May 13, 1969 J. J. SCHWEIHS 3,443,442

SELECTIVELY OPERABLE INTERMITTENT MOTION APPARATUS

Filed June 21, 1967 Sheet 1 of 2

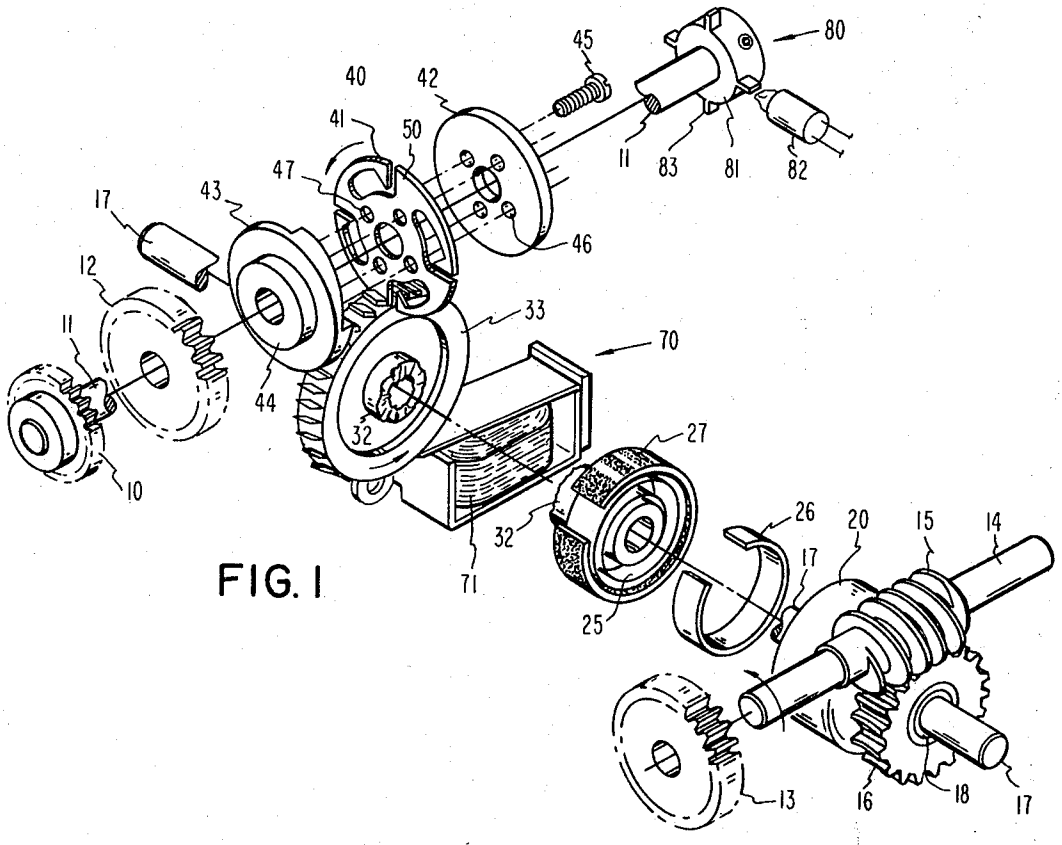

FIG. 1

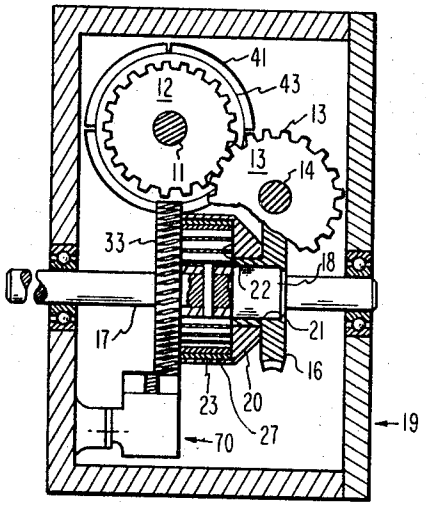

FIG. 3

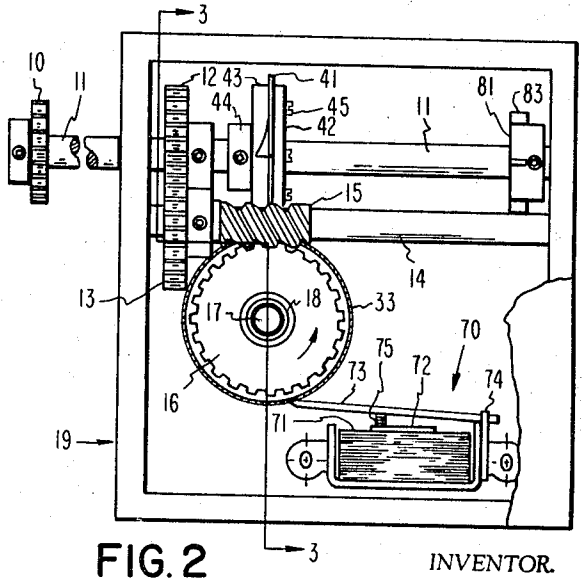

FIG. 2

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SELECTIVELY OPERABLE INTERMITTENT MOTION APPARATUS

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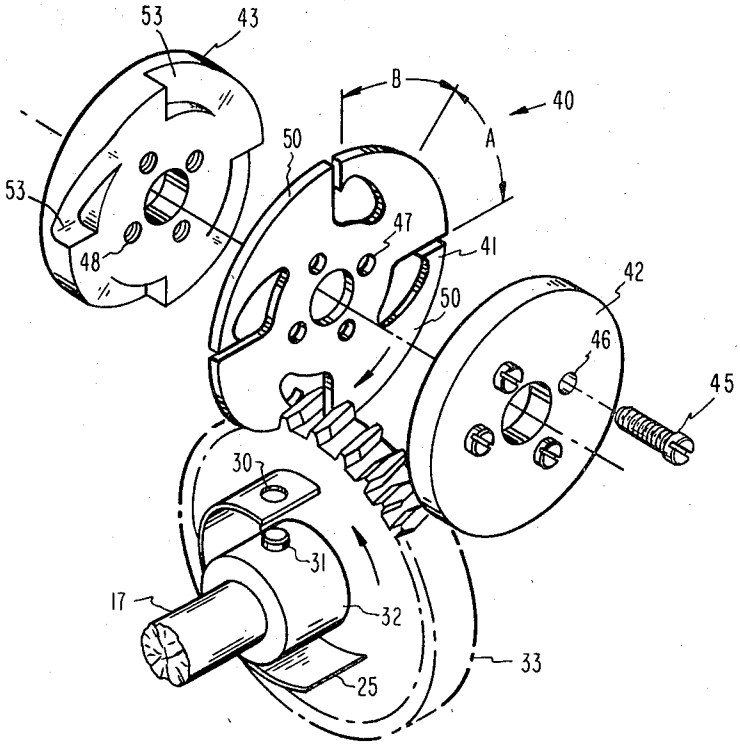

FIG. 4

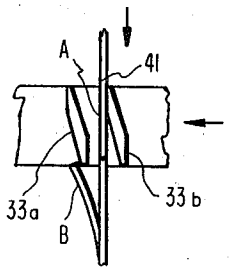

FIG. 5

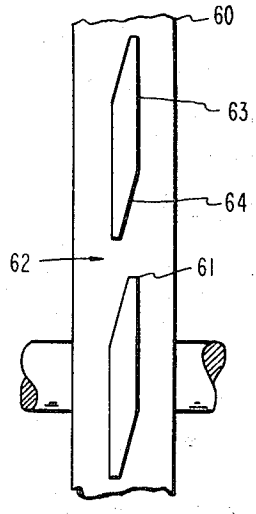

FIG. 7

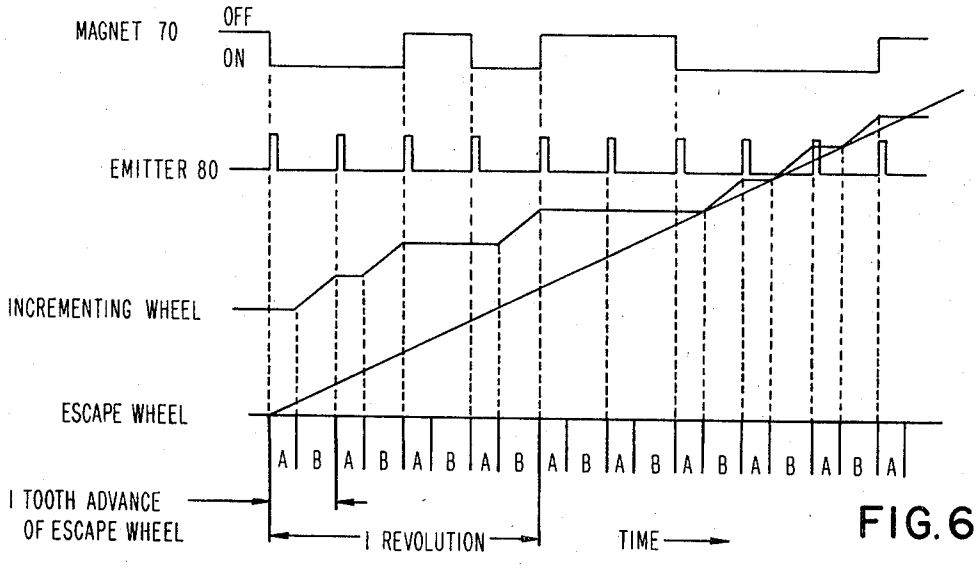

FIG. 6

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SELECTIVELY OPERABLE INTERMITTENT MOTION APPARATUS

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Int. Cl. F16h 27/10
U.S. Cl. 74—1.5 11 Claims

ABSTRACT OF THE DISCLOSURE

An input shaft rotating at a constant speed rotates an input drum. The rotating drum winds a spiral spring through a friction shoe connected to the outer convolution of the spring. The inner end of the spring is connected to the hub of an incrementing wheel. Although the incrementing wheel is urged by the spring to rotate, it moves under control of an escape wheel.

Spring teeth on the escape wheel include a dwell section and a section which can deflect laterally to permit escape of a tooth on the incrementing wheel. The rate of incrementing is determined by the speed of the escape wheel and the amount of torque furnished by the coil spring.

A selectively operable magnet controls the incrementing operation. To stop incrementing, the magnet is operated during a dwell time to release its armature which engages a tooth on the incrementing wheel. The input shaft continues to rotate; however, the spiral spring is wound until slippage occurs between the friction shoe and the input drum. Likewise, the escape wheel continues to rotate freely between a pair of teeth on the incrementing wheel. To resume incrementing, the armature is disengaged during a dwell time from the incrementing wheel. An emitter fixed to the escape wheel shaft provides an electrical control pulse for each dwell time.

BACKGROUND OF THE INVENTION

Field of the invention

This invention generally relates to improved intermittent motion apparatus and more particularly to such apparatus which is selectively operable, and still more particularly to selectively operable intermittent motion apparatus where the input shaft rotates continuously at a constant speed, even while incrementing has been stopped.

Description of the prior art

Prior art devices such as well-known cam and pin gear drives provide for intermittent motion but are not selectively operable. Further, if the input rotates continuously, the output shaft cannot be stopped. The present invention is selectively operable and the output shaft can be held against movement while the input rotates continuously. This is possible because the input drum slips relative to the friction shoe when the incrementing wheel is held stationary.

SUMMARY OF THE INVENTION

The principal object of the invention is to provide improved selectively operable intermittent motion apparatus which:

(a) does not require close tolerances;
(b) is relatively inexpensive;
(c) does not require detenting;
(d) is not affected by wear with regard to incrementing accuracy; and
(e) is relatively compact.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded isometric view of the device without the support structure;

FIG. 2 is a front elevational view of the device;

FIG. 3 is a sectional view taken along the lines 3—3 in FIG. 2;

FIG. 4 is an enlarged exploded isometric view of the incrementing and escape wheels;

FIG. 5 is a schematic developed view illustrating how the incrementing wheel exits from the escape wheel;

FIG. 6 is a diagram illustrating the energization and de-energization of the magnet, the emitter pulses, the motion of the incrementing wheel and the motion of the escape wheel; and,

FIG. 7 is a view showing an alternate embodiment of the escape wheel.

DESCRIPTION

With reference to the drawings, and particularly to FIGS. 1, 2 and 3, the invention is shown by way of example with input gear **10** fixed to shaft **11**. Gear **10** is driven from a suitable source, not shown. Gear **12** is also fixed to shaft **11** and it meshes with gear **13** fixed to shaft **14**. Worm **15** fixed to shaft **14** to rotate therewith meshes with worm gear **16**, which is journaled on output shaft **17** by means of needle bearing **18**. Shafts **11**, **14** and **17** are suitably supported for rotation by housing **19**.

Drum **20** is fixed to sleeve **21** which is integral with gear **16**. An annular outwardly opening recess **22** in drum **20** receives an assembly consisting of spiral spring **25**, expander **26** and friction shoe **27**. Shoe **27** is fixed, as by bonding, to the outer convolution of spring **25**. In fact, only a short arcuate section of the inner peripheral surface of shoe **27** is bonded to the outer convolution of spring **25**. The outer peripheral surface of shoe **27** is adapted to engage the inner peripheral surface of drum wall **23**.

The inner convolution of spring **25** is provided with the circular opening **30**, FIG. 4, for receiving the end of pin **31**. Additionally, pin **31** extends through hub **32** of incrementing wheel **33** and through shaft **17** to fix wheel **33** to shaft **17**. Expander **26** is compressed upon insertion between a convolution of spring **25** and shoe **27** so as to normally hold shoe **27** in pressure contact with the inner peripheral surface of drum wall **23**. Of course, as drum **20** rotates, spring **25** is wound via shoe **27** with the coils drawn inwardly. Expander **26** is further compressed and when maximum torque is reached, slippage occurs between friction shoe **27** and the inner peripheral surface of drum wall **23**.

Movement of the incrementing wheel **33** is under control of an escape wheel assembly **40**. Assembly **40** consists of a spring toothed escape wheel **41** sandwiched between backing plate **42** and receptacle plate **43**. Plate **43** is provided with hub **44** for rigid attachment to shaft **11**. Machine screws **45** pass through holes **46** and **47** in plate **42** and wheel **41** respectively and thread into tapped holes **48** in receptacle plate **43** to hold the elements in an assembled relationship.

In this example of the invention, escape wheel **41** has four teeth **50** as best seen in FIG. 4. Each tooth **50** has a rigid portion A and a laterally deflectable portion B. Receptacle plate **43** is provided with an angular recess **53** for receiving the deflectable portion B. The amount of lateral deflection of the portion B is determined by the circular pitch of the teeth on the incrementing wheel **33**. Portion A is held rigid between plates **42** and **43**. Thus the A portion of tooth **50** determines the length of dwell of the incrementing wheel **33**. The B portion controls the escapement of the incrementing wheel **33**. The rate of incrementing is determined by the speed of the escape wheel and the amount of torque provided by spring **25**.

Escape wheel assembly **40** is a preferred embodiment because it provides continuous control over the incrementing wheel **33**. As one tooth of the incrementing wheel **33** escapes, the following incrementing wheel tooth has engaged the A portion of the next escape wheel tooth. This is best illustrated in FIGS. 4 and 5 and particularly in FIG. 5, where tooth **33***a* has just escaped from wheel **41** and the A portion of the following tooth of the escape wheel **41** is in engagement with tooth **33***b* so as to cause incrementing wheel **33** to dwell.

An alternate form of an escape wheel is shown in FIG. 7. The teeth **61** of escape wheel **60** are rigid and are separated by slots **62**. The teeth **61** have a straight portion **63** which functions as a dwell and an angular portion **64** for controlling the advancement of the incrementing wheel **33**. As one tooth on the incrementing wheel **33** exits through slot **62**, the next tooth on the incrementing wheel engages the dwell portion of the next tooth on the escape wheel.

Incrementing wheel **33** can be selectively stopped by means of magnet **70**, FIGS. 1, 2 and 3. Magnet **70** is provided with a coil **71** which embraces pole piece **72**. Armature **73** is pivoted at **74** and is normally urged away from pole piece **72** by compression spring **75**. Thus when magnet **70** is de-energized, spring **75** urges armature **73** into engagement with a tooth on incrementing wheel **33**. When this occurs, the teeth of the escape wheel **41** rotate freely between adjacent teeth on the incrementing wheel **33**. The magnet **70** is energized or de-energized always during the time when a dwell portion of the escape tooth is in engagement with a tooth on the incrementing wheel **33**.

A magnetic emitter assembly **80** consisting of emitter wheel **81** and sensing head **82** provides an electrical impulse at the beginning of each dwell time. Emitter wheel **81** is fixed to shaft **11** and is provided with four arcuately spaced ferromagnetic projections **83**. As wheel **81** is rotated by shaft **11**, projections **83** successively pass sensing head **82**. Sensing head **82** is of the well known reluctance type magnetic pickup head and it generates an electrical impulse as projections **83** pass relative thereto. These repetitive electrical impulses are shown in FIG. 6. It is also seen in FIG. 6 that magnet **70** is turned on and off only at a dwell time. The escape wheel **41** rotates continuously; however, the incrementing wheel **33** is free to rotate only when magnet **70** is energized. Magnet **70** can be energized from any suitable source. During one revolution of the escape wheel, only three teeth of the incrementing wheel have escaped. This is because magnet **70** was de-energized during a portion of the revolution of escape wheel **41**.

In summary, input shaft **11** rotates continuously so as to continuously rotate escape wheel assembly **40** and drum **20** via gears **12** and **13**, shaft **14**, worm **15** and gear **16**. During the time that the dwell portion A of an escape wheel tooth **50** is in engagement with a tooth of incrementing wheel **33**, drum **20** winds spring **25** through friction shoe **27**. Thereafter, when escape wheel **41** has rotated to a position to permit a tooth on incrementing wheel **33** to escape, spring **25** unwinds to advance the incrementing wheel **33**. Of course, incrementing wheel **33** can only advance if magnet **70** is energized so as to disengage armature **73** from incrementing wheel **33**.

What is claimed is:

1. Intermittent motion apparatus comprising:
an incrementing wheel mounted for rotation and having arcuately spaced teeth around the periphery thereof,
means for constantly urging said incrementing wheel to rotate,
a constantly driven escape wheel having a predetermined number of teeth and mounted to rotate with the teeth thereof in engagement with the teeth of said incrementing wheel to control the movement of said incrementing wheel, said teeth on said escape wheel having a dwell portion and a portion enabling escapement of an incrementing wheel tooth, and
means selectively operable to engage said incrementing wheel to hold the same stationary as said escape wheel continues to rotate.

2. Intermittent motion apparatus comprising:
an incrementing wheel mounted for rotation and having arcuately spaced teeth around the periphery thereof,
means for constantly urging said incrementing wheel to rotate, and
a constantly driven escape wheel having a predetermined number of teeth and mounted to rotate with the teeth thereof in engagement with the teeth of said incrementing wheel to control the movement of said incrementing wheel, said teeth on said escape wheel having a dwell portion and a portion enabling escapement of an incrementing wheel tooth,
said means constantly urging said incrementing wheel to rotate comprising:
a constantly driven drum having an interior recess,
a friction shoe disposed within said interior recess, and
a spiral spring having a portion of an inner convolution connected to said incrementing wheel and a portion of an outer convolution connected to said friction shoe.

3. The intermittent motion apparatus of claim **2** further comprising:
an expander element positioned between a convolution of said spring and said shoe so as to normally urge said shoe in pressure contact with said drum.

4. Intermittent motion apparatus comprising:
an incrementing wheel mounted for rotation and having arcuately spaced teeth around the periphery thereof,
means for constantly urging said incrementing wheel to rotate, and
a constantly driven escape wheel having a predetermined number of teeth and mounted to rotate with the teeth thereof in engagement with the teeth of said incrementing wheel to control the movement of said incrementing wheel, said teeth on said escape wheel having a dwell portion and a portion enabling escapement of an incrementing wheel tooth,
the teeth of said escape wheel being arcuately spaced from each other by an amount equal to the width of the teeth on said incrementing wheel.

5. Intermittent motion apparatus comprising:
an incrementing wheel mounted for rotation and having arcuately spaced teeth around the periphery thereof,
means for constantly urging said incrementing wheel to rotate, and
a constantly driven escape wheel having a predetermined number of teeth and mounted to rotate with the teeth thereof in engagement with the teeth of said incrementing wheel to control the movement of said incrementing wheel, said teeth on said escape wheel having a dwell portion and a portion enabling escapement of an incrementing wheel tooth,
the teeth of said escape wheel being arcuately spaced from each other a distance less than the width of the teeth on said incrementing wheel and said portion of the escape wheel tooth enabling escapement being laterally deflectable.

6. The intermittent motion apparatus of claim **1** wherein said selectively operable means comprises:
an electromagnet, and
an armature controlled by said electromagnet and engageable with said incrementing wheel to hold the same stationary.

7. The intermittent motion apparatus of claim **1** wherein said last mentioned means includes an emitter operable to generate a control signal in synchronism

with the engagement of a dwell portion of an escape wheel tooth with an incrementing wheel tooth.

8. Intermittent motion apparatus comprising:

an incrementing wheel mounted for rotation and having teeth spaced around the periphery thereof,

an escape wheel having a predetermined number of teeth and mounted to rotate with the teeth thereof in engagement with the teeth of said incrementing wheel,

means for constantly driving said escape wheel, and

selectively operable brake means for braking said incrementing wheel to hold the same stationary, said teeth on said escape wheel and on said incrementing wheel being so arranged that the teeth on the escape wheel may pass between the teeth on the incrementing wheel when the incrementing wheel is stationary and control the rotation of said incrementing wheel when the incrementing wheel is allowed to rotate.

9. The intermittent motion apparatus of claim 8 wherein said teeth of said escape wheel are resilient so as to flex as they pass between the teeth of said incrementing wheel when the incrementing wheel is braked.

10. The intermittent motion apparatus of claim 8 including means for constantly urging said incrementing wheel to rotate and wherein said incrementing wheel and said escape wheel are mounted on axes that are at right angles to each other,

the teeth of said escape wheel being laterally deflectable so that they may pass between the teeth of said incrementing wheel when the incrementing wheel is braked.

11. The intermittent motion apparatus of claim 8 including means for constantly urging said incrementing wheel to rotate and wherein the teeth on said escape wheel each has a relatively rigid dwell portion allowing substantially no rotation of said incrementing wheel and a relatively flexible end portion allowing rotation of said incrementing wheel when said brake means is disengaged and flexing to allow the teeth of said escape wheel to pass between the teeth of said incrementing wheel when the incrementing wheel is braked.

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MILTON KAUFMAN, *Primary Examiner.*

U.S. Cl. X.R.

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