Sept. 2, 1947. E. TATTER 2,426,715

COUNTING DEVICE

Filed Oct. 9, 1941 2 Sheets-Sheet 1

Fig. 1.

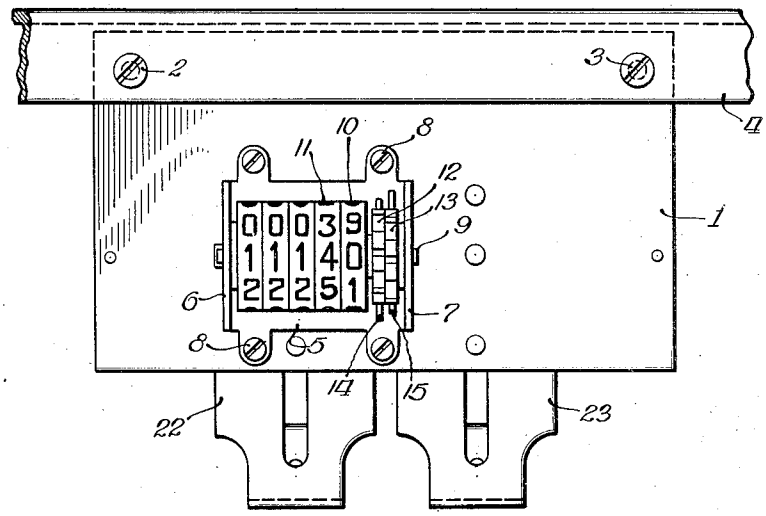
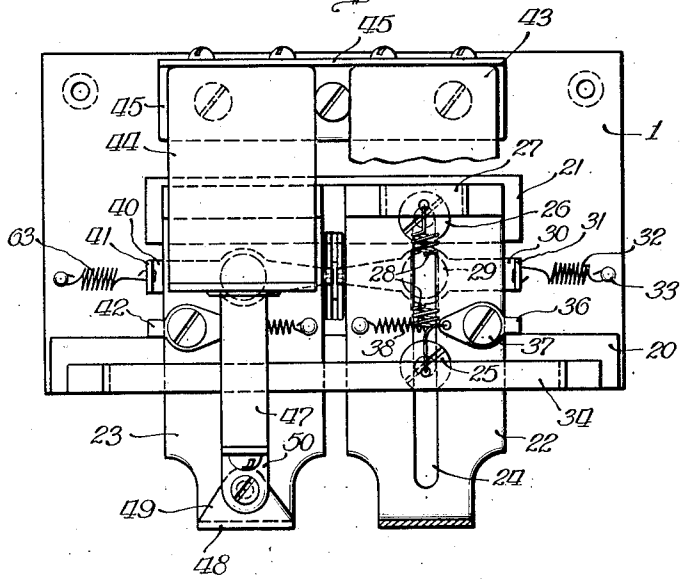


Fig. 2.



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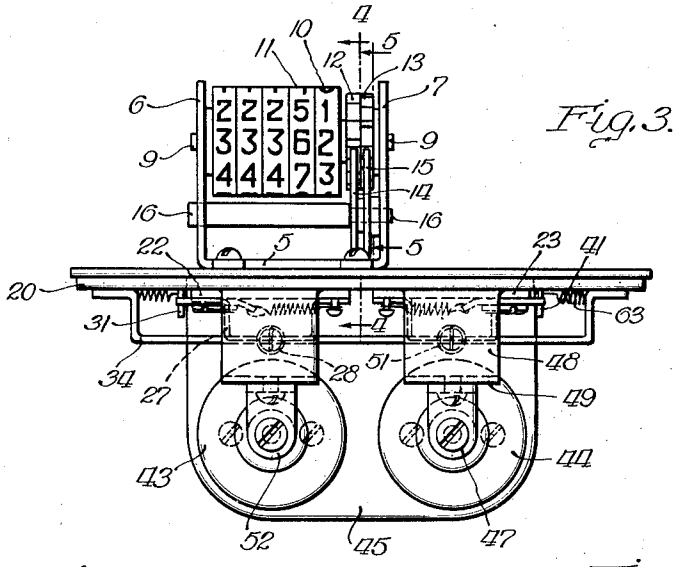


Fig. 3.

Fig. 4.

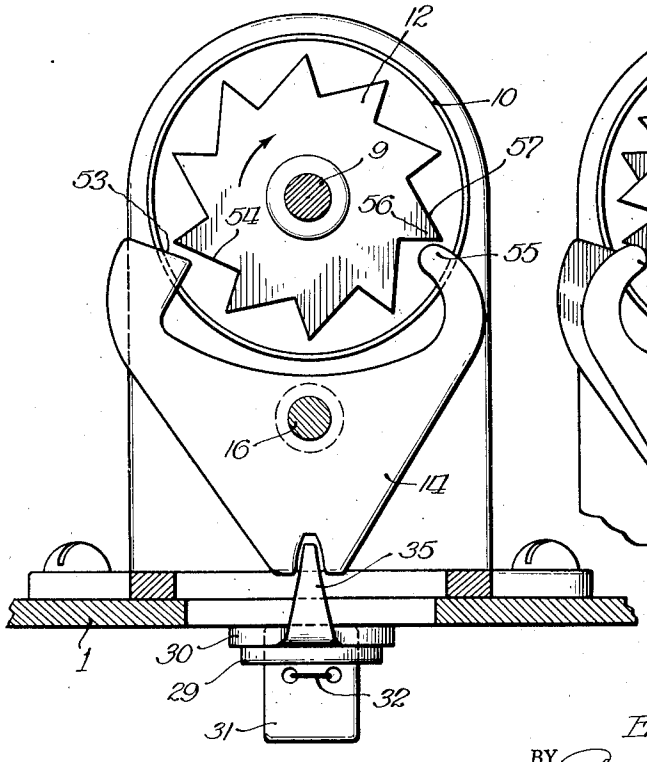
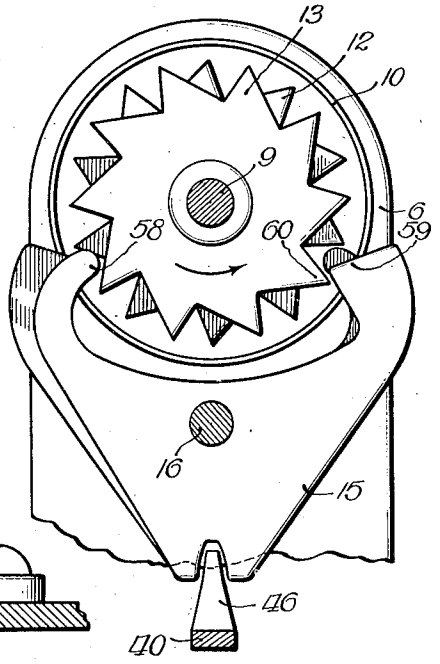


Fig. 5.



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UNITED STATES PATENT OFFICE

2,426,715

COUNTING DEVICE

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6 Claims. (Cl. 74—143)

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The present invention relates in general to counting devices, and more in particular to such counting devices as include a mechanical counter of known type having digit wheels of the different numerical orders in the decimal system of numbering. The object of the invention is to produce a new and improved counting device of this character.

A special object of the invention is to produce an improved counting device which is adapted to be operated in either direction at will in order to add or subtract from a total previously registered.

A further object of the invention is to produce an improved add-and-subtract counting device which is electromagnetically operated and which is compact in form, efficient in operation, and economical to manufacture.

The invention and various features thereof will be explained in detail in the following description, reference being made to the accompanying drawings, in which—

Fig. 1 is a top or plan view of the complete counting device;

Fig. 2 is a bottom view of the same, in which the counting device has been rotated about a vertical axis through an angle of 180° from the position in which it is shown in Fig. 1;

Fig. 3 is an end view, in which the counting device has been rotated about a horizontal axis through an angle of 90° from the position in which it appears in Fig. 1;

Fig. 4 is a partial section taken on the line 4—4, Fig. 3, and drawn to a larger scale; and

Fig. 5 is another partial section taken on the line 5—5, Fig. 3.

Referring to the drawings, the various parts of the counting device are mounted on a flat rectangular metal plate 1, which is of sufficient thickness to afford the necessary rigidity. Tapped holes may be provided near one edge of the plate 1 for mounting the counting device on a suitable support such as the angle iron piece 4 by means of screws 2 and 3. Any other suitable or desired mounting arrangement may be employed, however.

The mechanical counter is located on the top of plate 1 and for the most part is of known construction. There is a generally U-shaped frame comprising a base portion 5 and two upright portions 6 and 7, Figs. 1 and 3. This frame is attached to the plate 1 by means of screws such as 8, as shown in Fig. 1. The usual digit wheels such as the units digit wheel 10 and the tens digit wheel 11 are rotatably supported on the shaft 9,

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which extends between the vertical parts 6 and 7 of the frame. Two ratchet wheels 12 and 13 are provided, which are rigidly secured to the units digit wheel 10.

For cooperation with the ratchet wheels 12 and 13, pawls 14 and 15 are provided. These pawls are pivotally supported on the reduced portion of a shaft or rod 16, as shown in Fig. 3. The ratchet and pawl construction can best be understood from Figs. 4 and 5, which show these parts on an enlarged scale. The design of the ratchet wheel 12 and pawl 14 is such that oscillation of the latter on its pivot 16 is effective to drive the units wheel 10 in a clockwise direction, as will be explained in detail subsequently. The ratchet wheel 13 and pawl 15 are the same, except that the parts are reversed on their respective shafts 9 and 16, whereby oscillation of the pawl 15 is effective to drive the units wheel 10 in a counter-clockwise direction.

The mechanism for operating the pawl 14 includes a pivoted lever 30, a slide 22, and a pivoted cam 36 mounted on the slide. These parts will now be described.

The lever 30 is shown in Fig. 2, partly in dotted lines. It lies flat on the plate 1 and is pivoted on a shoulder screw 29 which is threaded into the plate. At the right hand end the lever is bent at right angles to form a projection 31. A spring 32 is tensioned between the projection 31 and a pin 33 and normally maintains the lever 30 in the position shown. At the end opposite the projection 31 the lever 30 has a part 35 bent in the opposite direction. The part or projection 35 extends through an opening in plate 1 and enters a recess in the end of pawl 14, as shown clearly in Fig. 4.

The slide 22 rests against the two metal strips 20 and 21, which are welded or soldered to the plate 1 and are just thick enough to space the slide away from the head of the shoulder screw 29. There is a slot 24 extending lengthwise of the slide 22. The shoulder screws 25 and 26 pass through this slot and are threaded into the metal strips 20 and 21, respectively. As the slide is shown in Fig. 2, the shoulder screw 26 is at the end of the slot and thus limits the possible movement of the slide in one direction. In the other direction, however, a considerable movement is possible, due to the fact that the slot 24 extends for some distance beyond the shoulder screw 25.

The bridge member 34 is a metal strip formed as shown in Fig. 3 and welded or soldered to the metal strip 20. A similar but shorter bridge member 27 is suitably secured to the end of the

slide 22. A coil spring 28 is connected between these bridge members and is under tension, whereby the slide is normally maintained in the position in which it is shown in Fig. 2, with the end of slot 24 against the shoulder screw 26.

The cam member 36 is shaped as shown in Fig. 2 and is pivoted on the slide 22 by means of a shoulder screw 37. A spring 38 extends between the end of the cam member 36 and a pin fixed to the slide 22 and is under tension to hold the cam member in the position shown.

The lever 40, slide 23, and cam 42 are similar to the lever 30, slide 22, and cam 36, and hence need not be described in detail. It may be mentioned, however, that lever 40 is provided with a projection 46 which extends through the opening in plate 1 and enters a recess in the end of pawl 15, as shown in Fig. 5.

The slides 22 and 23 are operated by means of two solenoids 43 and 44, which are supported on an L-shaped bracket 45, as shown in Fig. 2. The solenoids are identical and accordingly the construction may be explained in connection with solenoid 44, the other solenoid being only partially shown in Fig. 2.

The solenoid 44 is provided with a slidable core 47, the exterior end of which is secured to the slide 23 by means of an L-shaped piece 50. To this end the slide 23 is bent at right angles away from plate 1, as shown at 48, Fig. 3, and is then bent back on itself to form an offset part 49, Fig. 2, to which the piece 50 is attached. Energization of the solenoid 44 draws in the core 47 and thus actuates the slide 23. When the solenoid is deenergized, the slide is returned to normal by means of the spring 51, Fig. 3, which corresponds to and is arranged in the same manner as the spring 28 associated with the slide 22. Solenoid 43 actuates the slide 22 similarly.

The operation of the counting device may now be explained. For this purpose it may be assumed that the counting device is used for supervision in connection with doors or passages for entrance to and departure from a building. The arrangement may be such that the counting device is operated to add one each time a person enters the building and is operated to subtract one each time a person leaves the building. The reading of the counting device at any given time therefore depends on the difference between the number of persons who have entered and the numbers of persons who have departed, and indicates the excess of the former, or the number of persons at that time in the building. For operation of the counting device under conditions such as described in the foregoing known circuit arrangements controlled by turnstiles or photoelectric cells may be used. There are numerous other situations in which the add-and-subtract counting device may be used, e. g., for add-and-subtract counting of objects placed in and removed from storage to indicate at any time the number of actually stored objects, but the one mentioned will suffice to indicate the utility of the invention.

It will be understood that the solenoids 43 and 44 are intended to be operated by impulses, which should be of sufficient strength and duration to insure full energization of the solenoids. Direct current may be used, or the solenoids may be designed to operate on commercial alternating current according to known practice.

The solenoid 43 is the add solenoid, operation of which actuates the counter in a positive direction, whereby any total previously registered is added to or increased.

When the solenoid 43 is energized, the core 52 (corresponding to core 47 of solenoid 44) is drawn in and the slide 22 is moved in an upward direction as it appears in Fig. 2. After the slide has moved a short distance the cam 36 mounted thereon engages the projection 31 at the end of lever 30. The spring 38 may be slightly stiffer than spring 32 and is connected to the cam member 36 at a point rather close to the pivot 37. Accordingly the lever is rotated on its pivot when the projection 31 is engaged by cam 36, while the latter yields only a small amount during the rotation of the lever. In response to the rotation of lever 30 the projection 35 at the end thereof rotates the pawl 14 in a clockwise direction as the latter is seen in Fig. 4. When the pawl 14 is rotated in this manner the squared end 53 of the pawl engages the face 54 of the adjacent tooth of the ratchet wheel 12 and rotates the ratchet wheel in a clockwise direction, as shown by the arrow. The rotation continues until the end 53 of the pawl reaches the bottom of the valley between the two ratchet teeth, whereupon further rotation of the pawl 14 and of the lever 30 is prevented. Since further rotation of the lever 30 is inhibited, the continued motion of the slide 22 now causes the cam 36 to rotate on its pivot 37 far enough so that it can slip past the projection 31, whereupon the cam 36, lever 30, and pawl 14 restore to normal position. The motion of the slide 22 ceases when the end of slot 24 reaches the shoulder screw 25. In the fully actuated position of the slide 22 the cam 36 is approximately as far beyond the projection 31 as it was ahead of it prior to the initiation of the operation. The operations thus far described advance the ratchet wheel 12 through an angular distance equal to one-half of the tooth pitch.

When the solenoid 43 is deenergized the core 52 is released and the slide 22 is restored to its normal position by the spring 28. During the return movement of the slide the cam 36 engages the projection 31 as before, but on the opposite side, and the lever 30 is operated to rotate the pawl 14 in a counter-clockwise direction. Due to the previous rotation of the ratchet wheel, the tooth 56 thereof has passed by the rounded end 55 of the pawl 14, and as the latter rotates now, the rounded end 55 engages the face 57 of tooth 56 and further rotates the ratchet wheel in a clockwise direction. The rotation continues until the end 55 of the pawl 14 reaches the bottom of the valley between tooth 56 and the next tooth, whereupon the rotation of the pawl 14 and the lever 30 ceases. The cam 36 thereupon rotates on its pivot 37 responsive to further movement of slide 22 toward its normal position and slips past the projection 31, as previously described. As soon as the cam 36 has cleared the projection 31, the cam 36, lever 30, and pawl 14 are again restored. The cycle of operation is complete when the slide 22 reaches its initial position and results in the advance of the ratchet wheel through an angular distance equal to the tooth pitch. The ratchet wheel being rigidly fixed to the units wheel 10 of the counter, the units wheel has been advanced the same amount, which is equal to the spacing between the digits on the face of the wheel. Thus if the units wheel read zero when the operation was initiated it now shows the digit 1.

The foregoing operations take place in re-

sponse to a single impulse received by the solenoid 43. Succeeding impulses actuate the slide 22 in the same manner, and the units wheel is advanced to add one to the previous count for each impulse received.

During the operation of the counting device by the add solenoid 43 the teeth of the ratchet wheel 13 alternately engage the operating ends 58 and 59 of the pawl 15 and cause a slight oscillation thereof, as will be understood from an inspection of Fig. 5. The pawl 15 and the lever 40 are free to move, however, except for spring 63, and the rotation of the ratchet wheels in a clockwise direction is not interfered with.

The solenoid 44 is the subtract solenoid. It functions responsive to impulses to operate the counting device in a similar manner as solenoid 43, except that the operation is in the reverse direction; that is, each time the solenoid 44 is energized and deenergized one unit is subtracted from the total registered on the counter.

Upon the energization of solenoid 44 the slide 23 is moved to its operated position, and in the course of this movement the cam 42 actuates the lever 40 in a manner which will be readily understood from the preceding explanations, causing the lever 40 to rotate the pawl 15 in a clockwise direction. The rounded end 58 of the pawl engages the face of the adjacent tooth of ratchet wheel 13 and rotates the ratchet wheel in a counter-clockwise direction through an angular distance equal to one-half the tooth pitch. The cam 42 slips off the projection 41 on lever 40 toward the end of the movement of the slide 23 and the cam 42, lever 40, and pawl 15 restore to normal.

Upon the deenergization of the solenoid 44, the core 43 is released and the slide 23 is restored to normal by the spring 51. During the restoration of the slide 23 the cam 42 actuates the lever 40 again, which in turn operates the pawl 15, this time rotating it in a counter-clockwise direction. The squared end 59 of the pawl engages the face of tooth 60 of ratchet wheel 13, which has been moved somewhat past the end 59 of the pawl during the previous half-step rotation of the ratchet wheel, and thereby rotates the ratchet wheel the additional amount which is required to complete the rotation thereof for a full step, or an angular distance equal to the tooth pitch. The cam 42 slips past projection 41 shortly before the slide 23 has fully restored and the cam 42, lever 40, and pawl 15 again restore to normal.

It will be seen therefore that an impulse transmitted to the subtract solenoid 44 rotates the units wheel one step in a negative direction and thus causes the counting device to subtract one unit from the total previously registered. Additional impulses transmitted to the subtract solenoid operate the counting device in the same way; that is, it subtracts one unit for each impulse received.

During the operation of the counting device by the subtract solenoid the rotation of the ratchet wheel 12 in a counter-clockwise direction causes the pawl 14 to oscillate slightly, but this oscillatory motion is of small amplitude and is opposed only by the spring 32 associated with lever 30. The oscillation of pawl 14 under this condition is similar to the oscillation of pawl 15 when the counting device is being operated by the add solenoid 43 and does not appreciably impede the rotation of the ratchet wheels.

It will be seen that the ratchet wheels are not normally locked and that the units wheel is capable of being rotated in either direction by operation of the proper pawl and ratchet mechanism. However, it should be noted that the pawl and ratchet construction is such that when either pawl restores to normal it instantly breaks contact with the associated ratchet wheel and does not have any sliding contact therewith which might alter the position of the units wheel. It may be pointed out, moreover, that when the pawls are in normal position the ratchet wheels cannot rotate more than a very small amount before a tooth on one of the ratchet wheels comes into engagement with one of the pawls. While each pawl is free to move responsive to a positive drive by the other pawl there is some resistance offered by the springs 63 and 32, which is sufficient to hold the pawls normally in the position shown thereby preventing displacement of the units wheel by accidental shocks.

While a certain specific embodiment of the invention has been illustrated and described herein, it will be understood that this has been done for convenience and to acquaint the public with an operative embodiment of the invention, and that modifications may be made without departing from the principles of the invention. I do not therefore wish to restrict myself to the exact form of the invention which is shown and described herein, but desire to include and have protected by Letters Patent all forms and modifications thereof which come within the scope of the appended claims.

I claim:

1. In a device of the class described having a member carrying a ratchet wheel, the improvement which consists in an operating mechanism for rotating said ratchet wheel to actuate said member, said mechanism comprising a double-acting pawl having extensions forming two forked arms the ends of which point inwardly, means for pivotally mounting said pawl with the ends of said forked arms thereof extending inwardly toward the teeth of said ratchet wheel from opposite sides thereof, a slidably mounted drive member, a member for actuating said pawl, said last-named member being pivotally mounted in the path of said drive member, and means for actuating said drive member to slide past said actuating member so as to operate the actuating member to oscillate said pawl through an advance stroke in one direction followed by a return stroke in reverse direction for the purpose of advancing said ratchet by an angular displacement equivalent to the pitch of one tooth thereof.

2. The structure and combination defined in claim 1, wherein a pivotally resiliently mounted element constitutes said drive member.

3. The structure and combination defined in claim 1, wherein said actuating member for actuating said pawl is resiliently pivotally mounted for the purpose of maintaining said pawl in normal position with the end of one of said forked arms disposed between two adjacent teeth of said ratchet.

4. In a device of the class described having a rotatably mounted member, the improvement which consists in a mechanism for rotating such member selectively in either direction of rotation, said mechanism comprising unitary means forming a pair of ratchet wheels of identical configuration which are rotatable as a unit to rotate said member, a double-acting pawl associated with each ratchet wheel, each pawl being of

identical configuration having extensions forming forked arms the ends of which point inwardly, means for pivotally mounting said pawls each with the ends of the forked arms thereof extending inwardly toward the teeth of the associated ratchet wheel from opposite sides thereof, each pawl being so constructed and arranged with respect to its associated ratchet wheel that the rotation of such ratchet wheel is opposed when the pawl associated therewith is in normal position, resilient means for holding each pawl in its normal position, and means for positively actuating each pawl independent of the other to rotate its associated ratchet wheel and therewith the unitary means forming said pair of ratchet wheels against the opposition afforded by the resilient means associated with the other pawl which tends to oppose the rotation of its associated ratchet wheel.

5. The structure and combination defined in claim 4, wherein the means for positively actuating each pawl independent of the other comprises a slidably mounted drive member, means for actuating said drive member to slide past said resilient holding means for the associated pawl so as to actuate said holding means through an advance stroke in one direction followed by a return stroke in reverse direction for the purpose of oscillating the associated pawl to advance the ratchet wheel by an angular displacement equivalent to the pitch of one tooth thereof.

6. The structure and combination defined in claim 4, wherein a pivotally mounted spring controlled lever constitutes the resilient means for holding each pawl in its normal position, and

wherein the means for positively actuating each pawl independent of the other comprises a slidably mounted drive member and means for sliding such drive member through an advance and return stroke, said pivotally mounted lever being disposed in the path of the motion of said drive member and being displaced thereby for the purpose of oscillating the associated pawl to move its associated ratchet.

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