United States Patent

[11] 3,619,577

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[21] Appl. No. **826,395**
[22] Filed **May 21, 1969**
[45] Patented **Nov. 9, 1971**
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[54] **CLAPPER COUNTERWEIGHT**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **235/92 C,** 235/92 R, 235/1 C, 340/379
[51] **Int. Cl.** **G06m 1/10,** G06m 3/12
[50] **Field of Search** 235/131, 1.3, 95.3, 92; 74/575, 589

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ABSTRACT: An electromagnetic counting device having a rotary counter, an electromagnet with a U-shaped core and a coil encircling one of the legs of the core, a one-piece pivotal armature mounted aside the ends of the core legs and functioning as a clapper for the electromagnet and a verge for indexing the counter in stepwise fashion upon momentary energization of the electromagnet, and an inertial member rotatable on the counter shaft and having a radial arm with a bifurcated end receiving an edge of the clapper which provides for rotating the inertial member back and forth in conjunction with the pivotal movement of the clapper.

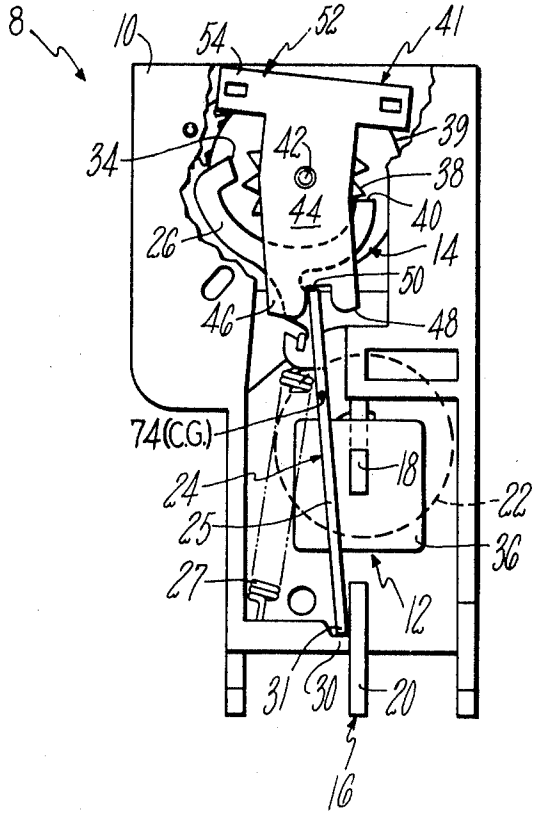

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FIG. 1

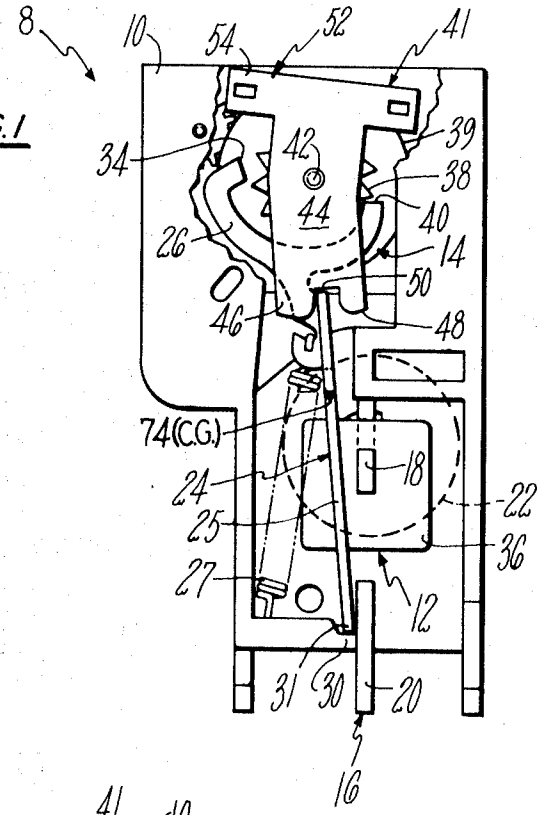


FIG. 2

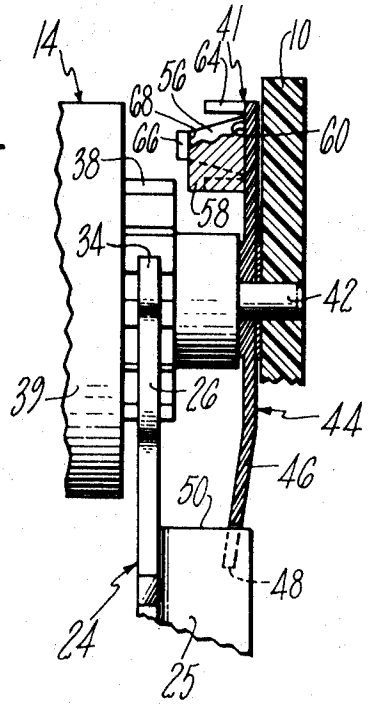
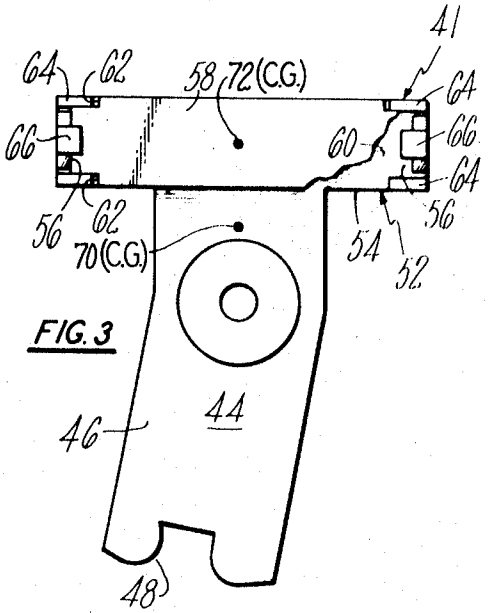


FIG. 3



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CLAPPER COUNTERWEIGHT

BRIEF SUMMARY OF THE INVENTION

The present invention relates to electromagnetic counting mechanisms of the type comprising a counter and an electromagnetic operator having an electromagnet and a pivotal clapper operable for indexing the counter in stepwise fashion by momentary energization of the electromagnet.

It is a principal aim of the present invention to provide a new and improved electromagnetic counting device of the type described which provides improved counting reliability through the avoidance of miscounts or overcounts due to a fluctuating electromagnetic field or to vibration or other shock forces.

It is another aim of the present invention to provide a new and improved electromagnetic counting mechanism of the type described having improved reliability with AC operation.

It is a further aim of the present invention to provide an electromagnetic counting mechanism of the type described having a new and improved inertial system for inertially improving the pivotal operation of the clapper.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

A better understanding of the invention will be obtained from the following detailed description and the accompanying drawing of an illustrative application of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a side view, partly broken away, of an embodiment of an electromagnetic counting mechanism incorporating the present invention;

FIG. 2 is an enlarged section view, partly broken away and partly in section, showing an armature and inertia control member of the mechanism; and

FIG. 3 is an enlarged view of the inertia control member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing in detail, an electromagnetic counting mechanism **8** shown in FIG. 1 is generally of the type described in detail in the copending U.S. Pat. application Ser. No. 813,490 of L. J. LaPointe et al. filed Apr. 4, 1969, assigned to the assignee of the present application and entitled "Electromagnetic Counting Mechanism." Briefly the electromagnetic counting mechanism **8** comprises a plastic frame **10** and an electromagnetic operator **12** and rotary counter **14** mounted on the frame. The electromagnetic operator has a one-piece U-shaped magnetic core plate **16** with generally parallel legs **18, 20**, a coil **22** encircling the leg **18**, a one-piece pivotal magnetic armature **24** (having a clapper **25** and an integral yoke or verge **26**) and an armature return spring **27** extending between the armature and frame. The armature **24** is pivotally mounted on a rib **30** of the frame **10** and with the pivot end **31** of the armature **24** in engagement with the end of the core leg **20** to minimize the air gap loss between the armature and the core leg **20**. The armature is mounted aside and extends in overlapping relationship with the ends of the core legs **20, 18** and is biased away from the leg **18** to its normal position shown in FIG. **1** by the return spring **27**. When the coil **22** is energized, the armature **24** is pivotally attracted by the electromagnet whereupon a point **34** of the verge **26** engages a plastic star wheel **38** on the lowest order counter wheel **39** (also made of plastic) to index the counter wheel one-half count. Thereafter when the coil is deenergized the spring **27** returns the armature to its normal position and the opposite point **40** of the verge **26** engages the star wheel **38** to index the counter wheel the remaining one-half count. For improving the actuation and release of the clapper **25** by the electromagnet, a shading ring **36** is mounted on the core leg **18** for which purpose the outer end of the core leg **18** is slotted to receive the shading ring.

In accordance with the present invention a rotatable inertial member **41** is rotatably mounted on the counter wheel shaft **42** for inertially controlling the pivotal motion of the armature **24**. The shown inertial member **41** comprises a very light molded plastic lever **44** having an opening receiving the shaft **42** and a first "long" radial arm **46** with a bifurcated end **48** loosely receiving an end **50** of the clapper **25**. The lever **44** has a second "short" arm **52** extending generally diametrically opposite (approximately 170°) the "long" arm **46** and formed with an outer transverse support **54** having opposed pockets **56** for receiving an elongated steel counterweight **58** (of square cross section) which in the shown embodiment weighs approximately 1 gram. The counterweight **58** has an elongated face thereof in engagement with a flat outer face **60** of the transverse support **54** and has recessed ends **62** receiving upstanding side tangs **64** of the pockets **56**. Also the pockets are formed with end tangs **66** which may be flexed outwardly for inserting the counterweight **58** on the support **54** and which have inner lips **68** for securely retaining the counterweight in place on the support **54** and within the pockets **56**.

The inertial member **41** is adapted to control the motion of the armature in several important ways for improving the reliability and service life of the counting mechanism. As a result of the positioning of the counterweight **58** relative to the armature **24** (i.e., such that the center of gravity **70** of the rotatable inertial member **41** as well as the center of gravity **72** of the counterweight **58** are located on the opposite side of their axis of rotation from the pivotal axis of the armature **24** and such that the center of gravity **74** of the pivotal armature remains close to the plane of such axes) any vibration or other shock forces on the mechanism will not cause sufficient pivotal actuation of the armature **24** to index the counter and in effect any shock caused torque on the armature **24** alone would be substantially offset by the shock caused torque on the inertial member **41**.

The inertial member **41** also provides for assuring relatively even motion (including relatively even acceleration and deceleration) of the armature even with a fluctuating electromagnetic field due for example to AC operation of the electromagnet. Accordingly, the armature will not move erratically during AC operation to miscount or to generate an overcount.

Further it has been found that the service life of the counter and the maximum counter speed are increased substantially by the use of the inertial member **41**. It is believed that such benefits are due, at least in part, to the more even armature movement and to the more even engagement of the verge **26** with the star wheel **38**.

Therefore, in accordance with the present invention the inertial member **41** provides for controlling the motion of the armature to prevent overcounting or miscounting from vibration or other shock or from a fluctuating magnetic field due for example to AC operation, and for additionally substantially increasing the service life of the counter and the maximum counter speed.

As will be apparent to persons skilled in the art, various modifications, adaptations and variations of the foregoing specific disclosure can be made without departing from the teachings of the present invention.

I claim:

1. In an electromagnetic counting device having a counter and an electromagnetic operator adapted for indexing the counter comprising an electromagnet, a clapper adapted to be pivoted from a withdrawn for pivotally retracting the clapper to its withdrawn position upon deenergization of the electromagnet, and indexing means operable by the clapper for indexing the counter in stepwise fashion upon pivotal movement of the clapper, the improvement wherein the electromagnetic operator comprises a rotatable inertial member connected to be rotated in opposite angular directions by the clapper in conjunction with the clapper movement in opposite pivotal directions for inertially controlling the pivotal motion of the clapper for improving the operation of the counter, the inertial member and clapper having an interfitting connection to provide for rotating the inertial member in opposite angular

directions in conjunction with the clapper movement in opposite pivotal directions.

2. In the electromagnetic counting device of claim 1 wherein the center of gravity of the inertial member is on the opposite side of its axis of rotation from the pivotal axis of the clapper.

3. In the electromagnetic counting device of claim 1 wherein the inertial member comprises a rotatable lever connected to the clapper and a counterweight mounted on the lever on the opposite side of the axis of rotation of the inertial member from the pivotal axis of the clapper.

4. The electromagnetic counting device of claim 1 wherein the counter comprises at least one rotatable counter wheel and wherein the inertial member is rotatable coaxially with the counter wheel.

5. In the electromagnetic counting device of claim 1 wherein the counter comprises at least one rotatable counter wheel and wherein the indexing means of the electromagnetic operator comprises a star wheel on the counter wheel and a verge integral with the clapper for pivotal movement therewith, and wherein the center of gravity of the combined verge and clapper is approximately in the plane of the axes of the clapper and inertial member.

6. In an electromagnetic counting device having a counter and an electromagnetic operator adapted for indexing the counter comprising an electromagnet, a clapper adapted to be pivoted from a withdrawn position to an extended position by energization of the electromagnet, spring means position to an extended position by energization of the electromagnet, spring means for pivotally retracting the clapper to its withdrawn position upon deenergization of the electromagnet, and indexing means operable by the clapper for indexing the counter in stepwise fashion upon pivotal movement of the clapper, the improvement wherein the electromagnetic operator comprises a rotatable inertial member connected to be rotated in opposite angular directions by the clapper in conjunction with the clapper movement in opposite pivotal directions for inertially controlling the pivotal motion of the clapper for improving the operation of the counter, the centers of gravity of the inertial member and clapper being related to their respective axes to inertially bias the clapper in opposite pivotal directions as a result of shock on the counting device normal to the common plane of said centers of gravity.

7. In the electromagnetic counting device of claim 6 wherein the inertial member has an arm with a bifurcated end receiving an edge of the clapper.

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