Aug. 9, 1960 P. LABOISSIERE 2,948,471

ELECTRO-MAGNETIC COUNTER

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Fig. 2.

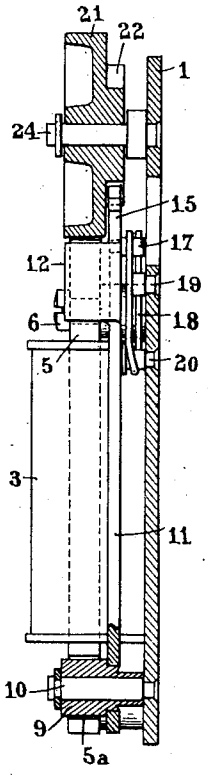


Fig. 1.

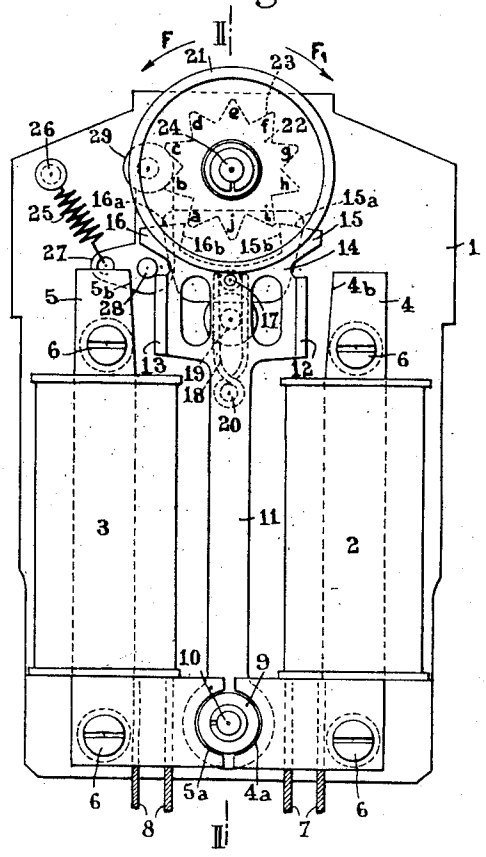
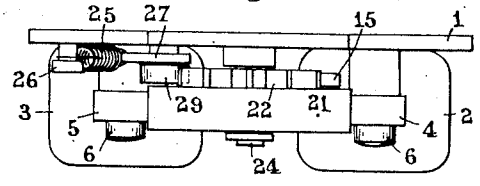


Fig. 3.



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Fig.5.

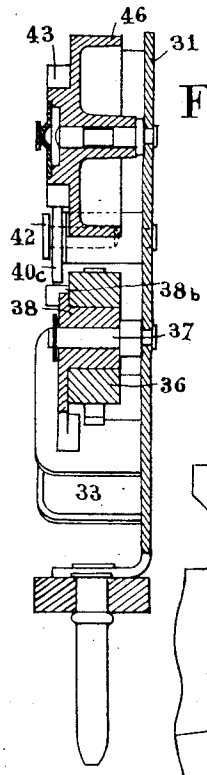
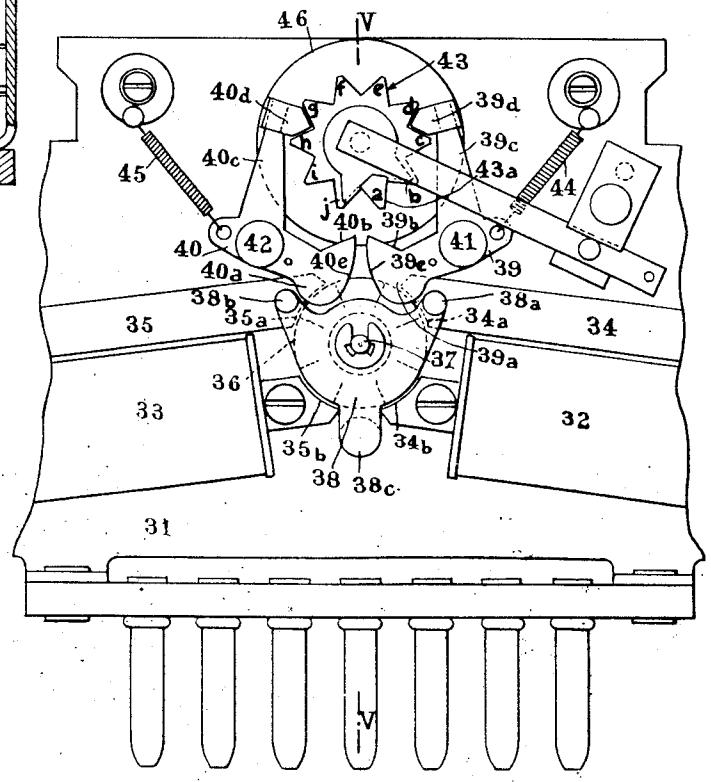


Fig.4.



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ELECTRO-MAGNETIC COUNTER

Pierre Laboissière, 1 Boulevard du Temple, Paris, France

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2 Claims. (Cl. 235—92)

This invention concerns an electro-magnetic counter which can be used, in particular, in accounting machines, computing machines and cash-registers.

It relates more particularly to a counter type in which the counter wheels can rotate in both directions so as to register both positive and negative quantities.

In known counters of this type each counting wheel is made fast with two ratchet wheels, the teeth of one ratchet wheel being inclined in the opposite direction to that of the other ratchet wheel. A pawl which is actuated by an electro-magnet engages each of the ratchet wheels. The numerical pulses are fed either to one electro-magnet or to the other, depending on the operation to be effected: addition or subtraction, the energised electro-magnet rotating the counting wheel forward or backward through the corresponding pawl and ratchet wheel. Such an arrangement involves the provision of a rather intricate mechanical structure including, in particular, two ratchet wheels which increase the inertia of the rotating assembly.

This invention relates to an electro-magnetic counter comprising a totalising pinion which can rotate and register in both directions, driving means which can be moved from an inoperative position to an operative position, said driving means inducing said pinion to effect a rotation, selectively, in one direction or the other, equalling an angle which is smaller than the angular distance between two consecutive teeth of said pinion, blocking any further rotation as long as said driving means are kept in the operative position, and locking means urged by a resilient member so as to hold the pinion in position and to complete the rotation movement of said pinion when said driving means are in their inoperative position.

Two forms of embodiment of this invention are described hereafter solely by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is an elevation of an electro-magnetic counter, according to the invention,

Figure 2 is a section and partial side view taken on the line II—II of Figure 1,

Figure 3 is a top view,

Figure 4 is an elevation of another form of embodiment, and

Figure 5 is a section taken on the line V—V of Figure 4.

In the form of embodiment shown by Figures 1 to 3, the electro-magnetic counter comprises a plate supporting two electro-magnets **2** and **3** the cores **4** and **5** of which have an L shape. Said cores are fixed at a certain distance from plate **1** by screws **6**. The free ends of the windings of the electro-magnets **2** and **3** are connected to the terminals **7** and **8** respectively. The ends **4***a* and **5***a* of cores **4** and **5** are provided with cylindrical recesses to accommodate a cylindrical metal part **9** which is secured to the pivot pin **10** of beam **11**. The pivot pin **10** is fixed on plate **1**. The beam **11** incorporates two bent members **12** and **13** of flat shape which act as movable armatures for the cores **4** and **5**. These cores **4** and

5 are provided with surfaces **4***b* and **5***b* which are inclined in relation to the longitudinal axis of the core. The movable armatures **12** and **13** can thus come into close contact with the slanting surfaces **4***b* and **5***b* respectively. At the free end of beam **11** is secured an anchor shaped member **14** provided with two projections **15** and **16**, each of these projections being limited by two edges **15***a* and **15***b*, **16***a* and **16***b* respectively. A pin **17** rigid with beam **11** is clamped between the two legs of a spring **18** which is kept in position by two pegs **19** and **20** fixed on plate **1**. The spring **18** keeps beam **11** in its inoperative central position, as shown on Figure 1. The totalising wheel **21** is made fast to a straight toothed pinion **22**, the ten teeth of which, **23***a*, **23***b*, **23***c*, **23***d*, **23***e*, **23***f*, **23***g*, **23***h*, **23***i* and **23***j*, have a triangular section. The assembly of totalising wheel **21** and pinion **22** is free to rotate on pivot pin **24** fixed to plate **1**. A spring **25** is secured on one side to a peg **26** fixed on plate **1**, and on the other side to one end of a knee lever **27** pivotally mounted on pivot pin **28**. The other end of the knee lever **27** is provided with a freely rotating roller **29** which is urged towards the teeth **23** of pinion **22** by the action of spring **25**.

The operation of the electro-magnetic counter, according to the invention, will now be described referring to Figure 1. If we assume that electro-magnet **2** is operating in the case of an addition, and electro-magnet **3** in the case of a subtraction (the contrary could also have been chosen) the electrical pulses corresponding to numbers which are to be added are applied on terminals **7**, the electrical pulses corresponding to numbers which are to be substracted then being applied to terminals **8**. When the electro-magnet **2**, used for additions, is energised, the armature **12** is attracted and comes into contact with surface **4***b* of core **4**, thus rotating beam **11** to the right, in the case shown by Figure 1. The tip of projection **16** of the anchor shaped member **14** then engages the tooth **23***a* of pinion **22**, rotating said pinion in the direction shown by the arrow F. The maximum angle of rotation of beam **11** and the shapes of the diverse cooperating members are such that, during its rotation, tooth **23***c* pushes back the roller **29** against the resistance of spring **25**, roller **29** thus passing over the tip of tooth **23***c* and pressing the back flank of said tooth in order to rotate pinion **22** in the direction shown by the arrow F. During the preceding rotation of pinion **22**, however, the tip of tooth **23***b* has come to stop on edge **16***a* of projection **16**. A further rotation of pinion **22** is thus being blocked by projection **16** as long as the energising pulse lasts. When electro-magnet **2** is de-energised, beam **11** is moved back to its central inoperative position by the action of return spring **18**, and projection **16** comes away from the path of the teeth **23**. Consequently, the pressure of roller **29** on the back flank of tooth **23***c* induces a complementary rotation of pinion **22** until roller **29** comes to rest simultaneously between tooth **23***c* and tooth **23***d*. Thus, the rotation of pinion **22** is accomplished in two steps: (1) when electro-magnet 2 is energised, through the action of projection **16** on the corresponding tooth **23***a*, (2) when electro-magnet **3** is de-energised, through the pressure of roller **29** on the back flank of tooth **23***c* which induces a complementary rotation of pinion **22**.

If the numerical pulses are fed to terminals **8**, the operation is reversed: the electro-magnet **3** is energised and rotates beam **11** to the left, thus inducing a first rotary movement of pinion **22** through the action of projection **15** on tooth **23***i*; the roller **29** passes on the other side of tooth **23***b* and tooth **23***h* comes to stop on edge **15***a*; finally, when the electro-magnet is de-energised a complementary rotation is effected by the pressure of roller **29** on the back flank of tooth **23***b*. The totalising wheel **21** is thus rotated in the direction of the arrow F_1.

In the second form of embodiment of the invention shown by Figures 4 and 5 the plates **31** supports the two electromagnets **32** and **33**, the cores **34** and **35** of which are provided with pole-shoes **34***a*, **34***b* and **35***a*, **35***b* respectively, with cylindrical surfaces disposed coaxially. The assembly is symmetrical in relation to axis V—V.

A ferrite core **36**, rigid with a member **38** which is freely rotatable on pivot pin **37**, comprises two north poles and two south poles placed at 90° to each other and which are alternate. These north and south poles are movable in relation to the polar shoes **34***a*, **34***b* and **35***a*, **35***b*.

Member **38** comprises two pegs **38***a* and **38***b* as well as a stop **38***c*. On Figures 4 and 5 the pegs **38***a* and **38***b* are placed, respectively, opposite the arms **39***a*, **40***a* of knee levers **39**, **40**. These levers **39** and **40** are pivotally mounted on pivot pins **41** and **42** respectively, which are fixed on plate **31**. The free ends of arms **39***a* and **40***a* are formed in the shape of pawls **39***b* and **40***b*, respectively, which are limited by the edges **39***c* and **40***c*, respectively, and can engage the teeth **43***a*, **43***b*, **43***c*, **43***d*, **43***e*, **43***f*, **43***g*, **43***h*, **43***i* and **43***j* of pinion **43** which is made fast with the totalising wheel **46**.

The free ends of the other arms **39***c* and **40***c*, of the knee levers **39** and **40** are respectively provided with locking pawls **39***d*, and **40***d*, which are urged towards pinion **43** by the action of springs **44** and **45**, respectively.

On Figures 4 and 5, the various movable parts are shown in their inoperative position when they are placed symetrically in relation to axis V—V.

The counter thus shown operates in the following way: assuming that a pulse is fed to electro-magnet **32**, the ferrite core **36** and associated member **38** are rotated in anticlockwise direction and are thus placed in a position which is determined by stop **38***c*. The peg **38***a* then engages the lower end of arm **39***a* and rotates knee lever **39** in a clockwise direction on pivot pin **41**. During this rotation the locking tooth **39***d* first moves away from pinion **43** thus releasing the said pinion for rotation. Then, pawl **39***b* engages tooth **43***a* and rotates pinion **43** in anticlockwise direction at an angle which is great enough for locking tooth **40***d* to slide on the forward flank of tooth **43***g*, to pass over the tip of said tooth and to engage on its back flank. Wheel **43** cannot complete its movement of rotation as the forward flank of tooth **40***j* is stopped by edge **39***e* of arm **39***a*.

When electro-magnet **32** is de-energised, the four poles of the ferrite core **36** act in such a way as to move said core rapidly back to its inoperative position, as shown in Figures 4 and 5. The lever **39** is then rotated by the action of spring **44** in anticlockwise direction and edge **39***e* slides on the forward flank of tooth **43***j* until said tooth is released. The arm **40***c* which is brough into engagement with the back flank of tooth **43***g* through the action of spring **45**, completes the rotation movement

of pinion **43** and locks said pinion in its final position. On the other hand, arm **39***c* continues to rotate in anticlockwise direction and tooth **39***d* completes the locking of pinion **43**.

The device operates in a similar way if electro-magnet **33** is energised. The pinion **43** and wheel **46** are then rotated in clockwise direction.

In the above description, only one counter element, able to count ten pulses in one direction or the other has been shown and described. It is self-explanatory that a counter for several numerical orders can be made by assembling several counters according to the invention. All that is necessary is to provide a carrying over device of any known type, as, for example, a cam member provided with a projection and rigid with the totalising wheel, which closes a contact when the totalising wheel passes from position 9 to position 0, thus sending a supplementary pulse to the counting wheel of the next upper order.

It is also possible to provide a different number of teeth for pinion **22** if the operations are made in a non-decimal numerical system.

What I claim is:

1. Electro-magnetic counter comprising a totalising pinion which can rotate and register in both directions, two electromagnets, a ferrite core selectively moved in one direction or the other from its inoperative position by said electromagnets, a member provided with two pegs rigid with said ferrite core, two knee levers pivotally mounted, each of these levers comprising an arm the end of which is formed in the shape of a pawl and which can be rotated by one of the pegs in such a way that, when the ferrite core rotates in one direction, one of the pegs rotates the corresponding arm and its pawl engages a tooth of the pinion to rotate it, the rotation of said pinion along a complete pitch being blocked by the pawl which engages the teeth of the pinion, and locking means urged by a resilient member so as to hold the pinion in position and to complete the rotation movement of said pinion when said ferrite core is restored in their inoperative position.

2. Electro-magnetic counter according to claim 1, in which the other arm of the pivotally mounted levers is provided with a locking pawl which, by the action of a return spring, engages the teeth of said pinion.

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