



(12) **United States Patent**  
**Ben-Tsur et al.**

(10) **Patent No.:** **US 10,905,378 B1**  
(45) **Date of Patent:** **Feb. 2, 2021**

- (54) **METHOD FOR TREATING GASTROPARESIS USING A VIBRATING INGESTIBLE CAPSULE**
- (71) Applicant: **VIBRANT LTD.**, Yokneam (IL)
- (72) Inventors: **Lior Ben-Tsur**, Netanya (IL); **Camille Morliere**, Hadera (IL)
- (73) Assignee: **VIBRANT LTD**, Yokneam (IL)
- (\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 190 days.

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(21) Appl. No.: **15/882,329**

(22) Filed: **Jan. 29, 2018**

**Related U.S. Application Data**

(60) Provisional application No. 62/451,837, filed on Jan. 30, 2017.

(51) **Int. Cl.**  
**A61B 5/00** (2006.01)  
**A61B 5/07** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61B 5/6861** (2013.01); **A61B 5/073** (2013.01); **A61H 2201/1207** (2013.01)

(58) **Field of Classification Search**  
CPC ..... **A61B 5/6861**; **A61B 5/073**  
See application file for complete search history.

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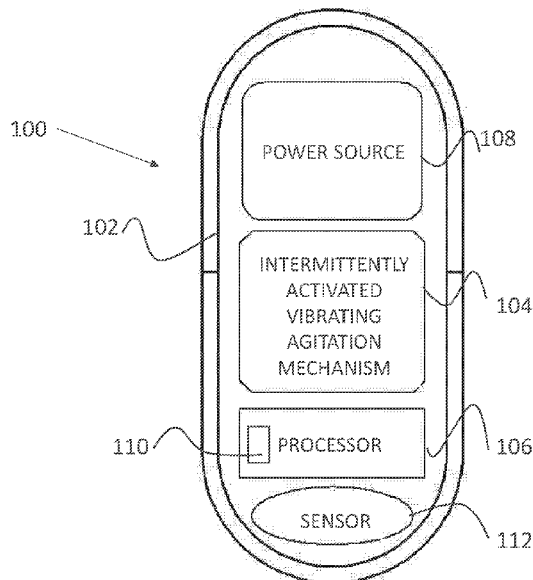
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*Primary Examiner* — Samchuan C Yao  
*Assistant Examiner* — Matthew Standard  
(74) *Attorney, Agent, or Firm* — Momentum IP Group; Marc Van Dyke

(57) **ABSTRACT**

A method for treating gastroparesis in a subject using a vibrating ingestible capsule ingested by the subject and activated in a targeted zone of the gastrointestinal tract of the subject.

**17 Claims, 2 Drawing Sheets**





US010888277B1

(12) **United States Patent**  
**Ben-Tsur et al.**

(10) **Patent No.:** **US 10,888,277 B1**  
(45) **Date of Patent:** **Jan. 12, 2021**

(54) **METHOD FOR TREATING DIARRHEA AND REDUCING BRISTOL STOOL SCORES USING A VIBRATING INGESTIBLE CAPSULE**

(71) Applicant: **VIBRANT LTD.**, Yokneam (IL)

(72) Inventors: **Lior Ben-Tsur**, Netanya (IL); **Camille Morliere**, Hadera (IL)

(73) Assignee: **VIBRANT LTD**, Yokneam (IL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 186 days.

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9,707,150	B2	7/2017	Shabbat
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(21) Appl. No.: **15/882,289**

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(22) Filed: **Jan. 29, 2018**

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**Related U.S. Application Data**

(60) Provisional application No. 62/451,834, filed on Jan. 30, 2017.

(51) **Int. Cl.**  
**A61B 5/00** (2006.01)  
**A61B 5/07** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61B 5/6861** (2013.01); **A61B 5/073** (2013.01); **A61H 2201/1207** (2013.01)

(58) **Field of Classification Search**  
CPC ..... **A61B 5/6861**; **A61B 5/073**  
See application file for complete search history.

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*Primary Examiner* — Samchuan C Yao  
*Assistant Examiner* — Matthew Standard  
(74) *Attorney, Agent, or Firm* — Momentum IP Group; Marc Van Dyke

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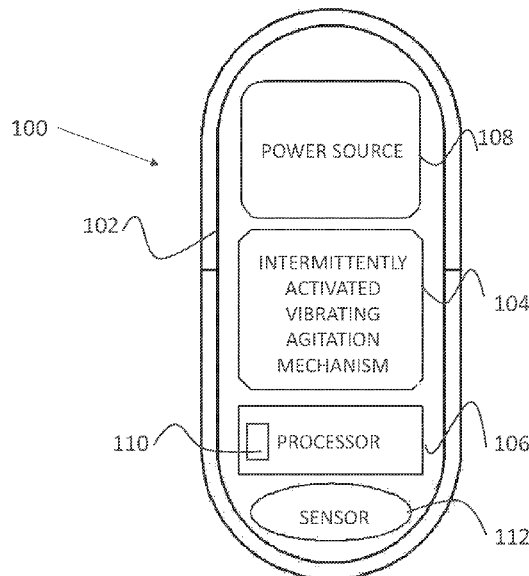
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5,170,801	A	12/1992	Casper et al.

(57) **ABSTRACT**

A method for treating diarrhea in a subject and/or for reducing Bristol stool scores of fecal matter of a subject using a vibrating ingestible capsule ingested by the subject and activated in a targeted zone of the gastrointestinal tract of the subject.

**20 Claims, 2 Drawing Sheets**





(12) **United States Patent**  
**Ben-Tsur et al.**

(10) **Patent No.:** **US 10,814,113 B2**  
(45) **Date of Patent:** **Oct. 27, 2020**

(54) **DEVICE AND METHOD FOR DELIVERING AN INGESTIBLE MEDICAMENT INTO THE GASTROINTESTINAL TRACT OF A USER**

(71) Applicant: **VIBRANT LTD.**, Yokneam (IL)

(72) Inventors: **Lior Ben-Tsur**, Netanya (IL); **Shai Molnar**, Shorashim (IL); **Ronny Shabbat**, Kibbutz Yizra'el (IL)

(73) Assignee: **Vibrant Ltd.**, Yokneam (IL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/732,883**

(22) Filed: **Jan. 2, 2020**

(65) **Prior Publication Data**

US 2020/0214592 A1 Jul. 9, 2020

(30) **Foreign Application Priority Data**

Jan. 3, 2019 (GB) ..... 1900082.7

(51) **Int. Cl.**  
**A61M 31/00** (2006.01)  
**A61B 5/07** (2006.01)  
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(52) **U.S. Cl.**  
CPC ..... **A61M 31/002** (2013.01); **A61B 5/0051** (2013.01); **A61B 5/073** (2013.01);  
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(58) **Field of Classification Search**  
CPC .. A61M 37/00; A61M 5/168; A61M 5/16804; A61M 5/16836; A61M 5/172;  
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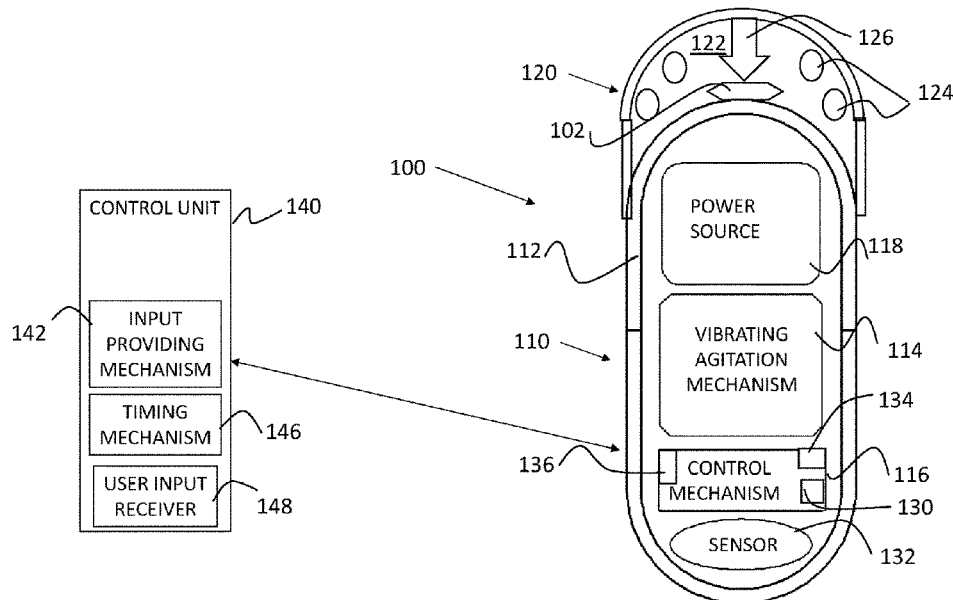
*Primary Examiner* — Jenna Zhang

(74) *Attorney, Agent, or Firm* — Marc Van Dyke; Momentum IP Group

(57) **ABSTRACT**

Devices and methods for delivering an ingestible medication of a medicament tablet into the gastrointestinal tract of a user. A device according to the invention includes a vibrating ingestible capsule and a hollow medicament compartment housing. The vibrating capsule includes a housing, a vibrating agitator disposed within the housing, a power supply, and a control element. The hollow medicament compartment housing is associated with the housing of the capsule and includes at least one aperture. The hollow of the medicament compartment housing is configured to have the medicament tablet disposed therein. The aperture(s) are dimensioned to enable fluid communication the surrounding environment and the hollow.

**21 Claims, 10 Drawing Sheets**





(12) **United States Patent**  
**Ben-Tsur**

(10) **Patent No.:** **US 10,543,348 B2**  
(45) **Date of Patent:** **Jan. 28, 2020**

(54) **METHOD OF ENHANCING ABSORPTION OF INGESTED MEDICAMENTS FOR TREATMENT OF AN AN AILMENT OF THE GI TRACT**

(71) Applicant: **VIBRANT LTD.**, Yokneam (IL)

(72) Inventor: **Lior Ben-Tsur**, Netanya (IL)

(73) Assignee: **Vibrant Ltd.**, Yokneam (IL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/185,044**

(22) Filed: **Nov. 9, 2018**

(65) **Prior Publication Data**

US 2019/0308002 A1 Oct. 10, 2019

**Related U.S. Application Data**

(60) Provisional application No. 62/655,031, filed on Apr. 9, 2018.

(51) **Int. Cl.**  
**A61M 37/00** (2006.01)  
**A61K 9/00** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **A61M 37/00** (2013.01); **A61K 9/0053** (2013.01); **A61K 41/0023** (2013.01);  
(Continued)

(58) **Field of Classification Search**  
CPC .... A61M 31/00; A61M 37/00; A61M 31/002; A61K 41/0023; A61K 9/0053; A61B 5/073

See application file for complete search history.

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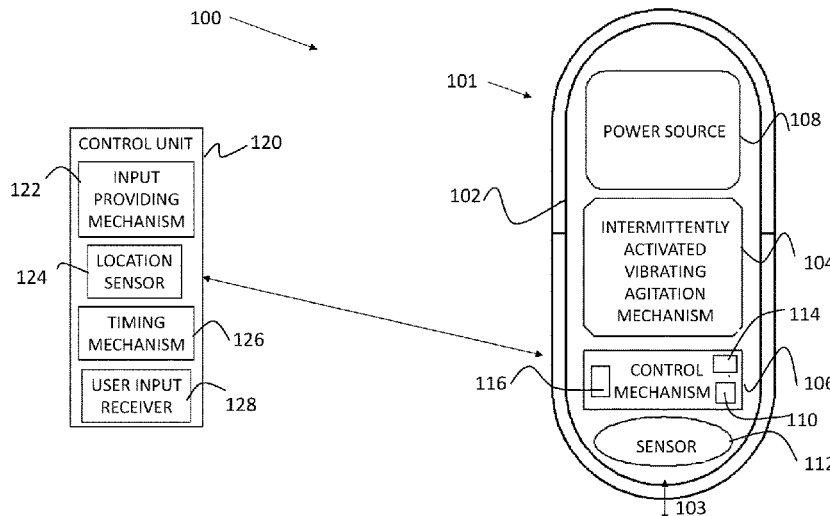
*Primary Examiner* — William R Carpenter

(74) *Attorney, Agent, or Firm* — Marc Van Dyke; Momentum IP Group

(57) **ABSTRACT**

A method of using a vibrating gastrointestinal capsule in coordination with an ingestible medicament for treatment of an ailment of the GI tract. The vibrating gastrointestinal capsule, is provided to the subject, and includes: a housing; a vibrating agitation mechanism causing the housing to exert vibrations on an environment thereof; a power supply for powering said vibrating agitation mechanism; and a control mechanism for activating said vibrating agitation mechanism to operate in said vibration mode of operation. The subject ingests the ingestible medicament and the vibrating gastrointestinal capsule. At least one of a time of ingesting of the vibrating gastrointestinal capsule and a timing or activation delay of the vibration mode of operation is controlled, such that the vibration mode of operation at least partially transpires or completely transpires within an actual or estimated absorption time period of the ingestible medicament within the gastrointestinal tract of the subject.

**16 Claims, 2 Drawing Sheets**



(12) **United States Patent**  
**Ben-Tsur**

(10) **Patent No.:** **US 10,537,720 B2**  
(45) **Date of Patent:** **Jan. 21, 2020**

(54) **METHOD OF ENHANCING ABSORPTION OF INGESTED MEDICAMENTS FOR TREATMENT OF PARKINSONISM**

FOREIGN PATENT DOCUMENTS

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(Continued)

(71) Applicant: **VIBRANT LTD.**, Yokneam (IL)

(72) Inventor: **Lior Ben-Tsur**, Netanya (IL)

(73) Assignee: **Vibrant Ltd.**, Yokneam (IL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(21) Appl. No.: **16/178,425**

(22) Filed: **Nov. 1, 2018**

(65) **Prior Publication Data**

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**Related U.S. Application Data**

(60) Provisional application No. 62/655,031, filed on Apr. 9, 2018.

(51) **Int. Cl.**

**A61M 31/00** (2006.01)  
**A61K 9/00** (2006.01)  
**A61K 41/00** (2006.01)

(52) **U.S. Cl.**

CPC ..... **A61M 31/00** (2013.01); **A61K 9/0053** (2013.01); **A61K 41/0023** (2013.01);  
(Continued)

(58) **Field of Classification Search**

CPC . **A61K 41/0023**; **A61K 9/0053**; **A61M 31/00**;  
**A61M 37/00**

See application file for complete search history.

(56) **References Cited**

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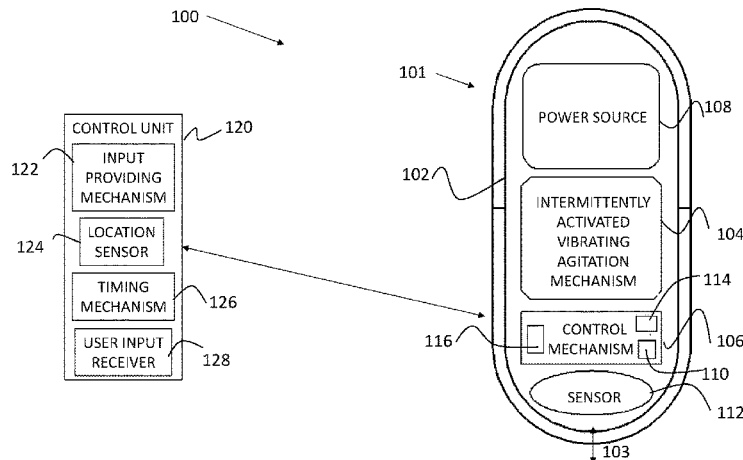
*Primary Examiner* — William R Carpenter

(74) *Attorney, Agent, or Firm* — Marc Van Dyke;  
Momentum IP Group

(57) **ABSTRACT**

A method of using a vibrating gastrointestinal capsule in coordination with an ingestible medicament for treatment of Parkinsonism. The vibrating gastrointestinal capsule, is provided to the subject, and includes: a housing; a vibrating agitation mechanism causing said housing to exert vibrations on an environment surrounding the vibrating gastrointestinal capsule; a power supply for powering said vibrating agitation mechanism; and a control mechanism for activating said vibrating agitation mechanism to operate in said vibration mode of operation. The subject ingests the ingestible medicament and the vibrating gastrointestinal capsule. At least one of a time of ingesting of the vibrating gastrointestinal capsule and a timing or activation delay of the vibration mode of operation is controlled, such that the vibration mode of operation at least partially transpires or completely transpires within an actual or estimated absorption time period of the ingestible medicament within the gastrointestinal tract of the subject.

**17 Claims, 2 Drawing Sheets**





(12) **United States Patent**  
**Shohat et al.**

(10) **Patent No.:** **US 9,532,923 B2**  
(45) **Date of Patent:** **Jan. 3, 2017**

(54) **METHOD OF OPERATING A GASTROINTESTINAL CAPSULE**

(71) Applicant: **VIBRANT LTD.**, Migdal Haemek (IL)

(72) Inventors: **Shaul Shohat**, Kfar Hoaranim (IL);  
**Alexander Belenky**, Hod Hasharon (IL); **Roni Shabat**, Kibbutz Izrael (IL)

(73) Assignee: **VIBRANT LTD.**, Yokneam (IL)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/732,733**

(22) Filed: **Jun. 7, 2015**

(65) **Prior Publication Data**

US 2015/0313792 A1 Nov. 5, 2015

**Related U.S. Application Data**

(63) Continuation of application No. 12/310,201, filed as application No. PCT/IL2007/001139 on Sep. 17, 2007, now Pat. No. 9,078,799.

(60) Provisional application No. 60/845,200, filed on Sep. 18, 2006.

(51) **Int. Cl.**  
**A61H 23/00** (2006.01)  
**A61H 23/02** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61H 23/02** (2013.01); **A61H 23/0263** (2013.01); **A61H 2205/083** (2013.01)

(58) **Field of Classification Search**  
CPC .... **A61H 23/00**; **A61H 23/02**; **A61H 23/0254**;  
**A61H 23/0263**; **A61H 2205/083**; **A61H**  
1/00

See application file for complete search history.

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*Primary Examiner* — Quang D Thanh

(74) *Attorney, Agent, or Firm* — Marc Van Dyke

(57) **ABSTRACT**

An ingestible gastrointestinal capsule (GIC) for mechanically stimulating a segment of the gastrointestinal (GI) wall by alternately and repeatedly pressurizing, and/or vibrating it is provided. The GIC is programmed to being activated following a predefined time delay. The activated GIC agitates, shakes, rattles, jolts, vibrates and/or moves in a reciprocal expanding and contracting motion thereby mechanically stimulating the adjacent segment of the GI wall at a targeted location. Activation of the GIC may include a number of automatically accomplished partial activations, such as when the time elapsed from the moment of setting the GIC on equals a predefined time delay; when the mechanical load applied onto the GIC exceeds, and/or gets lower than a respective predefined level of mechanical load; when the ambient pH reaches a predefined level, or changes, and/or a temperature associated with the user reaches a predefined threshold. Agitation is accomplished by means of agitation means embedded in the GIC. Such agitation means includes an unbalanced weight attached to the shaft of an electric motor, an actuator implemented by, such as an electric solenoid, an electro-active polymer (EAP), a dielectric elastomer actuator (DEA), embedded in a GIC of the invention.

**18 Claims, 2 Drawing Sheets**

