

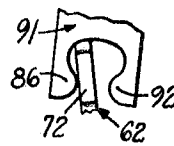
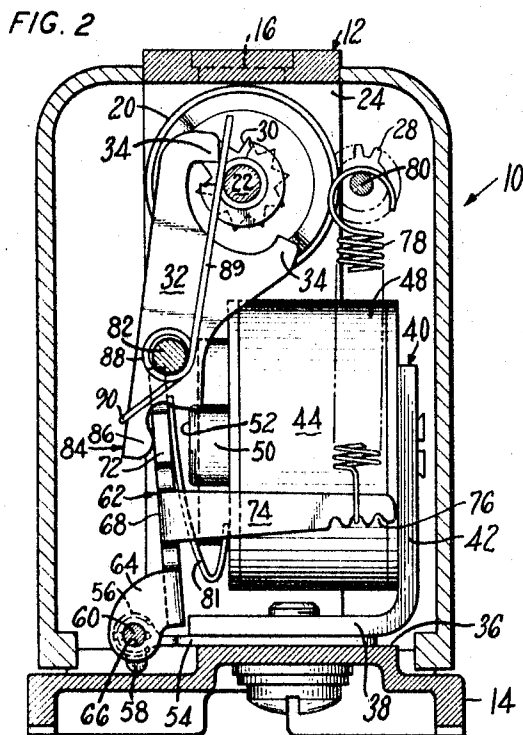
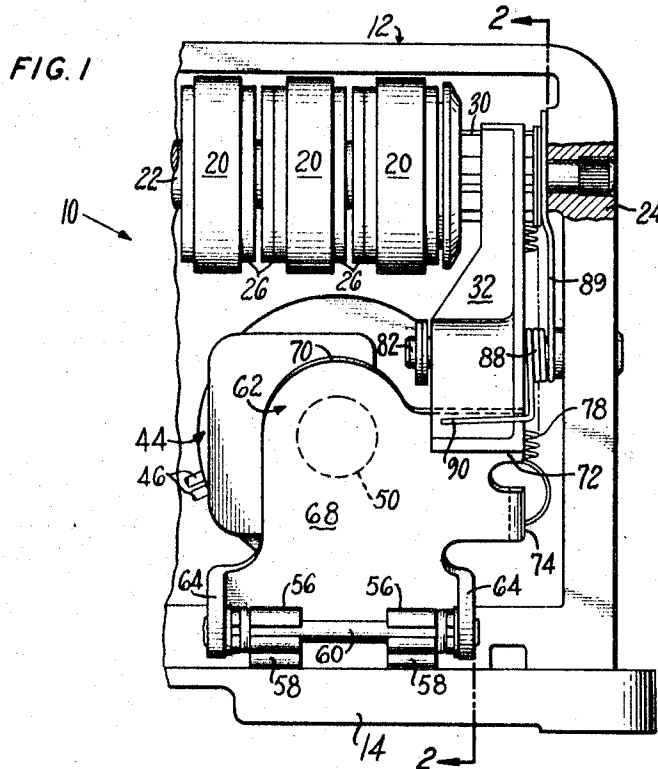
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MAGNETIC COUNTER

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**FIG. 3**

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## MAGNETIC COUNTER

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10 Claims

### ABSTRACT OF THE DISCLOSURE

A magnetic counter is provided with an electromagnetic drive mechanism including a clapper spring-biased away from the electromagnet and an independent verge carrying a pair of drive pawls and having a separate drive spring for indexing the counter wheel upon movement of the clapper during energization of the electromagnet.

The present invention relates to magnetic counters and the like. More particularly it is directed to a new and improved magnetic counter of the type utilizing a two-step actuator for indexing a counter wheel in response to an electrical impulse.

A primary object of the present invention is to provide a new and improved magnetic counter of the type described which eliminates inadvertent and undesirable overcounting and facilitates an increased operating speed and a prolonged useful life span for the components of the counter.

Another object of the present invention is to provide a new and improved magnetic counter incorporating a two-step actuator which exhibits improved dynamic characteristics and counting reliability while at the same time obviating critical adjustments and tolerances within the drive assembly of the counter, particularly in those counters where the actuator bottoms during the drive operation.

A further object of the present invention is to provide a new and improved magnetic counter of increased operating life which eliminates the fluctuations or A.C. "buzz" heretofore associated therewith.

Another object of the present invention is to provide a new and improved magnetic counter of the type described which provides improved reliability and noise free operation with A.C. power.

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

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application which will be indicated in the appended claims.

In the drawing:

FIG. 1 is a fragmentary side view, partially broken away, of a magnetic counter embodying the features of the present invention;

FIG. 2 is a transverse sectional view of the counter of FIG. 1 taken along the line 2—2 and showing one embodiment of the actuator of the present invention; and

FIG. 3 is a fragmentary view, partially broken away, of another embodiment of an actuator operative in accordance with the present invention.

Referring now to the drawing in greater detail wherein like referenced characters indicate like parts throughout the several figures there is shown a general purpose magnetic counter designated 10 which comprises an elongated, generally rectangular casing or housing 12 of U-shaped cross section mounted on a back plate 14 for enclosing both the number wheel subassembly and the electromagnetic drive subassembly of the counter. As illustrated the housing is provided with a read-out window

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16 on the front face 18 thereof for exposing certain indicia on the number wheels as they are advanced in response to an electrical signal.

Within the housing adjacent the read-out window is the actuator-driven number wheel subassembly which comprises a plurality of rotatable, coaxially aligned number wheels 20 mounted on a shaft 22 for controlled sequential actuation, the shaft 22 being supported within the ends 24 of the housing 12 and preferably extending along the full length of the counter. Each of the coaxially aligned number wheels spaced along the shaft 22 have associated therewith suitable gears 26 which are operatively interconnected through the transfer pinions 28 for providing the proper sequential operations of the wheels. Interconnected with the lowest order number wheel is a star-shaped ratchet drive wheel 30 mounted on the shaft 22 for driving the lowest order number wheel in response to the reciprocable movement of the actuator or verge 32. As best seen in FIG. 2, the double acting ratchet pawls 34 of the actuator or verge 32 are positioned to cooperate with the teeth of the ratchet wheel to enable the pawls 34 to sequentially engage the ratchet wheel 30 and thereby step the lowest order number wheel in steps equal to one half digit or count.

The back plate 14 of the counter is provided with a raised platform 36 to which is affixed the base leg 38 of an L-shaped bracket 40, the other leg 42 of the bracket firmly supporting an electromagnet of an electromagnetic operator generally denoted by the numeral 44. The electromagnetic operator 44, which is provided with suitable leads 46 for receiving electrical impulses, is shown comprising a coil 48 wound on a central core 50 capable of acting as a magnet with its flat face 52 serving as one pole thereof.

Sandwiched between the platform 36 and the base leg of the bracket is a flat, generally rectangular plastic hinge plate 54 projecting beyond the platform 36 and having along its projecting edge a pair of axially aligned, integral hinge knuckles 56. Each hinge knuckle is provided with a supporting lug 58 which protrudes rearwardly from the knuckle and rests against the back plate 14 to provide added support for the hinge. Supported within the knuckles to provide a firm pivotal hinge connection is the hinge pin 60. The knuckles and pin are preferably made of a tough durable material which provides a bearing surface that functions without play within the hinge connection. Materials such as "Delrin," "Teflon" or the like have been found particularly well suited for this purpose and are preferred since they advantageously help reduce the A.C. "buzz" in the pivotal mounting and the often resulting corrosive wear of the hinge pin.

An armature or clapper 62 of the electromagnetic operator 44 is pivotally supported on a hinge pin 60 for reciprocable motion toward and away from the flat pole face 52 of the fixed core 50, the clapper having a pair of upstanding side flanges 64 with aligned apertures 66 for receiving the pin 60. The clapper extends forwardly from the flanges in the form of a flat body portion 68 terminating in an arcuate forward edge 70, the magnetically attractable body portion 68 fully covering the pole face 52 of the core 50 and extending outwardly therebeyond. Protruding from one side of the body 68 is an integral extension 72 from which an elongated arm 74 extends in a direction opposite that of the side flanges 64. As shown, the free end of the arm 74 is provided with a plurality of notches 76 suitable for adjustably receiving one end of a clapper return spring 78 for adjusting the return torsional bias on the clapper provided by the return spring. The other end of the tension spring 78 is mounted on the transfer pinion shaft 80 whereby the clapper is urged, in a counterclockwise direction as viewed in FIG. 2, away from the pole face 52. Also, a thin separator 81

of paper or other flexible nonmagnetic material is preferably interposed between the clapper 62 and the pole face 52 in a conventional manner to provide for assuring a rapid return of the clapper after the coil 48 is deenergized.

The verge 32 is shown pivotally mounted on a shaft 82 which is supported in the end 24 of the housing rearwardly of the shaft 22. As mentioned, the forwardmost end of the verge has a pair of opposed pawls 34 which coact with the ratchet wheel 30 to index the lowest order number wheel in stepwise fashion. The opposite or rearward end 84 of the verge has a shoulder portion 86 which is biased against the flat extension 72 of the clapper by a drive spring 88 which encircles the verge-supporting shaft 82 and which has legs 89, 90, respectively, engaging the counter wheel shaft 22 and the verge shoulder 86. Thus, under the force of the torsion spring 88, the verge 32 creates a bias on the clapper 62 in opposition to the bias on the clapper provided by the clapper return spring 78.

The verge may, if desired, be modified in accordance with the present invention as illustrated in FIG. 3. In that embodiment a verge 91 is provided with a bifurcated end which comprises, in addition to the shoulder 86, an auxiliary shoulder 92 which is spaced from the first shoulder 86. The spacing provided between the shoulders is sufficient to provide substantial freedom of movement of the clapper 62 and independent movement thereof during normal operation of the counter. Thus the spacing should be sufficient to permit the clapper 62 and verge 91 to be driven independently by the magnetic force of the core 50 and by the torsion spring 88 respectively so that the counter drive under normal operation is independent of the magnetic attraction of the core 50 and dependent upon the bias of the torsion spring 88 only. However, the spacing should be such that the clapper will engage the verge and thereby assist the spring 88 in actuating the verge if the normal verge motion is unduly restrained, as for example as a result of an inordinate restraint in the drive train of the counter. In the shown embodiment the spacing is such that the clapper is free to move approximately half of its travel before it will engage the auxiliary shoulder 92. As a result the kinetic energy or momentum of the clapper 62 will provide for effectively assisting in overcoming the restraint to the normal operation of the verge and in indexing the counter one half count. The normal operation of the verge 91 is however substantially unchanged over that of the embodiment of FIG. 2 so long as sufficient clearance is provided to permit operation of the verge independently of the clapper during normal operation.

As will be appreciated, operation of the counter is such that one full count on the lowest order number wheel is effected for each electrical impulse received by the electromagnet. The electrical impulse energizes the coil 48 of the electromagnet to attract the clapper sufficiently to overcome the bias of the clapper return spring. Substantially at the same time the verge is pivoted, in a counterclockwise direction as viewed in FIG. 2, by its drive spring 88 to index the ratchet wheel 30 a first drive step or one half count. More particularly the torsion spring is preferably designed so that the verge is pivoted by its drive spring independently of the pivotal movement of the clapper and therefore so that the verge movement is independent of the magnetic attraction of the core 50. Thus in the type of verge drive shown in the drawing the operation of the verge and the shock on the counter resulting from the engagement of the verge with the ratchet wheel is pre-established in accordance with the drive spring selected. Also by permitting independent operation of the clapper and verge, it will be assured that the clapper will complete its forward stroke to press the flexible separator 81 against the pole face 52 and it can be assured that the verge will complete its forward stroke to fully index the counter wheel a full half step, both

without the necessity of maintaining close tolerances in the manufacture and assembly of the clapper and verge. Further the nonuniform clapper action which is often present when the electromagnet is A.C. powered and which occasionally causes an extra count in the counter does not affect the operation of the verge in the magnetic counter of the present invention due to the independent operation of the clapper and verge.

When the electromagnet is de-energized the return spring 78 provides the driving force for returning the clapper and verge to their initial positions, during which return movement the counter wheel is indexed the second half count. Thus it will be appreciated that the clapper return spring 78 must be of sufficient strength not only to overcome the force of the verge spring 88 but also to index the number wheel through the full second half count.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A magnetic counter comprising a rotatable counter wheel, a two-step actuator reciprocally mounted for bidirectional movement and for angularly stepping the counter wheel upon movement in each direction, an electromagnetic operator having an armature reciprocally mounted for movement in one direction in response to the energization of the electromagnetic operator, armature return means for returning the armature in its opposite direction upon de-energization of the electromagnetic operator, the armature and actuator having cooperating means permitting movement of the actuator in a first direction in response to but substantially independently of the movement of the armature in said one direction, and actuator drive means operable to drive the actuator in said first direction in response to but substantially independently of the movement of the armature in said one direction for stepping the counter wheel a first drive step, the armature being adapted upon return movement to drive the actuator in its opposite direction for stepping the counter wheel a second drive step.

2. The magnetic counter of claim 1 wherein the actuator and counter wheel have engageable drive means for angularly stepping the counter wheel in response to the reciprocable movement of the actuator, and wherein the actuator drive means urges the actuator in said first direction into engagement with the armature for driving the actuator in response to but substantially independently of the movement of the armature in said one direction.

3. The magnetic counter of claim 1 wherein the cooperating means includes shoulder means on the actuator engageable with the armature to permit the actuator drive means to drive the actuator in said first direction in response to but substantially independently of the movement of the armature in said one direction.

4. The magnetic counter of claim 1 wherein the actuator drive means comprises a spring urging the actuator in said first direction with a bias that is independent of the reciprocable position of the armature.

5. The magnetic counter of claim 1 wherein the counter wheel has a drive ratchet wheel, wherein the actuator has a pair of opposed ratchet pawls engageable with the ratchet wheel for angularly stepping the counter wheel, wherein the actuator is engageable with the armature for movement in response thereto and wherein the actuator drive means urges the actuator into engagement with the armature to step the counter wheel with one of the opposed ratchet pawls upon movement of the armature in said one direction.

6. The magnetic counter of claim 1 wherein the actuator is pivotally mounted and the armature is a pivotally mounted clapper; wherein the actuator drive means comprises a drive spring adapted to pivotally urge the actuator

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in said first direction into engagement with the clapper and thereby urge the clapper in said one direction, said drive spring thereby urging the actuator in said first direction to effect the first drive step upon movement of the clapper in said one direction; and wherein the armature return means comprises a return spring for moving the clapper in its opposite direction upon de-energization of the electromagnetic operator and thereupon to overcome the bias of the drive spring and pivot the actuator in its opposite direction to effect the second drive step.

7. The magnetic counter of claim 1 wherein the counter wheel has a drive ratchet wheel, wherein the actuator has a pair of opposed ratchet pawls engageable with the ratchet wheel for angularly stepping the counter wheel, wherein the actuator drive means comprises a drive spring for biasing the actuator into contact with the armature and for biasing one of the ratchet pawls into engagement with the ratchet wheel upon movement of the actuator in said one direction to effect the first drive step, and wherein the armature return means comprises a return spring biasing the armature in its opposite direction to move the actuator against the bias of the drive spring and thereby bring about engagement of the other ratchet pawl with the ratchet wheel to effect the second drive step.

8. The magnetic counter of claim 1 wherein the cooperating means of the actuator and armature permit limited relative freedom of movement between the armature and actuator which enables the armature upon energization of the electromagnetic operator to be partly displaced in said one direction independently of the movement of the actuator in said first direction and which thereby enables the actuator to be normally actuated by the actuator drive means in response to the energization of the electromagnetic operator and substantially independently of the movement of the armature in said one direction, said cooperating means providing however for actuation of the actuator in said first direction by the armature after the armature has been partly displaced in said one direction if the actuator is inordinately restrained against movement in said first direction.

9. In an electromagnetic drive for electromagnetically indexing a counter comprising a rotary ratchet wheel connected for indexing the counter, reciprocable ratchet pawl means having a pair of stepping pawls in operative association with the ratchet wheel and operable for indexing the ratchet wheel in one angular direction in stepwise fashion upon reciprocable movement thereof, and an electromagnetic operator having a coil and an armature reciprocably mounted for movement in one direction in response to energization of the coil, the armature and ratchet pawl means having cooperating means for operating the ratchet pawls in conjunction with the reciprocable movement of the armature, the improvement where-

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in the electromagnetic drive comprises spring means for operating the ratchet pawls and wherein the spring means and the cooperating means cooperate to provide for operation of one of the ratchet pawls by the spring means in response to but substantially independently of the movement of the armature in said one direction for indexing the ratchet wheel a first drive step and for operating the other ratchet pawl in response to the movement of the armature in the opposite direction for indexing the ratchet wheel a second drive step.

10. In an electromagnetic drive for electromagnetically indexing a counter comprising a rotary ratchet wheel connected for indexing the counter, reciprocable ratchet pawl means having a pair of stepping pawls in operative association with the ratchet wheel and operable for indexing the ratchet wheel in one angular direction in stepwise fashion upon reciprocable movement thereof, and an electromagnetic operator having a coil and an armature reciprocably mounted for movement in one direction in response to the energization of the coil, the armature and ratchet pawl means having cooperating means for operating the ratchet pawls in conjunction with the reciprocable movement of the armature, the improvement wherein the electromagnetic drive comprises spring means for operating the ratchet pawls and wherein the spring means and the cooperating means cooperate to provide for operation of one of the ratchet pawls by the spring means in response to movement of the armature in said one direction for indexing the ratchet wheel a first drive step and for operating the other ratchet pawl in response to the movement of the armature in the opposite direction for indexing the ratchet wheel a second drive step, and wherein the cooperating means comprises secondary abutment means which permits the armature to positively engage the ratchet pawl means to positively index the ratchet wheel with said one stepping pawl after the armature has moved in said one direction a predetermined amount relative to the ratchet pawl means.

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