preferred embodiments each include a plurality of circular frames which are secured to an interior surface of the dispenser shell. A plurality of interface fittings are secured to an exterior surface of the dispenser shell and support a plurality of satellites thereon. **Scott, U.S. 5242135**, discloses a space launch system and a space transfer vehicle usable within such system. The space transfer vehicle includes a primary propulsion engine and attitude control system. A guidance system for both the atmospheric launch vehicle and the space transfer vehicle is integral with the space transfer vehicle. **King, et al., U.S. 5199672**, discloses an effect of orbit plane precession that is used to place a plurality of satellites into one or more desired orbit planes. The satellites are distributed within each desired orbit plane in a selected configuration. The satellites are transported into orbit on one or more frame structures referred to as "pallets". When more than one pallet is used, they are placed on top of each other in a "stack". After the stack of the pallets has been launched into an initial, elliptical orbit, the pallets are separated sequentially from the stack at selected time intervals. Thrust is applied to transfer a first pallet from the initial orbit to a first, circular orbit, wherein the initial and first orbits are in planes that process at different predetermined initial and first rates, respectively. After waiting for a predetermined time while the initial orbit plane and the first orbit plane precess with respect to each other, thrust is applied to the next pallet to transfer it into a next, circular orbit in a next orbit plane, wherein the precession rate of the next orbit plane also is different from the initial precession rate of the initial orbit plane. The foregoing step is repeated until the satellites on the respective pallets have been sequentially deployed into the desired orbit planes. The satellites on each pallet are then separated from the pallet simultaneously, but at different rates to achieve separation among the satellites within each orbit. **Wether, U.S. 3907245**, discloses a

spacecraft for deploying objects into selected multiple flight paths. The spacecraft has two separable, individually powered deployment vehicles each carrying a number of the objects. During launch, the two vehicles are mated, in interfitting relation, into a compact unitary spacecraft which is placed into a predetermined initial flight path. The two deployment vehicles are then separated and powered across the selected flight paths of the objects to be deployed. Upon arrival of each vehicle at a selected flight path, the vehicle is momentarily arrested and positioned in a proper deployment attitude and an object is deployed along the path. **Wether, U.S. 3652042,** discloses a spacecraft for inserting multiple objects into selected space flight paths in selected attitudes relative to the flight paths by deploying the objects, either passively or actively, from extendable object mounting platforms gimballed on one end of the vehicle body. During launch the platforms are retracted to fit within the launch vehicle shroud. After separation of the spacecraft from the booster in space, the platforms are extended to object deployment positions and the spacecraft is oriented by thrusters in a flight attitude wherein the thrust vector of a main propulsion engine on the vehicle body is aligned with the local range insensitive axis. Object deployment is accomplished by utilizing the main engine to propel the spacecraft along the range insensitive axis across the selected flight paths and by tilting the mounting platforms at each deployment point to orient the object to be deployed in the proper deployment attitude relative to the selected flight path. **Mueller, et al., U.S. 2002/0179776,** discloses an active satellite dispenser that is preferably attachable to a reusable launch vehicle for deployment of one or more satellites into one or more desired orbits. The active satellite dispenser includes a center mast that releasably receives the satellite(s), a liquid propellant rocket, and an orbital control system on an avionics pallet. In the preferred embodiment, a pressurized gas selectively pressurizes the propellant tanks (which may include fuel and oxidizer tanks), to provide propellant to the rocket. In operation, the launch vehicle releases the satellite dispenser in a first deployment orbit. The active dispenser rocket and orbital control system then transport the active dispenser and satellite(s) into the final deployment orbit. In the

preferred embodiment the active dispenser can operate multiple times to place individual satellites in different orbits.

[8] The related art described above discloses various methods and apparatus for placing satellites carried by a carrier craft into orbit initially upon liftoff from Earth and also after the carrier craft attains an initial orbit. However, the prior art fails to disclose methods and apparatus for launching satellites from a carrier craft in orbit by manual means. The present disclosure distinguishes over the prior art providing heretofore unknown advantages as described in the following summary.

BRIEF SUMMARY OF THE INVENTION

[9] Space exploration has expanded the horizons of the human race and has provided opportunity for unparalleled co-operation between teams of astronauts, cosmonauts, scientists and engineers from different countries. Research performed in preparation for, and during, space flights has been used to improve life on earth and has permitted the establishment of the International Space Station (ISS). This disclosure teaches certain benefits in construction and use which give rise to the objectives described below.

[10] Described herein is a manual method of launching a satellite from a space borne vehicle which includes fixing a launching platform onto a space vehicle and fixing a satellite holder or support onto the launching platform. A person, properly suited for extra-vehicular activity, i.e. without a support environment outside of his or her personal suit, is temporarily fastened or tethered to the launching platform and a satellite is engaged with the satellite holder adjacent to the person. The person throws, kicks or strikes the satellite to dislodge it from the holder and to direct it in a path away from the vehicle. Once given impetus and direction and freed of the satellite holder, the satellite continues to move in its initial directions at a velocity approximately equal to that of the vehicle relative to the surface of the Earth, assuming that the vehicle is orbiting the

Earth. The satellite therefor also orbits the Earth and takes up its own orbital path depending on its initial velocity and direction of thrust.

[11] A primary objective inherent in the above described apparatus and method of use is to provide advantages not taught by the prior art.

[12] Another objective is to direct a satellite from a space vehicle by manual exertion so as to avoid the necessity of providing for launch equipment that may add unwanted payload to the space ship.

[13] A further objective is to provide the flexibility of launching the satellite in a direction of choice with a maximum flexibility of choice of such direction.

[14] Other features and advantages of the present invention will become apparent from the following more detailed description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the presently described apparatus and method of its use.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[15] Illustrated in the accompanying drawing(s) is at least one of the best mode embodiments of the present invention In such drawing(s):

[16] Figures 1 and 2 are perspective views of the present method and apparatus showing the launching of a golf ball satellite using a golf club, where a person launching the satellite is tethered to a launching platform;

[17] Figures 3 and 4 are perspective views of the present method and apparatus showing the launching of a baseball satellite using a baseball bat, where the person launching the satellite is anchored to the launching platform by boot straps; and

[18] Figures 5 and 6 are perspective views of the present method and apparatus showing the launching of a soccer ball satellite by the act of kicking, where the person launching the satellite is tethered to the launching platform.

DETAILED DESCRIPTION OF THE INVENTION

[19] The above described drawing figures illustrate the described apparatus and its method of use in at least one of its preferred, best mode embodiment, which is further defined in detail in the following description. Those having ordinary skill in the art may be able to make alterations and modifications what is described herein without departing from its spirit and scope. Therefore, it must be understood that what is illustrated is set forth only for the purposes of example and that it should not be taken as a limitation in the scope of the present apparatus and method of use.

[20] Described and illustrated now in detail is an apparatus for manually launching a relatively low weight satellite 10 from a Space borne vehicle 20. In the figures, only a portion of the vehicle 20 is shown, as the vehicle 20, such as the International Space Station is quite large relative to the other objects of the present apparatus which are herein described. The apparatus includes a launching platform 30 which is rigidly mounted exteriorly on vehicle 20 as shown, by any mechanical fastening device such as bolts, etc. A satellite holder 40 is engaged with the launching platform 30, again by any convenient rigid fastening means. A Space suit 25 of any well known type, is configured for protecting a person 25' within the suit 25 when the person 25' are external to the vehicle 20, i.e., when the person is exposed to the Space environment where temperatures are near absolute zero when in shadow, and external pressure is near

perfect vacuum. A tether 35 or 35' engages the person 25', securing the person to the launching platform 30. The satellite holder 40 preferably includes a coil spring 42 configured to temporarily engage the satellite 10 in a manner enabling the satellite to be jettisoned from the satellite holder 40 using only manual force.

[21] Preferably, the satellite 10 has a common shape such as spherical, oblate, oblong or disk shaped and preferably is constructed with a structural outer covering to withstand the forces that are applied to it at launch. The satellite 10 is preferably one of a golf ball, a baseball, a soccer ball, a football, a tennis ball, a softball or other well known objects that are, during traditional game play, manually thrown, kicked or hit with a club, bat, stick or other well known force directing object. Clearly, the satellite 10 may be placed into orbit as a novelty, or for telemetry purposes or other useful purposes. Placement of sports related objects into Earth or Moon orbit is useful for advertising, business promotions and other highly useful purposes, i.e., public awareness, the development of a symbolic marketing icon, establishment of a prestigious image based on "the longest golf ball drive," for instance, or other bragging rights.

[22] The satellite 10 may be propelled by hand, foot or by a driver 70 or 70', but it is driven in the present method using only the force of the human body, possibly supplemented through the use of the driver 70 or 70'. The driver 70 or 70' may be a baseball bat (Figs. 3 and 4), a softball bat, golf club (Figs. 1 and 2), a tennis racquet or a game stick such as those used in the games of hurling, hockey, jai alai, lacrosse, and the like. Of course, the satellite 10 may be launched through the acts of throwing or kicking, the latter shown in Fig. 6.

[23] The satellite holder 40 preferably uses a coil spring 42 set with its axis normal to the holder's surface. Other holder configurations and types may be used beside a coil spring 42, but the coil spring 42 is particularly useful in that the satellite 10 is effectively held between adjacent windings of the spring 42 and is then easily dispatched from the coil

spring 42 using only manual force. Because most materials become hard, ridged and brittle when exposed to the temperatures of Space, the satellite holder 40 provides a source of heat 44 which is engaged such that thermal energy is conducted to the metal coil spring 42. This source of heat 44 is preferably an electrical resistance circuit, a chemical heat source or any other well known thermal source. The source of heat 44 is sufficient to maintain the coil spring 42 in a state of flexibility during the holding and launching of the satellite 10.

[24] The person 25' within the space suit 25 is secured, as previously discussed, to the launching platform 30. The tether may be a harness 35 as shown in Fig. 5 or Fig. 6, Such a harness 35 engages the person 25' around the waist of the suit 25 grounding the person 24' while allowing considerable freedom of motion. Alternately, or in addition to the harness 35, the space suit may be anchored to the launching platform 30 by securing one or both of its boots 26 to the platform 30 with a metal tie strap 35'. Such a metal tie strap 35' is preferably secured using a magnetic latch or other well known fastener including common screws. The tie strap 35', provides greater freedom of motion of the center portions of the body, while the harness 35 provides freedom of the feet. Of course, both the harness 35 and the tie strap 35' may be used at the same time (not shown).

[25] The instant method uses the above described apparatus in achieving the objectives of the invention. The method is in fact a manual method of launching satellite 10 from space borne vehicle 20 and includes the steps of: fixing the launching platform 30 on the exterior of the vehicle 10, and fixing the satellite holder 40 on the launching platform 30. The person 25' who launches the satellite 10 is garbed in a Space suit 25 enabling the person to conduct extra-vehicular activities as is well known. Therefore, the person 25' is able to exit the vehicle 20 and move to, and take a position on the launching platform 30 as shown in the figures. The Space suit 25 is tethered to the launching platform 30 as a necessity so as to transfer inertial forces created by the person to the vehicle 20 thereby

enabling the person 25' to maintain his/her own equilibrium and orientation while launching the satellite 10. The satellite 10 is engaged with the satellite holder 40 in a position adjacent to the person, i.e., within natural reach so that the person 25' is able to launch the satellite 10 without undue reaching, stretching or bending, activities radically restricted by the suit 25. To launch the satellite 10, the person directs his manual force, either directly by hand or foot, i.e., throwing or kicking, or by the use of an implement (driver), to the satellite 10 so as to disengage the satellite 10 from the satellite holder 40 and to further project the satellite 10 away from the vehicle 20. When the person 25' is provided with the driver 70 or 70' the manual force is delivered by the person to the satellite 20 through the driver 70 or 70' generally by swinging the driver at the satellite 10 and striking it to impart a launching force to it. Clearly, an opposite and equal reactive force is delivered to the driver 70 or 70' but this reactive force is channeled through the tether to the vehicle 20 so that the person 25' is not launched as well as the satellite 10.

[26] The enablements described in detail above are considered novel over the prior art of record and are considered critical to the operation of at least one aspect of the apparatus and its method of use and to the achievement of the above described objectives. The words used in this specification to describe the instant embodiments are to be understood not only in the sense of their commonly defined meanings, but to include by special definition in this specification: structure, material or acts beyond the scope of the commonly defined meanings. Thus if an element can be understood in the context of this specification as including more than one meaning, then its use must be understood as being generic to all possible meanings supported by the specification and by the word or words describing the element.

[27] The definitions of the words or drawing elements described herein are meant to include not only the combination of elements which are literally set forth, but all equivalent structure, material or acts for performing substantially the same function in

substantially the same way to obtain substantially the same result. In this sense it is therefore contemplated that an equivalent substitution of two or more elements may be made for any one of the elements described and its various embodiments or that a single element may be substituted for two or more elements in a claim.

[28] Changes from the claimed subject matter as viewed by a person with ordinary skill in the art, now known or later devised, are expressly contemplated as being equivalents within the scope intended and its various embodiments. Therefore, obvious substitutions now or later known to one with ordinary skill in the art are defined to be within the scope of the defined elements. This disclosure is thus meant to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, what can be obviously substituted, and also what incorporates the essential ideas.

[29] The scope of this description is to be interpreted only in conjunction with the appended claims and it is made clear, here, that each named inventor believes that the claimed subject matter is what is intended to be patented.

CLAIM(S)

What is claimed is:

Claim 1. A manual method of launching a satellite from a space borne vehicle comprising the steps of:

a) fixing a launching platform on an exterior portion of the vehicle;

b) fixing a satellite holder on the launching platform;

c) garbing a person in a suit protective of a space environment external to the vehicle;

d) fastening the person to the launching platform;

e) engaging the satellite with the satellite holder in a position adjacent to the person; and

f) directing a manual force of the person to the satellite sufficient to disengage the satellite from the satellite holder and further to project the satellite away from the vehicle.

Claim 2. The method of claim 1 further comprising the step of forming the satellite as one of spherical, oblate, oblong and disk shaped.

Claim 3. The method of claim 2 wherein the satellite is a golf ball.

Claim 4. The method of claim 3 further comprising the step of providing the person with a driver.

Claim 5. The method of claim 4 wherein the driver is a golf club and the manual force is delivered by the person to the golf ball using the golf club.

Claim 6. The method of claim 2 wherein the satellite is a baseball.

Claim 7. The method of claim 6 further comprising the step of providing the person with a driver.

Claim 8. The method of claim 7 wherein the driver is a baseball bat and the manual force is delivered by the person to the baseball using the baseball bat.

Claim 9. The method of claim 2 wherein the satellite is a soccer ball.

Claim 10. The method of claim 9 further comprising the step of providing the person with a driver.

Claim 11. The method of claim 10 wherein the driver is a boot and the manual force is delivered by the person to the soccer ball using the boot.

Claim 12. The method of claim 1 further comprising the step of heating the satellite holder.

Claim 13. An apparatus for launching a satellite from a space borne vehicle comprising in combination: a launching platform engaged with an exterior portion of the vehicle; a satellite holder engaged with the launching platform; a suit configured for protecting a person external to the vehicle; a tether engaging the person with the launching platform; and a satellite holder engaged with the launching platform adjacent the tether, the satellite holder configured to further engage the satellite in a manner enabling the satellite to be jettisoned from the satellite holder using a manual force.

Claim 14. The combination of claim 13 wherein the satellite is one of spherical, oblate, oblong and disk shaped.

Claim 15. The combination of claim 14 wherein the satellite is one of a golf ball, a baseball, a soccer ball, a football, a tennis ball, and a softball.

Claim 16. The combination of claim 14 further comprising a driver, wherein the driver is one of a golf club and a tennis racquet.

Claim 17. The combination of claim 14 wherein the satellite holder is a coil spring.

Claim 18. The combination of claim 17 further including a source of heat engaged with the coil spring, the source of heat sufficient to maintain the coil spring in a state of flexibility when exposed to a space environment.