Feb. 11, 1936. E. EK ET AL 2,030,624

COUNTING DEVICE

Filed Jan. 14, 1930 3 Sheets-Sheet 1

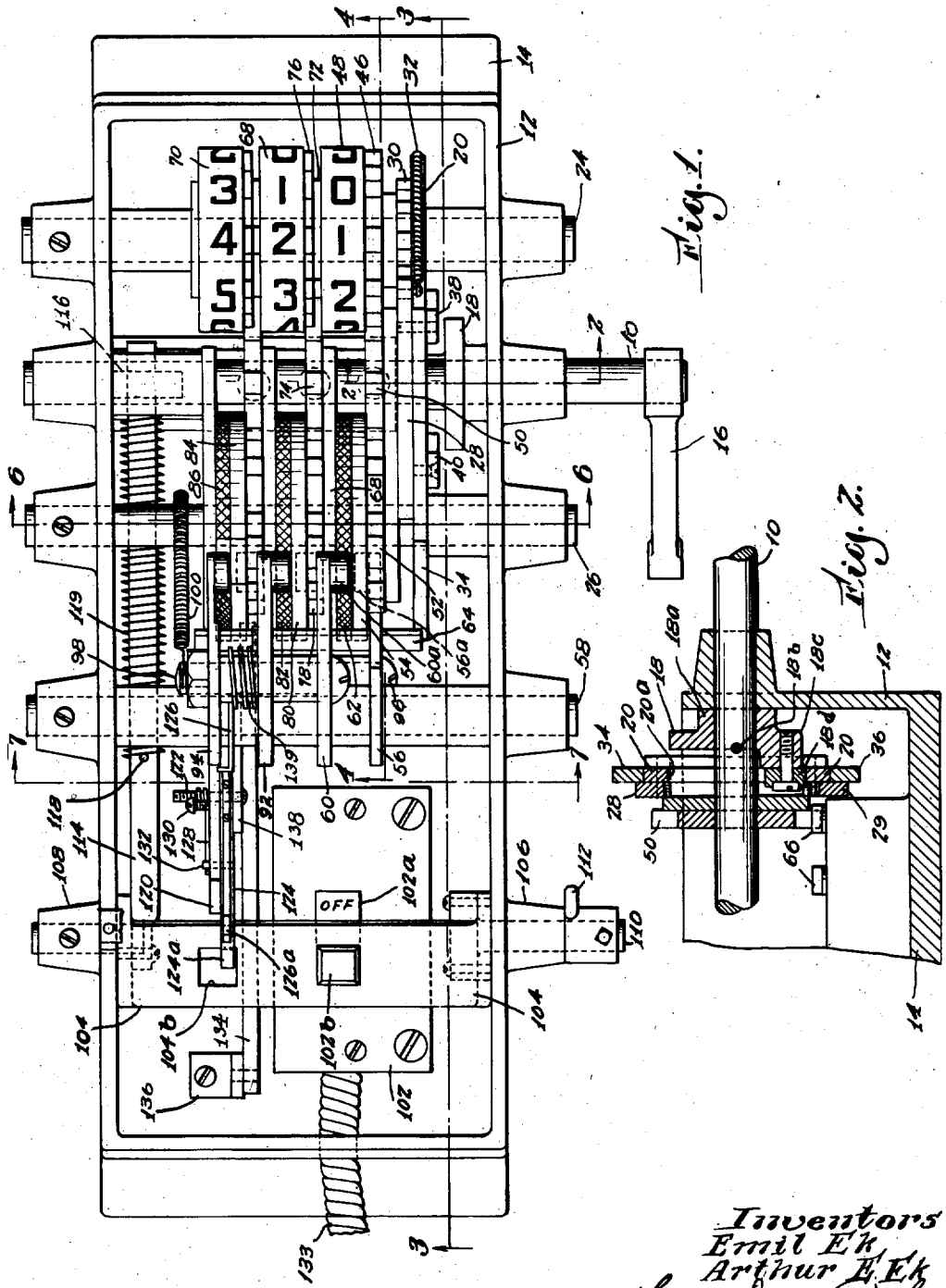


Fig. 1.

Fig. 2.

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COUNTING DEVICE

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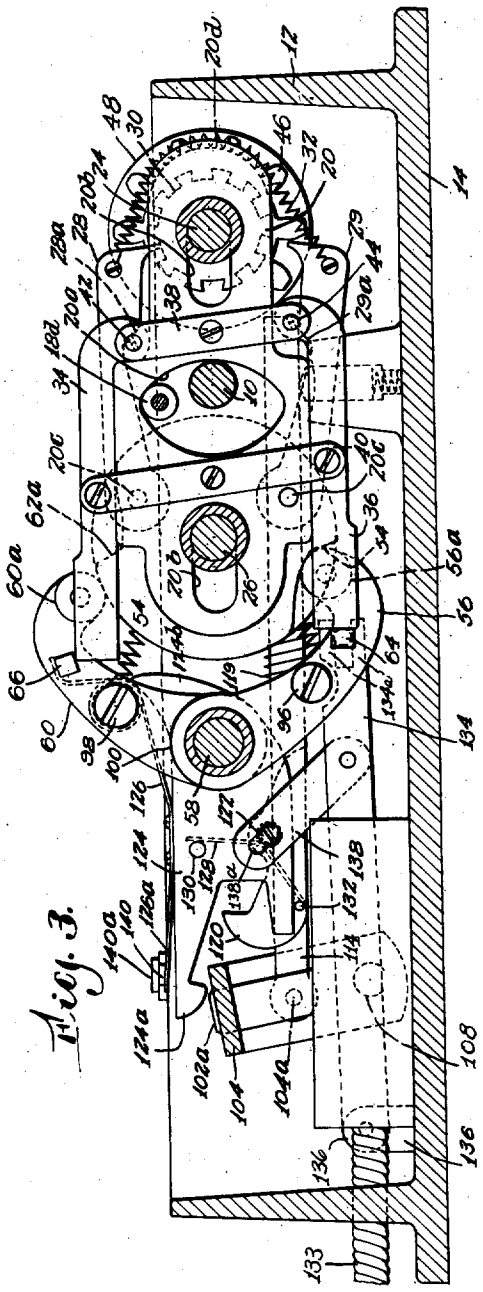


Fig. 3.

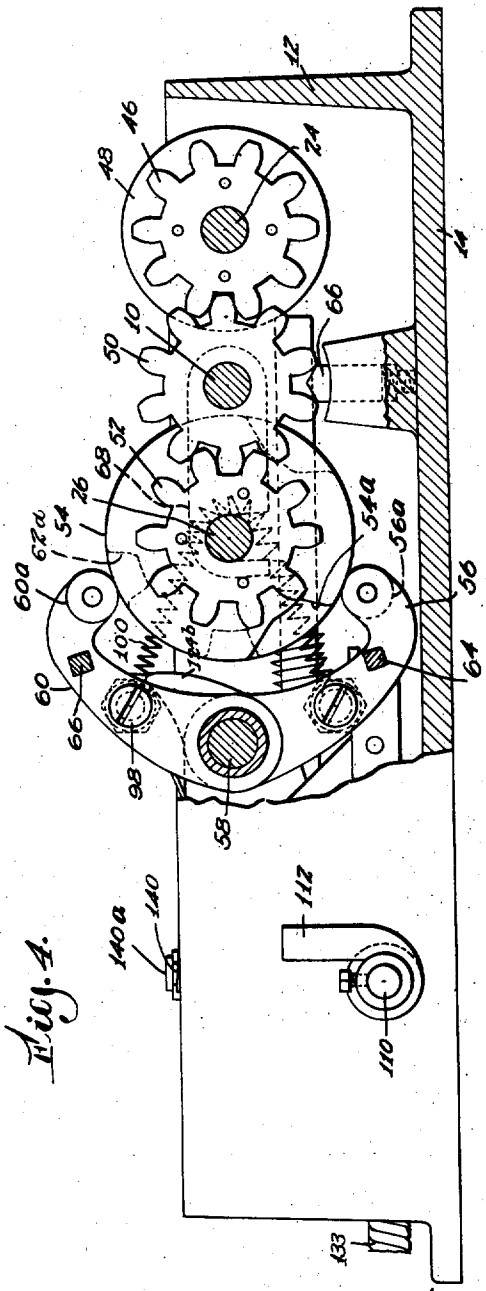


Fig. 4.

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COUNTING DEVICE

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Fig. 5.

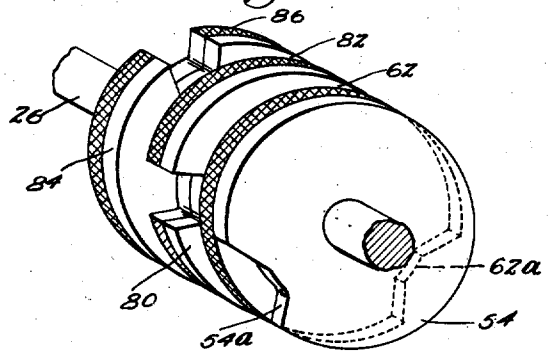


Fig. 6.

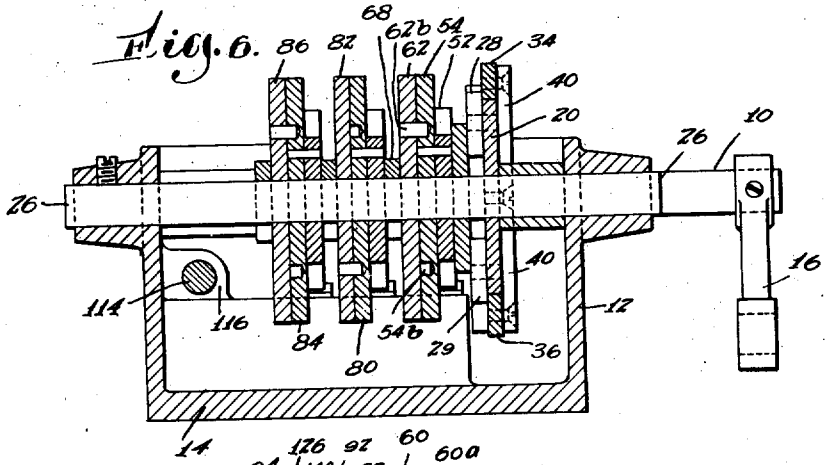
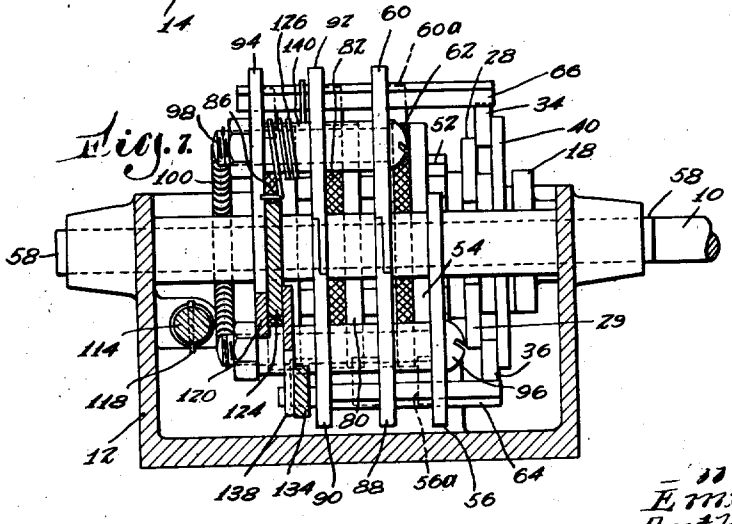


Fig. 7.



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UNITED STATES PATENT OFFICE

2,030,624

COUNTING DEVICE

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Application January 14, 1930, Serial No. 420,744

9 Claims. (Cl. 235—132)

This invention relates to improvements in counting devices. More especially it relates to a counting device which is capable of counting between one predetermined number and another, reversing itself as each predetermined number is reached and then counting back again to the other predetermined number.

It is frequently desired to indicate when a predetermined number of operations has been completed or to indicate when a predetermined number of units of material has been produced or withdrawn. For example, in the case of machines, handling wire, cloth, paper and the like, it may be desirable to know when a certain number of unit lengths has been run off. In other cases, such as where a machine is performing repeated operations and producing individual products, it may be desirable to know when a certain number of such products, such as a gross, has been completed.

It is among the objects of this invention to provide a counting device which can be set to count a definite number of operations or unit lengths and then reverse its direction and make the same count back again. At the end of each such count a signal may be given and, if but one count is desired, the device may be utilized to actuate control means for stopping the operation, production or travel of whatever is being counted at the end of the single count. In the preferred form of the device one predetermined number is zero and it is a feature that such device can be set initially at any other predetermined number and then count back to zero. This is of particular advantage where only one count is desired because it greatly simplifies the setting of the device and where the count is to be repeated it avoids the necessity of restoring the counting device to zero before beginning its action and insures that the proper count has been accurately provided for.

The particulars of the best mode in which we have contemplated applying the principles of this invention will be pointed out in the detailed description which follows, and other features of the invention will be noted as the description develops.

It is intended that the patent shall cover by suitable expression in the appended claims, whatever features of patentable novelty exist in the invention disclosed.

In the accompanying drawings:

Figure 1 is a plan of a counting device, with the cover casing removed, embodying the principles of the present invention;

Figure 2 is an elevation in section, as one line 2—2 of Figure 1, showing details of the operating connection between the main shaft and registering unit of the counting device;

Figure 3 is a side elevation, partly in section as on line 3—3 of Figure 1; but with the parts in positions corresponding to a zero reading of the tally wheels;

Figure 4 is a similar elevation, taken as on line 4—4 of Figure 1, but with the units tally wheel and associated parts shifted to the one reading;

Figure 5 is a perspective of the tumbler disks of the control unit;

Figure 6 is another elevation in section as on line 6—6 of Figure 1; and

Figure 7 is a similar elevation, taken as on line 7—7 of Figure 1.

Referring to the drawings the main shaft 10 is journaled in bearings suitably provided in the upstanding casing walls 12 of the base 14. This shaft is shown as having a crank 16, but the latter is merely representative for it might be a wheel adapted to contact with moving material such as lumber, cloth, paper, wire, etc., whose linear length is to be registered by the meter. The shaft 10 may be rotated in either direction or merely oscillated through a part rotation by other apparatus, (not shown) whose cycles of movements or oscillations are to be registered or controlled. On this shaft within the casing is secured another crank 18, here shown in the form of a hub 18*a* fastened by pin 18*b* to the main shaft and having an offset portion 18*c* carrying a roller 18*d* whose axis is parallel to that of the shaft 10. This roller 18*d* engages the edge of a suitably shaped hole 20*a* in the middle of a main motion plate 20. The latter also has two elongated slots 20*b*, in alignment but on opposite sides of the roller hole 20*a*, which slidably fit about two bearing shafts 24 and 26 that are secured to the casing and extend across it parallel to the main shaft 10. These bearing shafts and the elongated slots of the motion plate cooperate to guide the motion plate in a straight line direction as it is moved one way and then the other by the roller 18*d*, the rotative motion of the roller about the main shaft 10 being transformed into reciprocating motion of the plate 20.

Two pawls 28 and 29 are pivotally mounted at one side of the motion plate on pins 20*c* and extend to the right, as seen in Figures 1 and 3, so as to engage a ratchet wheel 30 which is rotatable on the bearing shaft 24. The ends of these pawls are connected by a light coiled spring 32

which lies in a groove 20*d* provided in the curved end of the motion plate. The pull of this spring tends to swing both pawls into contact with the ratchet wheel 30 but while one is permitted to engage it and thus cause its rotation in one direction, the other pawl is held out of engagement therewith. This is accomplished by means of two bars 34, 36, carried by a pair of links 38, 40, pivotally mounted at 39 and 41 respectively on the motion plate. Pins 42 and 44 which connect the right hand ends of these bars with their connecting link 38 extend under the pawls 28 and 29. When the upper bar 34 is in the position in which it extends farthest to the left, as shown in Figure 3, the pin 42 is so positioned with respect to the cam edge 28*a* of pawl 28, that the latter is swung toward the ratchet wheel 30 by spring 32 and will rotate the ratchet wheel as the plate is moved to the right on its driving stroke. At the same time, the other cam pin 44 will be so positioned with respect to the cam edge 29*a* of the other pawl 29 that the latter will be swung out of the path of engagement with the ratchet wheel 30. Upon a shifting of the bars 34 and 36, the upper bar moving to the right and the lower bar to the left, the relative positions of the pins and cam edges of the pawls are reversed, thereby swinging the upper pawl 28 out of contact with the ratchet wheel and the lower pawl 29 into engagement with it. As the pawls move toward the right, the spring 32 will cause the pawl which is free to do so, (pawl 28 in Figure 3) to enter a notch of the ratchet wheel 30 and engage one of the teeth. Upon the return stroke of the pawl, that is to the left as seen in Figure 3, the curved side 28*b* of the pawl rides up on the tooth in its path, the pawl overcoming the force of spring 32 and swinging about its pivot 20*c*. Thus the direction of rotation of the ratchet wheel is governed by the respective positions of the bars 34 and 36 and their positions, as will hereinafter more particularly appear, are altered by the control unit of the device.

The ratchet wheel 30, a gear wheel 46 and the unit tally wheel 48 are secured together and all turn one-tenth of a rotation during a driving stroke of the motion plate 20. This rotative movement of the gear wheel 46 is transmitted to a back or intermediate gear wheel 50 which can turn freely on the main shaft 10. (See Fig. 4.) This intermediate gear meshes with both the unit gear wheel 46 and a third gear wheel 52 rotatable on bearing shaft 26. This latter gear is pinned to a cam disk 54 having a notch 54*a* (one edge of which is inclined to form a cam) adapted to receive the roller 56*a* on the end of a cam lever 56 pivotally supported on a bearing shaft 58. On this latter shaft is another cam lever 60 having a roller 60*a* adapted to engage a notch 62*a* in another cam disk 62 rotatable on bearing shaft 26. This cam disk 62 is normally immediately adjacent to its companion disk 54 and turns therewith, there being a pin 62*b* (see Figure 6) on the disk 62 which projects into one of a series of ten holes 54*b* provided in cam disk 54. These holes correspond to the ten units of the unit tally wheel 48.

The operation of the cam disks and cam levers associated with the unit tally wheel will now be described. Assume the tally wheel is set at 0, and it is desired to count or register up to 9 in one direction of rotation and then reverse and count down to 0 again. When the unit tally wheel 48 is at 0 position the notch 54*a* in cam disk 54 will always be opposite roller 56*a* and accordingly the lever 56 will be swung counterclockwise, with its roller resting in the notch as seen in Figure 3. When so swung, a rod 64 carried by lever 56 will have moved into the path of bar 36 so that upon the next return movement of the motion plate the bars 34 and 36 and links 38 and 40 will be shifted into the positions shown in Figure 3, thereby causing the pin 44 to swing pawl 29 out of engagement with ratchet wheel 30, and, by simultaneous movement of bar 34 and pin 42, permitting pawl 28 to swing into engagement with the ratchet wheel. Accordingly the next rotation, or oscillation of the main shaft through a part rotation, will cause the motion plate to move on its driving stroke, carrying with it the pawls, and thus rotate the ratchet wheel and advance the unit tally wheel reading one unit for each driving stroke of the motion plate. At the same time, of course, intermediate gear wheel 50 and gear wheel 52 will also be rotated one-tenth of a complete turn, and since the cam disk 54 is attached to gear wheel 52, the disk will also be similarly rotated. In consequence the cam side of the notch 54*a* will force the roller 56*a* out of notch 54*a*, leaving it to ride on the edge of the disk 54 until the notch again comes in register with it. The swing of lever 56, as its roller is forced out of notch 54*a*, has no effect on the pawls because the bar 64 is merely drawn away from the end of the bar 36 leaving the latter undisturbed. It follows then that continued movement of the main shaft 10 will cause the ratchet wheel 30, unit tally wheel 48, the gears 46, 50 and 52, and the cam disk 54, all to advance one-tenth of a rotation for each driving stroke of the motion plate. This definite one-tenth of a rotation is assured by a spring actuated detent 67 (see Fig. 4) provided in a suitable boss on the base, which engages the teeth of gear wheel 50 and prevents any over-travel.

To change the direction of rotation of the unit tally wheel when it reaches the unit 9, it is necessary to set the cam disk 62, with respect to disk 54, so that as the latter reaches its position, corresponding to the position of the unit tally wheel at 9, the notch 62*a* of disk 62 will then be in register with the roller 60*a*. This setting of cam disk 62 is accomplished as follows. The tally wheel is first turned to read 9. Beside disk 62 is a spacing hook 68, which is pivoted on main shaft 10 (see Figure 4) and hooks over bearing shaft 26. By raising this hook and swinging it clear of disk 62, the latter can then be slipped along bearing shaft 26, thus withdrawing its pin 62*b* from engagement with disk 54. While thus disengaged, disk 62 is then rotated about shaft 26 until its notch 62*a* is in register with the roller 60*a* of lever 60. When so set, the disk is slipped back against its companion disk 54 and the spacing hook 68 returned to its engagement with shaft 26. The tally wheel is returned to zero, during which movement the roller 60*a* will have moved out of notch 62*a* and will be resting on the edge of cam disk 62. But when the tally wheel has moved forward nine units, then the notch 62*a* will have come into register with roller 60*a*, the latter will drop into the notch and the lever 60 will swing toward shaft 26. As it does so, a rod 66 carried by it will move into the path of bar 34, so that upon the next return stroke of the motion plate the bars 34 and 36 and the pawls 28 and 29 will again be shifted. Consequently, upon the next driving stroke of the motion plate the pawl 29 will actuate ratchet wheel 30 to move the tally wheel from 9 to 8. And so on, until the

unit 0 is again reached. Thereupon, the resulting drop of roller 56a into the notch 54a of cam disk 54 will effect another shifting of the pawls and the count will begin again and go up to 9. Thus it is clear that by setting cam disk 62 with respect to roller 60a, the device can be used to count up to any number from 1 to 9 and then reverse and count down again

The description just given with respect to the unit tally wheel is applicable to the tens tally wheel 69 and the hundreds tally wheel 70, and their associated gears and cam disks. The units tally wheel has a single toothed gear 72 on its side opposite to the ten-toothed gear 46. This meshes with an intermediate gear 74 on the main shaft 10, which in turn meshes both with the ten-tooth gear 76 on the tens tally wheel 69 and with a gear 78 on another cam disk 80 on shaft 26. This cam disk has a companion disk 82, similar in every way to cam disk 62. In like manner gear connections are provided between the tens tally wheel and the hundreds tally wheel 70. This also has its associated cam disks 84 and 86.

On shaft 58 are also pivoted levers 88 and 90 (see Figure 7) which co-operate with cam disks 80 and 84, and levers 92 and 94 which co-operate with cam disks 82 and 86 respectively. Bar 64 extends through the three levers 56, 88 and 90 and bar 66 likewise extends through levers 60, 92 and 94. The latter levers are also rigidly secured together by the bolt 98 and the former levers by bolt 96. Attached to these bolts is a coiled spring 100, which passes around the bearing shaft 26, holding the rollers of the levers against the edges of their respective cam disks and tending always to force them into the notches of these disks. These notches in cam disks 80, 82, 84 and 86 are shown as radial notches having straight sides. Whenever any roller is bottomed in these notches the companion roller (56a or 60a) of the units wheel assembly will be in the corresponding notch (54a or 62a) of the cam disks 54 or 62. Since the latter notches 54a and 62a have diverging sides which act as cam faces to lift their respective levers 56, 60, and since these levers are connected to levers 88, 90 and 92, 94 by the bars 64 and 66 respectively, the notches in the cam disks 80, 82, 84 and 86 need not have tapered sides but may be made with radial sides as shown.

To set the counting device for any desired number, turn the tally wheels until they display this number, and then set the three disks 62, 82 and 86 with their notches in alignment and under the three rollers of levers 60, 92 and 94. The device can then be operated from this number back to zero, or can be set at zero and run up to the desired number.

In either case when the predetermined number of counts has been completed, the device will have reached a zero reading, or the reading of the desired number and then, if nothing more is done, will reverse itself and start the count over again.

There is disclosed herein means whereby the counter may be used, if desired, as a stopping device, but this adaptation is optional and when so adapted the device ceases to function as an automatically reversible counting device. These means comprise an electric switch 102 which is thrown to the "on" or closed position manually and which is released or thrown to the "off" position automatically by the device when a predetermined count has been registered. When the device is acting as a reversible counting device, the switch 102 does not control the operation of the machine whose movements are being counted.

For purposes of illustration the switch 102 shown is the ordinary type of house lighting switch having a slot 102a in its cover plate through which projects an arm 120b that can be thrown from the off to on position and vice versa. As here employed, this switch arm 102b is engaged by a lever arm 104 of yoke shape which is pivoted at 106 and 108 to the casing, there being a trunnion 110 extending outside the casing, carrying a handle 112. A rod 114 is pivotally connected at one end to the lever 104 at 104a and at its other end slides loosely in a hole through the boss 116. Intermediate the boss and a pin 118 projecting through the rod is a coiled spring 119 tending constantly to swing the lever and switch arm to off position.

In the path of movement of lever 104 is a latch 120 which can be temporarily depressed by lever 104, and which then swings upward to engage the lower edge of a slot 104b in the lever 104. This latch 120 is pivoted on a stud 122 that is attached to another latch lever 124 pivotally mounted on bearing shaft 58. This latter lever is constantly urged to swing counterclockwise by a spring 126, clamped to it and passing around bolt 98 and thence into engagement with bar 66. The latch 120 is likewise normally held in the position seen in Figure 3 by another spring 128 which extends from a pin 130 on lever 124 around stud 122 to another pin 132 on the latch 120. This latter pin also rests against latch lever 124, this engagement limiting the upper swing of the latch 120 under the force of spring 128.

Assume the counting device to be set at zero with the switch 102 at off position as seen in Figure 3. The rollers on levers 56, 88 and 90 will then be resting in the notches of cam disks 54, 80 and 84. Handle 112 is then turned to close switch 102 and thereby the circuit, represented by cable 133, which controls the operation of the machine or apparatus whose operations are to be counted by the device. As previously explained, latch 120 yields and then engages lever 104 to hold the switch closed. The first operation of the machine will cause rotation of the cam disks and consequent swinging of levers 56, 88 and 90, downward or clockwise. Bar 64, carried by these levers, engages the forked end 134a of a lever 134 pivoted to an angle plate 136 attached to the base. Between its ends, this lever is pivotally connected to a link 138 which has a slot 138a through which extends the stud 122. As the levers 56, 94 and 92 swing downward, the bar 64 swings lever 134 also downward and as the link 138 and its slot 138a also move downward, spring 126 acting on latch lever 124 causes it to swing counterclockwise and bring its hook end 124a into engagement with the upper edge of slot 104b in the lever arm 104. Of course, the movement of lever 124 toward the slot 104b also swings latch 120 downward out of the slot (because of the engagement between lever 124 and pin 132) but the holding surface of the latch 120 is long enough to maintain contact with the edge of slot 104b until after the latter has become engaged by the hook end 124a. Accordingly the switch will be held in closed position until the device reaches a predetermined number. When this occurs, the notches in cam disks 62, 82 and 86 will all be in register with the rollers on levers 60, 92 and 94, consequently the latter will swing downward and cause the spacing sleeve 139, on bolt 98 between levers 92 and 94, to strike the dog end 124b of latch lever 124 and release the latter from switch lever 104. Spring 119 will then

throw the latter lever and switch to the off position.

Upon again moving handle 112, lever 104 will be first engaged by the latch 120 as before and then as the disks revolve and levers 60, 92 and 94 are raised, latch lever 124 will be swung by spring 126 as before described. During this run of the meter, it is approaching the zero reading and when this is reached the lower group of levers will swing counterclockwise. This movement also lifts lever 134 and, acting through the link 138 and stud 122, again causes release of latch lever 124 with consequent opening of the switch and stoppage of operations. As previously stated, the employment of switch 102 is entirely optional and is to be used only when the device is to operate through a predetermined count. When the device is employed to register repeated counts, the switch 102 and its connections exercise no control on the operations being counted.

If it be desired to announce the completion of a prescribed count, a pair of switch contacts 140—140a can be set so as to be brought into contact by an extension 126a of spring 126 when the lever 124 is released. The closing of such contacts will complete a circuit controlling a suitable signal. It is obvious that the circuit controlled by these contact points might govern a relay which in turn may set in operation various agencies adapted to do several things, such as to make a record of the count, give a signal, etc. etc. It is also within the scope of the invention to utilize the physical movement of the disk levers to operate a purely mechanical signal, if desired.

I claim:

1. A counting device having, in combination, a main shaft adapted to be moved in accordance with the measurement being taken; a series of interconnected tally wheels rotatable in both directions; a single ratchet wheel connected to said series of tally wheels for actuating them; means connecting said main shaft with the ratchet wheel arranged to effect rotation of the latter in either direction in accordance with the movement of the former; and control means actuated by the rotation of said tally wheels and adapted upon the completion of a predetermined tally to shift the said connecting means whereby the direction of rotation of ratchet wheel and said tally wheels is changed without change of movement of the main shaft.

2. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a series of tally interconnected wheels rotatable in both directions for indicating the tally of said cycles completed; a single ratchet wheel connected to said tally wheels and adapted when rotated to effect rotation of the tally wheels; means connecting said shaft and said ratchet wheel comprising pawl and ratchet mechanism adapted when set in one position to transmit the movement of said shaft to cause rotation of the tally wheels in one direction and when set in another position to transmit the movement of said shaft to cause rotation of the tally wheels in the reverse direction; and means actuated by the movement of said tally wheels controlling the position of said pawl and ratchet mechanism and capable, upon the tally wheels reaching a predetermined tally, of altering the position of said mechanism and thereby effecting a change in direction of rotation of said tally wheels.

3. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a tally wheel indicating the tally of said completed cycles; means connecting said shaft and said tally wheel comprising a ratchet wheel and a pair of pawls arranged to engage therewith separately and thereby effect rotation of the tally wheel in different directions; and control means actuated by the rotation of the tally wheel comprising one member adapted to shift its position upon the completion of a predetermined tally in one direction of rotation of said tally wheel and another member similarly shiftable upon the completion of a predetermined tally in the reverse direction of rotation of said tally wheel; and means arranged to engage said members when so shifted and thereby effect withdrawal of one pawl from engagement with the ratchet wheel and simultaneously effect engagement of the other pawl therewith, thereby causing the tally wheel to count from one predetermined tally to the other predetermined tally and then back again successively.

4. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a tally wheel for indicating the tally of said cycles completed; a ratchet wheel attached to said tally wheel; a motion plate having operative connection with said shaft whereby the rotative movement of the latter is transformed into reciprocative movement of the plate; a pair of pawls carried by said plate and adapted to engage said ratchet wheel and thereby effect actuation of the tally wheel; and pawl control means also carried by said plate for holding one pawl out of engagement with the ratchet while the other is engaged therewith; and control means operatively connected with the tally wheel comprising members adapted upon the completion of a predetermined tally to move into the path of said means controlling the respective positions of the pawls, whereby upon engagement of said members and the last said means, the positions of the pawls are altered and the tally wheel is actuated in direction opposite to that in which it rotated prior to said engagement of the members and the pawl control means.

5. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a tally wheel for indicating the tally of said cycles completed; means connecting the two capable of effecting rotation of the tally wheel in either direction in accordance with the cyclic movements of said shaft; and means controlling said connecting means comprising a cam disk, a lever arranged to engage said disk and move in accordance with the cam edge thereof; there being an operative connection between the said lever and the said connecting means whereby upon movement of the lever the said connecting means are shifted to effect change of direction of rotation of the tally wheel.

6. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a tally wheel for indicating the tally of said cycles completed; means connecting the two capable of effecting rotation of the tally wheel in either direction in accordance with the cyclic movements of said shaft; and means controlling said connecting means comprising a pair of disks having cam edges with a notch therein; a pair of levers, each adapted to engage one of said disks and to move in accordance with its cam edge; an operative connection between said shaft and said disks whereby the rotation of the latter is in

predetermined relation with the rotation of the tally wheel; and means actuated by the movement of either lever upon engaging its respective notch of the disk to alter the connection means between said shaft and said tally wheel whereby the direction of rotation of the latter is changed.

7. A counting device having, in combination, a shaft adapted to be moved repeatedly through the same cycle of movements; a series of interconnected tally wheels for indicating the tally of said cycles completed; means for transmitting the movement of said shaft to said tally wheels and adapted to effect rotation of the latter in either direction in accordance with the cyclic movements of said shaft; a series of cam disks rotatable in synchronism with said tally wheels, there being a pair of said disks associated with each tally wheel; a notch in each disk so disposed that when the tally wheels all indicate a predetermined number, the notches of one of the disks in each pair are in the same angular relation; the other disks of the said pairs being adjustable whereby their respective notches can be set in the same angular relation to correspond with any other predetermined tally; and means engaging said cam disks and moving in accordance with the notches thereof, capable of controlling the transmitting means between the shaft and the tally wheels whereby, upon the said wheels reaching either predetermined tally, the rotation thereof will be reversed.

8. A counting device for counting between two predetermined numbers, comprising in combination, an operating shaft movable in accordance with the unit being counted; indicating means comprising a series of interconnected tally wheels rotatable in both directions means transmitting the movements of said shaft to said indicating means; and control means actuated by said indicating means and adapted to respond when one of said predetermined numbers is reached and thereby alter said transmitting means so as to cause the indicating means to operate in the opposite direction toward the other predetermined number.

9. A counting device for making a predetermined count in opposite directions; comprising, in combination, an operating shaft; means for indicating the units of each count comprising a series of interconnected tally wheels; means connecting said shaft and said indicating means and adapted to actuate the indicating means in either direction; and means for controlling the count having operative connection with the indicating means and being responsive thereto so that upon the completion of a predetermined count in one direction the said control means alter the relation of the said connecting means, thereby causing the latter to actuate the indicating means in the reverse direction.

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