United States Patent

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[54] **ELECTROMAGNETIC COUNTING MECHANISM**
15 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **235/117,** 235/1, 235/91, 235/92
[51] **Int. Cl.** **G06m 1/02,** G06m 1/10
[50] **Field of Search** 235/117, 118, 79, 91.1, 1.3, 96, 92.1, 92.13, 92

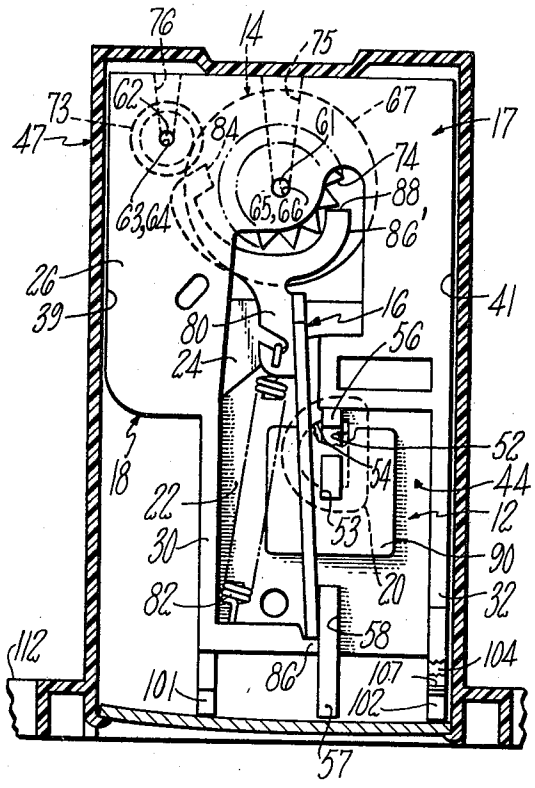
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Primary Examiner—Stephn J. Tomsky
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ABSTRACT: An electromagnetic counting mechanism having a one-piece molded plastic frame with a pair of elongated parallel end supports and an intermediate tubular connector extending transversely therebetween, an electromagnet comprising a coil encircling the tubular connector and a U-shaped magnetic core piece with one leg extending through the tubular connector and a second leg extending between the supports, a counter mounted between the supports, and a counter drive mechanism mounted on one of the supports in operative relationship with the electromagnet and counter for indexing the counter upon momentary energization of the electromagnet. The end supports of the frame are contoured to permit access to the tubular connector 360° thereabout and along its full length to provide for winding the coil about the tubular connector by treating the entire frame as a bobbin in conventional coil winding apparatus, and the remaining parts of the counting mechanism are assembled on the frame after the bobbin is wound.

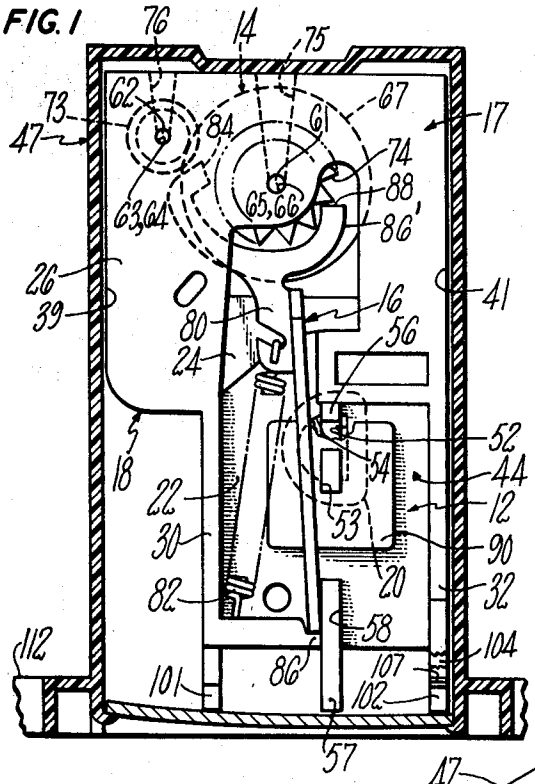


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SHEET 1 OF 2

FIG. 1



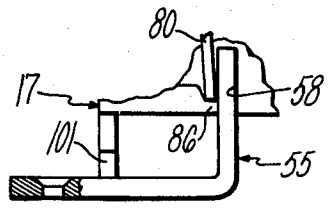
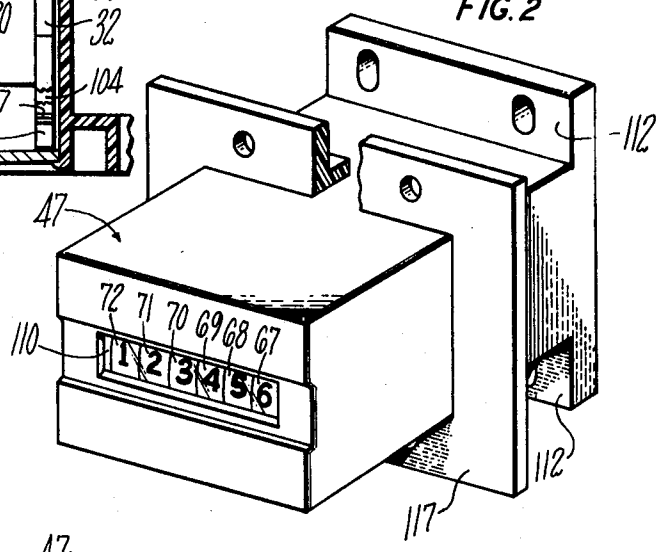


FIG. 4

FIG. 2



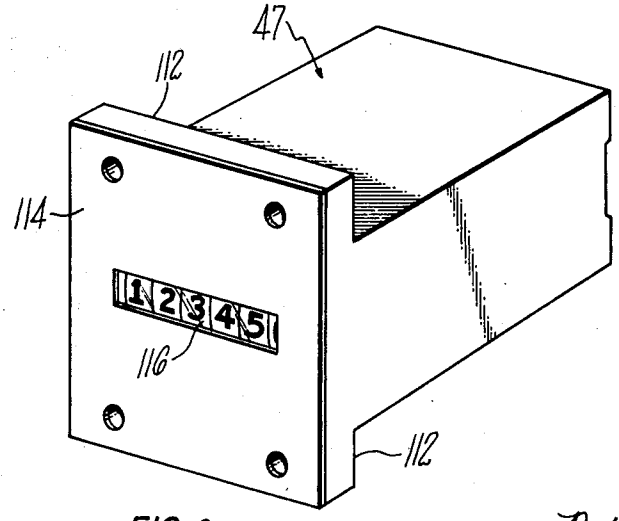
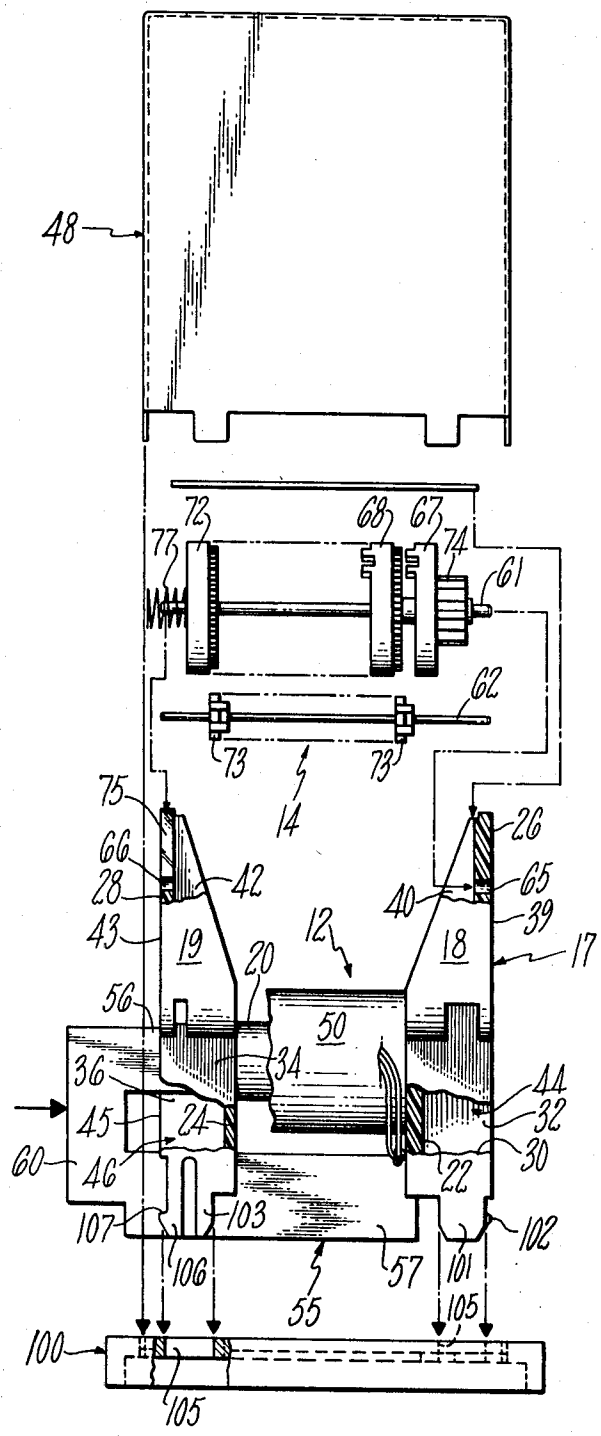


FIG. 3

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FIG. 5


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ELECTROMAGNETIC COUNTING MECHANISM

BRIEF SUMMARY OF THE INVENTION

The present invention relates to electromagnetic counting mechanism of the type having a counter and an electromagnetic operator for indexing the counter.

It is a principal object of the present invention to provide a new and improved electromagnetic counting mechanism having an economical construction and a minimum number of parts designed to facilitate economical and rapid assembly.

It is another aim of the present invention to provide a new and improved electromagnetic counting mechanism having a new and economical frame and coil subassembly.

It is a further aim of the present invention to provide a new and improved electromagnetic counting mechanism adapted for low-cost mass production.

It is another aim of the present invention to provide an electromagnetic counting mechanism having improved installation versatility.

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 drawings of illustrative applications of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a transverse section view, partly broken away and partly in section of an assembly showing a counting mechanism incorporating the present invention installed in a boxlike housing;

FIG. 2 is an isometric view of the assembly of FIG. 1 additionally showing a mounting collar for mounting the assembly;

FIG. 3 is an isometric view showing an assembly with the counting mechanism reversed end for end in the housing;

FIG. 4 is a partial transverse section view of a modified counting mechanism having an integral mounting plate; and

FIG. 5 is a partly exploded side view, partly broken away and partly in section, of an assembly of the counting mechanism of FIG. 1 with another housing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in greater detail wherein like reference numerals indicate like parts throughout the several figures, an embodiment of the counting mechanism of the present invention is shown comprising a frame and electromagnet subassembly 12, a counter 14 mounted on one end of the frame, and a counter drive mechanism 16 mounted on one side of the frame and operable upon momentary energization of the electromagnet to index the counter. The frame and electromagnet subassembly 12 consists of a one-piece molded plastic frame 17 having a pair of spaced generally parallel elongated end supports 18, 19 and an integral elongated tubular connector 20 extending transversely between inner opposed parallel walls 22, 24 at the inner end of the supports 18, 19. The frame supports 18, 19 have outer opposed parallel walls 26, 28 at their outer ends and sidewalls 30, 32 and 34, 36, respectively, extending substantially their full length. The sidewalls 30, 32 and 34, 36 form with the outer opposed walls 26, 28 a pair of opposed inwardly opening pockets 40, 42, respectively, at the outer end of the frame. Similarly, the sidewalls form with the inner opposed walls 22, 24 a pair of opposed outwardly opening pockets 44, 46, respectively, at the inner end of the frame. In addition the sidewalls and outer walls 26, 28 form parallel outer edges 39, 41, 43 and 45 which define a rectangular outer perimeter so that the frame (and also the entire counting mechanism assembly) may be supported within a boxlike housing, for example the housing 47 shown in FIGS. 1—3 or the housing 48 shown in FIG. 5.

The one-piece molded plastic frame 17 is adapted to be employed as a bobbin in conventional coil winding apparatus so that a coil 50 may be wound about the tubular connector 20 and thereby accurately position the coil on the frame without

requiring the coil and frame to be assembled together after the coil is wound. For this purpose the end supports are contoured to provide unobstructed access to the tubular connector 20, 360° about the connector and along its entire length between the opposed walls 22, 24, so that the coil wire may be freely wound on the connector as the frame is rotated as a bobbin in conventional coil winding apparatus.

The tubular connector 20 has a generally D-shaped cross section (FIG. 1) to provide that the coil wound on the connector remains inside the rectangular perimeter of the frame; and the connector 20 has a through passage 52, extending between the outwardly opening pockets 44, 46, and having an upright rectangular passage portion 53 and a partially cylindrical passage portion 54. A one-piece U-shaped magnetic core plate 55 is mounted on the frame with one of its legs 56 extending through the tubular connector snugly received within its rectangular passage portion 53; with its other leg 57 extending between the pockets 44, 46 through opposed slot openings 58 in the inner walls 22, 24; and with its base 60 received within the pocket 46 of the end support 19.

The counter 14 is mounted on the frame partly within the inwardly opening pockets 40, 42 and such that the counter readout may be viewed at the outer longitudinal end of the counting mechanism. The counter comprises a counter shaft 61 and transfer pinion shaft 62 which are mounted and retained on the end supports 18, 19 within opposed openings or pockets 63—66 in the outer walls 26, 28 and with the shafts 61, 62 parallel to the tubular connector 20. Six counter wheels 67—72 of ascending order are shown rotatably mounted on the counter shaft 61 and five transfer pinions 73 are rotatably mounted on the pinion shaft 62 intermediate the counter wheels for interconnecting the counter wheels in a well-known manner. For the purpose of installing the counter parts on the frame 17 the wall 28 is provided with slot openings 75, 76 leading to the shaft pockets 64, 66 to permit the counter wheels (and a compression spring 77) and the transfer pinions to be preassembled on separate jig shafts which are dimensioned to be inserted sideways into the shaft pockets 64, 66 via the slot openings 75, 76, and which are spring mounted to be retracted by the shafts 61 and 62 as they are inserted through the opposed shaft pockets and counter wheels and pinions. The lowest order counter wheel 67 is provided with an integral star or drive wheel 74 and the compression spring 77 is provided on the counter shaft 61 between the highest order counter wheel 72 and the wall 28 to maintain the counter parts in a compact assembled relationship and to maintain the star wheel 74 in its proper position adjacent the opposite wall 26.

The counter drive mechanism 16 comprises a one-piece magnetic armature 80 (which functions as both a clapper and verge) and a return tension spring 82. The armature 80 is pivotally mounted on a rib 86 of the frame 17 aside the core plate 55 and with the inner end of the armature 80 received within a recess in the rib 86 and in engagement with the side of the core leg 57 so as to minimize the air gap loss between the armature and the core leg 57. The armature extends in overlapping relationship with the core legs 57, 56 and is biased away from the leg 56 to its normal position shown in FIG. 1 by the tension spring 82 which is connected between the armature and the frame 17. When the electromagnet is energized, the armature 80 is pivotally attracted by the electromagnet whereupon a point 84 of a yoke or verge 86' at the outer end of the armature engages the star wheel 74 to index the counter one-half count, and when the coil is subsequently deenergized, the spring 82 returns the armature to its normal position whereupon the opposite point 88 of the verge 86' engages the star wheel 74 to index the counter the remaining one-half count. For improving the actuation and release of the clapper by the electromagnet, a shading ring 90 is mounted on the core leg 56 for which purpose the outer end of that leg is slotted to receive the shading ring.

For mounting the counting mechanism on a suitable support plate, for example the plate 100 of the housing 48 (FIG. 5),

the frame sidewalls **30, 32, 34, 36** are provided with longitudinally extending tangs **101—104**. Suitable slot openings **105** are provided on the support plate **100** for snugly receiving the tangs and three of the tangs **102, 103** and **104** are bifurcated and have outer legs **106** provided with lips **107** to provide snap engagement with the underside of the plate **100** to lock the counting mechanism in place on the support plate **100**.

Alternately, as shown in FIG. **1** the counting device may be mounted within a suitable boxlike shell **47** having a window **110** at its outer end for viewing the counter reading and having support flanges **112** at the opposite end for mounting the assembly. For substantially flush mounting, the counting device could be inserted in the shell **47** as shown in FIG. **3** so that its viewing end is at the mounting end of the shell, in which case an additional plate **114** with a window **116** is provided for enclosing the counting device. Also, for more flexible mounting, a collar **117**, shown in FIG. **2**, may be employed for selectively mounting the counting mechanism as desired by appropriately longitudinally positioning the collar **117** on the shell **47** and securing it in place by a suitable adhesive or by welding. Further, the counting mechanism may be mounted directly to a suitable support by forming the core plate with a suitable mounting portion as shown in FIG. **4**.

It can be seen therefore that the counting mechanism of the present invention provides an economical design with a minimum number of parts arranged to facilitate rapid assembly. Moreover, the counting mechanism provides a frame with an integral coil bobbin such that the entire frame may be treated as a bobbin in coil winding apparatus, thereby simplifying the overall design and assembly while ensuring accurate positioning of the coil on the frame. Further the counting device is designed for being selectively mounted in a variety of ways such that the basic design may be employed in a number of different types of installations.

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.

We claim:

1. In an electromagnetic counting device having a frame, and a counter and electromagnetic operator mounted on the frame in operative relationship to provide for indexing the counter by energization of the electromagnetic operator; the improvement wherein the frame is formed with a pair of spaced end supports and an intermediate elongated connector extending transversely therebetween, the end supports being contoured to permit unobstructed access to the connector 360° thereabout for at least a substantial portion of its length; wherein the counter is mounted on the end supports; and wherein the electromagnetic operator comprises a coil encircling the connector and energizable for operating the electromagnetic operator to index the counter.

2. In the electromagnetic counting device of claim **1** wherein the frame is of one-piece molded plastic construction.

3. In the electromagnetic counting device of claim **1** wherein the elongated connector is a tube of nonmagnetic material having a passageway extending therethrough, and wherein the electromagnetic operator comprises a U-shaped magnetic core piece with one leg extending through the connector passageway and a second leg extending generally parallel thereto between the frame supports.

4. In the electromagnetic counting device of claim **3** wherein the core piece is a plate having a mounting portion extending from the second leg for mounting the electromagnetic counting device.

5. In the electromagnetic counting device of claim **1** wherein the end supports have opposed inner parallel walls and wherein the elongated connector extends transversely between said inner parallel walls.

6. In the electromagnetic counting device of claim **5** wherein the end supports define inwardly opening opposed pockets at one end thereof and outwardly opening opposed pockets at the opposite end thereof, the outwardly opening pockets being defined in part by the opposed inner parallel walls, wherein the counter is mounted on the supports at said one end thereof in part within the inwardly opening pockets; and wherein the electromagnetic operator is mounted on the frame in part within one of the outwardly opening pockets.

7. In the electromagnetic counting device of claim **1** wherein the counter comprises a counter shaft mounted on the frame supports and extending transversely therebetween substantially parallel to the elongated connector and a plurality of counter wheels rotatably mounted on the counter shaft.

8. In the electromagnetic counting device of claim **7** wherein the frame supports have opposed openings receiving the ends of the counter shaft to accurately locate the counter on the frame, and wherein at least one of the frame supports has a slot extending from an edge thereof to the shaft receiving opening therein.

9. In the electromagnetic counting device of claim **3** wherein one of the frame supports has an armature support portion aside the outer end of said second core leg, and wherein the electromagnetic operator comprises a pivotal magnetic armature extending aside and overlapping the core legs and with one end thereof mounted on said support portion adjacent said second core leg for pivotal movement about an axis substantially parallel to the axis of the elongated connector and adapted, when the coil is energized, to be pivotally attracted by the magnetic core piece to index the counting device.

10. In the electromagnetic counting device of claim **1** wherein the end supports are elongated, wherein the counter is mounted on the end supports at one longitudinal end thereof; and wherein the end supports have depending longitudinally extending tangs at the opposite longitudinal end thereof for mounting the counting device.

11. An electromagnetic counting device comprising a one-piece plastic frame having a pair of spaced generally parallel upstanding elongated supports and an intermediate tubular connector extending transversely therebetween, the supports having outer opposed parallel walls and sidewalls providing a generally rectangular frame perimeter, the outer walls and sidewalls of the supports defining inwardly opening opposed pockets at one longitudinal end of the frame, the supports having inner opposed parallel walls defining with the sidewalls outwardly opening opposed pockets at the other longitudinal end of the frame, a counter with a plurality of coaxial counter wheels mounted on the supports at said one longitudinal end of the frame and in part within said inwardly opening opposed pockets, generally U-shaped magnetic core plate having one leg extending through the tubular connector between the outwardly opening pockets and a second leg extending generally parallel thereto between the outwardly opening pockets, a coil encircling the tubular connector, and a counter drive mechanism having a pivotal magnetic armature mounted in part in one of the outwardly opening pockets adjacent the outer ends of the core legs and adapted, when the coil is energized, to be pivotally attracted by the core plate to index the counter.

12. An electromagnetic counting device comprising an integral frame of nonmagnetic material having a pair of spaced generally parallel supports and an intermediate elongated tubular connector extending transversely therebetween, the supports being contoured to permit unobstructed access to the tubular connector 360° thereabout and along substantially its full length a counter mounted on the supports, a coil encircling the tubular connector, a magnetic core piece within the tubular connector, and a counter drive mechanism mounted on the frame and having a magnetic armature adapted, when the coil is momentarily energized, to be momentarily attracted by the core piece for indexing the counter.

13. In an electromagnetic counting device having a frame, and a counter and electromagnetic operator mounted on the frame in operative relationship to provide for indexing the counter by energization of the electromagnetic operator, the improvement wherein the frame is integrally formed of non-

magnetic material with a support portion and an elongated tubular portion integral therewith, the support portion being contoured to permit unobstructed access to the elongated tubular portion 360° thereabout and along substantially its full length; wherein the counter is mounted on the support portion; and wherein the electromagnetic operator comprises a coil encircling the elongated tubular portion and an elongated magnetic core piece within the tubular connector such that the coil when energized magnetizes the core piece for operating the electromagnetic operator to index the counter.

14. A method of making an electromagnetic counting device of the type having a frame in and a counter and electromagnetic operator mounted on the frame in operative to provide for indexing the counter by energization of the electromagnetic operator; comprising the steps of forming an integral frame of nonmagnetic material having a support portion and an elongated tubular portion and with the support portion contoured to permit unobstructed access to the elongated tubular portion 360° thereabout for at least a substantial portion of its length, winding a coil of the electromagnetic operator about the elongated tubular portion using the entire frame as a coil bobbin, inserting a core piece of the electromagnetic operator into the elongated tubular portion, and assembling the counter and remaining parts of the electromagnetic operator onto the frame in operative relationship with the core piece to provide for indexing the counter by energization of the coil.

15. In the method of claim 14 wherein the forming step comprises forming a one-piece frame of nonmetallic material having a support portion with a pair of spaced generally parallel end supports and an intermediate elongated tubular portion extending transversely therebetween, and with the end supports being contoured to permit unobstructed access to the elongated tubular portion 360° thereabout and along substantially its full length; and wherein the assembling step comprises inserting a magnetic core piece of the electromagnetic operator into the elongated tubular portion.