

[54] **INTERGRATING COUNTER**

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[51] Int. Cl. **G06m 1/04**

[58] Field of Search..... 235/92 C, 92 EL, 136

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ABSTRACT

In an integral counter having a drive motor rotating each time it receives a pulse from a meter, digit wheels adapted to be rotated by the drive motor and sensing means generating output signals in accordance with the degree of angular rotation of each digit wheel, first and second rotating means and energy storing means therebetween are provided. The energy storing means have a spring adapted to store the energy of rotation of the first rotating means. control means are provided so as to case the second rotating means to rotate instantaneously to the action of the spring, the rotation of the second rotating means being transmitted to the digit wheels.

7 Claims, 12 Drawing Figures

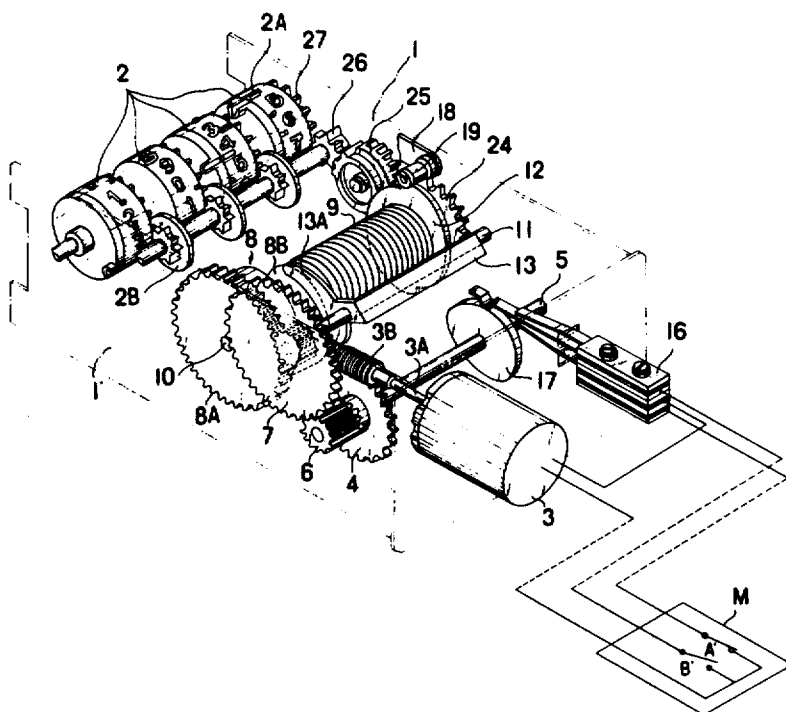


FIG. 1

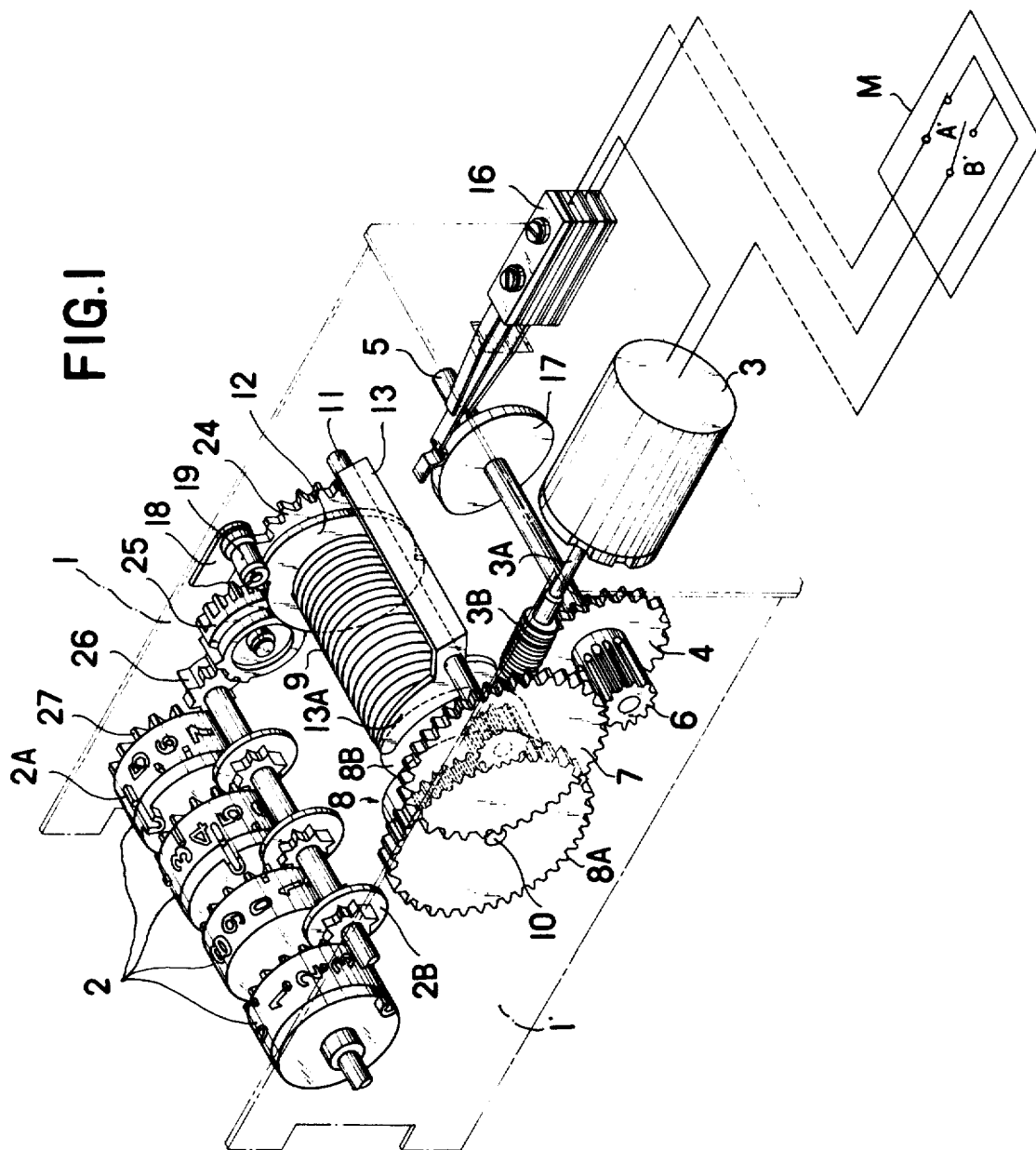


FIG.2

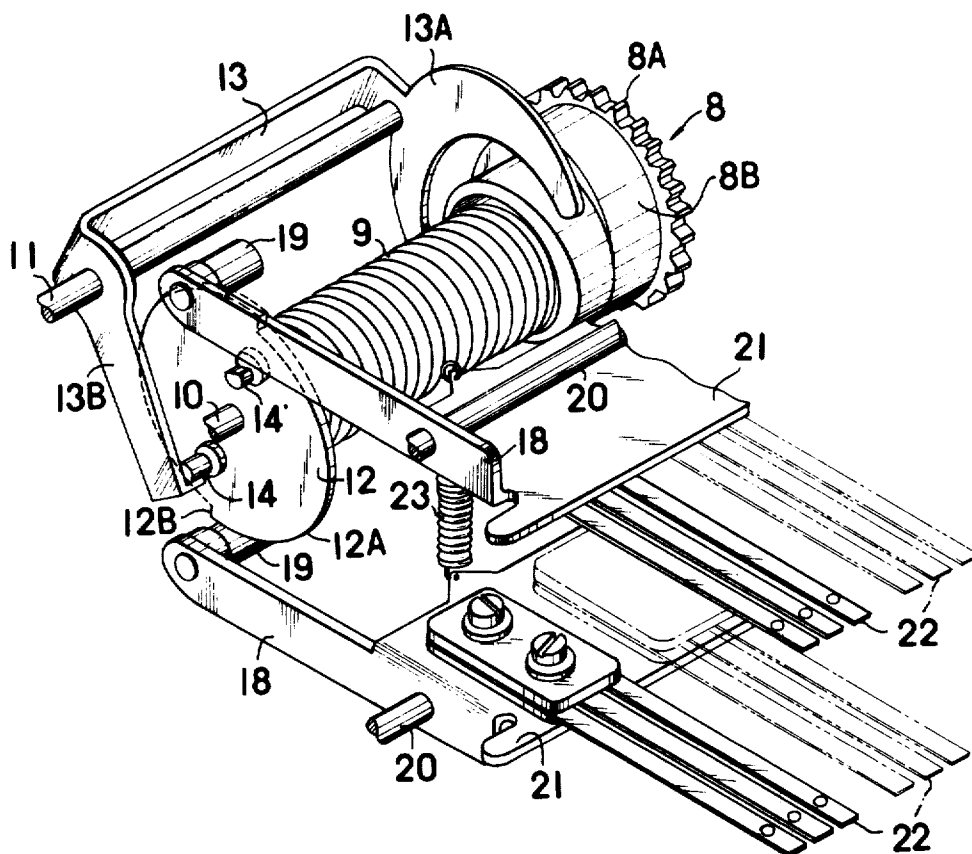


FIG.3

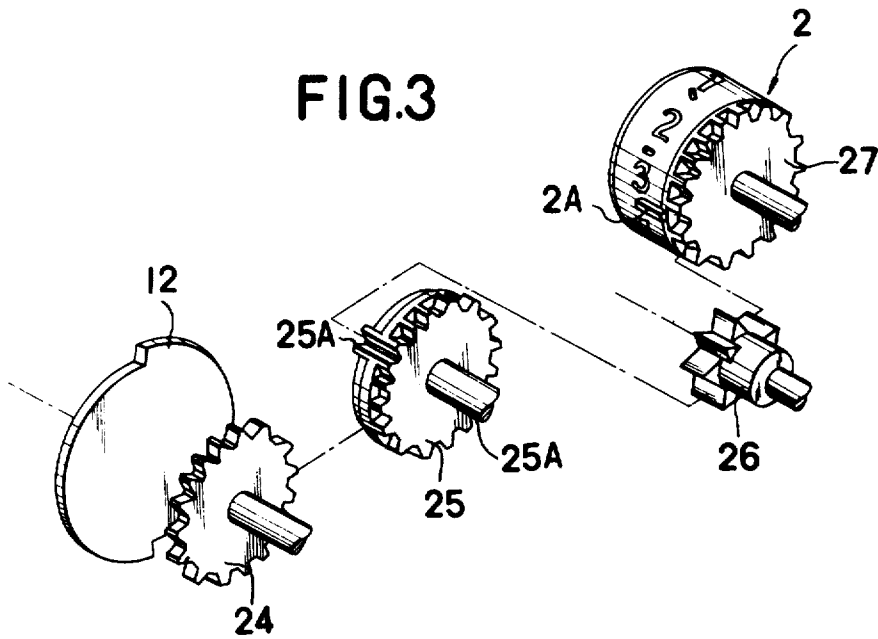


FIG.4

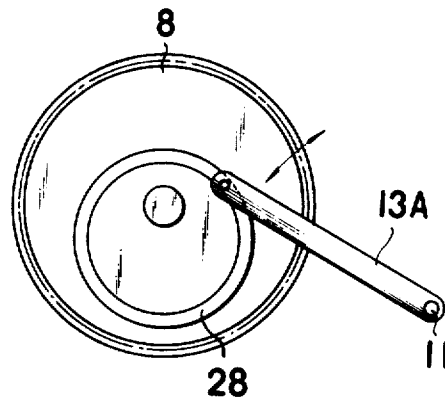


FIG.5

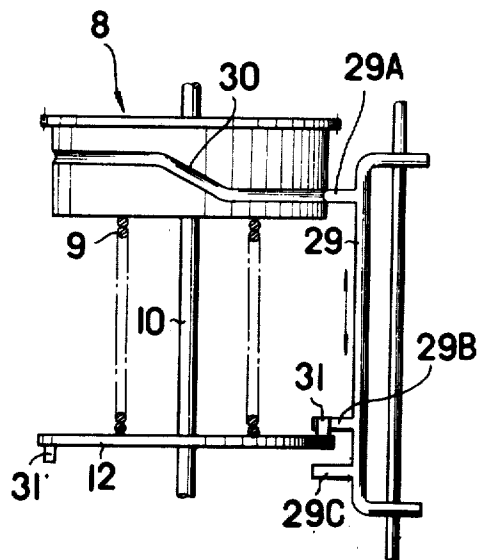


FIG.6

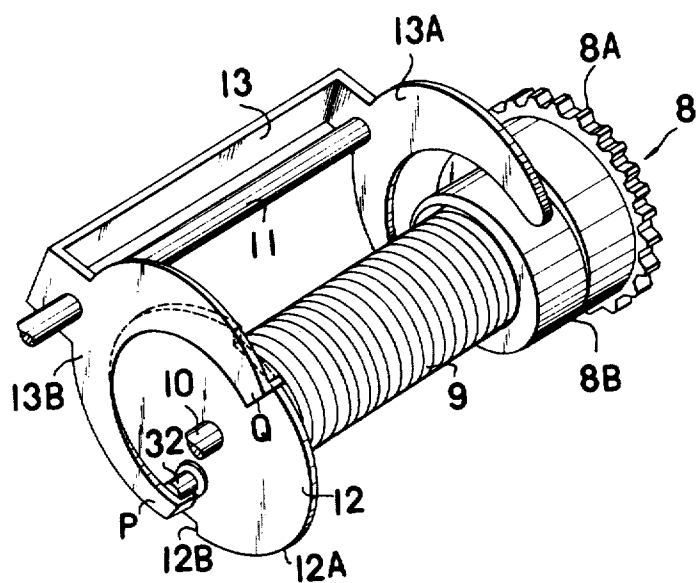


FIG. 7

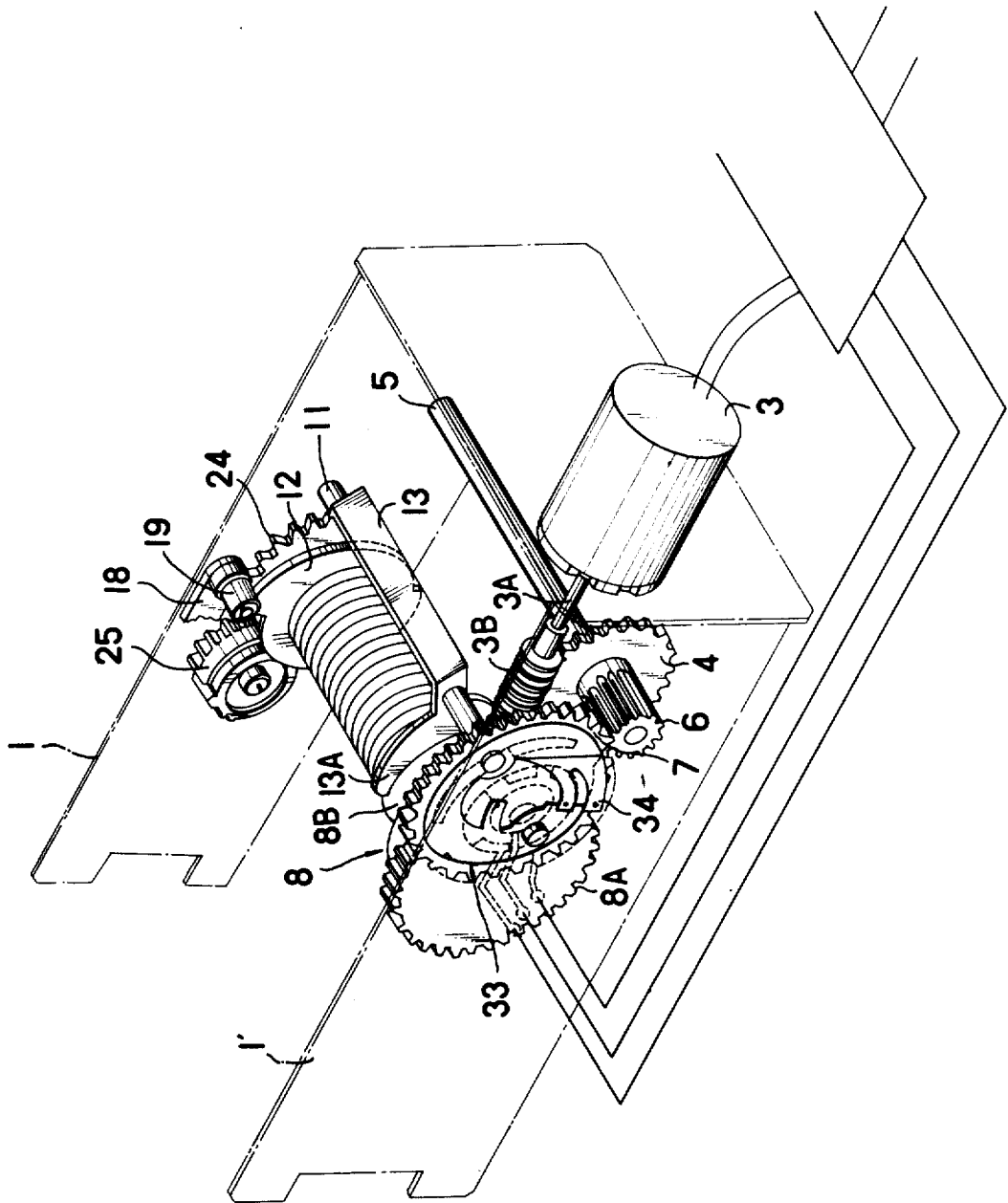


FIG.8

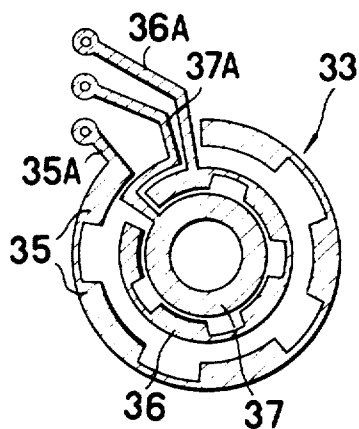


FIG.9

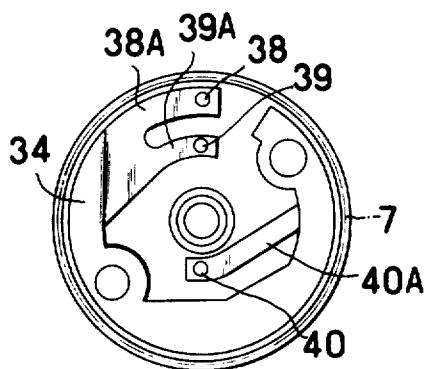


FIG.10

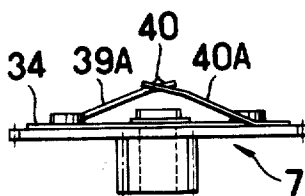


FIG. 11

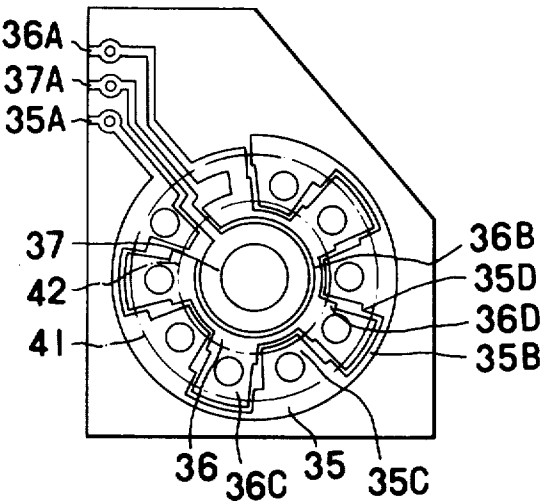
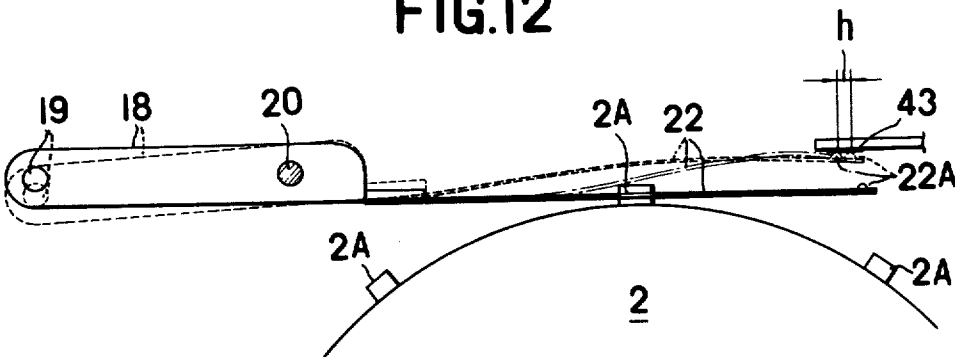


FIG. 12



INTERGRATING COUNTER

BACKGROUND AND SUMMARY OF THE INVENTION

This invention relates to a counter for indicating the time integration of the consumption of electric power or the quantity of fluid, such as gas, running water or the like.

Several proposals have been made to provide improvements in the counter of the character described wherein the value registered in a meter counter is read and the read value is manually entered in a specified form by an inspector at predetermined time intervals. In the proposed systems, attempts are made to operatively connect the counter to a data collector or use a telemeter to ensure that read-out and recording of the value indicated by the counter is carried out readily and positively and in a manner such that the recorded value can be taped readily for use with a computer.

The most advantageous apparatus of one of proposed systems comprises a predetermined number of digit wheels provided with coded elements on its periphery representing numerals for indicating the quantity of flow, for example means including members each provided for one of the rows of the coded elements on the periphery of the digit wheels for sensing the presence or absence of the coded elements, contacts attached to the sensing means and connected to outside for producing binary coded decimal output signals, and a motor adapted to rotate through a predetermined angle upon receipt of a pulse from a meter for driving the digit wheels.

In the apparatus described above, energy is stored each time the motor makes an angular rotation and is released when the stored energy reaches a predetermined level, so as to drive the digit wheels by the stored energy, whereby it is possible to have the digit to indicate the value in a digital system.

Some disadvantages are associated with energy storing means used in the aforementioned apparatus. It is complex in construction and entails a number of parts, and consequently it is high in cost and yet lacks reliability in performance.

Accordingly, this invention has as its object the provision a novel integrating counter which obviates the aforementioned disadvantages of the prior art.

According to the invention, there is provided an integrated counter comprising drive means adapted to be actuated by electric signals from a meter, digit wheel means comprising a predetermined number of digit wheels adapted to be driven by the drive means, first rotating means adapted to be angularly rotated by the drive means, second rotating means adapted to be rotated intermittently, energy storing means comprising a spring connecting the two rotating means and adapted to store the energy of rotation of the first rotating means, sensing means adapted to generate output signals in accord with the degree of angular rotation of each digit wheel, and control means adapted to release the second rotating means and cause the same to rotate instantaneously by the action of the spring when the first rotating means has been rotated through a predetermined angle.

The integrating counter according to the invention offers many advantages over the prior art. It requires less energy to operate and yet has a higher mechanical

efficiency than conventional counters of the same type. It has a smaller number of sliding parts and springs and its construction is simpler than the prior art, so that cost is lower and service life is longer.

Additional and other objects as well as features and advantages of the invention will become evident from the description set forth hereinafter when considered in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of the integrating counter according to the invention;

FIG. 2 is a perspective view of essential portions of the counter shown in FIG. 1;

FIG. 3 is an exploded perspective view of the gear train interposed between the second rotating means and the digit wheels;

FIG. 4 is a schematic view of a modification of a control lever drive mechanism;

FIG. 5 and FIG. 6 are views in explanation of other modifications of the control lever drive mechanism;

FIG. 7 is a perspective view of an integrating counter comprising another embodiment of the invention;

FIG. 8 is a plan view of a printed contact portion used in the counter shown in FIG. 7;

FIG. 9 and FIG. 10 are a plan view and a side view respectively of a movable contact portion adapted to cooperate with the printed contact portion shown in FIG. 8;

FIG. 11 is a plan view of a modification of the printed contact portion shown in FIG. 8; and

FIG. 12 is a view in explanation of the manner in which the contact bars are in engagement with the contacts.

DETAILED DESCRIPTION

In FIG. 1, four digit wheels 2 are shown as being rotatably mounted on a common shaft supported at opposite ends by two parallel side plates 1 and 1'. Digit wheels 2 are each formed on its periphery with coded elements 2A so as to indicate a digit on the wheel in code, and coupled to one another by a tens-transfer wheel 2B as is well known.

A motor 3 adapted to rotate through a predetermined angle each time it receives a pulse generated by pulse generating means A', B' of a meter M for a predetermined quantity of flow, for example, is mounted in the machine frame consisting of the two side plates 1 and 1'. Motor 3 has a motor shaft 3A whose rotation is transmitted, through a worm 3B secured to motor shaft 3A, a worm wheel 4 maintained in meshing engagement with worm 3B, a shaft 5 which worm wheel 4 is secured, a pinion 6 secured to shaft 5 and a stepped gear 7 rotatably supported by a shaft 11, to an energy storing means 8 which comprises a gear 8A in meshing engagement with a pinion of stepped gear 7, and a cam portion 8B integral with gear 8A, and a spring 9 connected at one end to gear 8A and at the other end to a cam plate 12 also rotatably mounted on shaft 10.

A control lever 13 in the shape of  is pivotally connected to shaft 11 and has one arm 13A which is forked to hold the cam portion 8B of energy storing means 8 between its forks and the other arm 13B which is disposed such that it engages and locks one of pins 14 and 14' connected to a cam plate 12 and disposed in positions diametrically opposed and differing in distance from shaft 10 as shown in FIG. 2. By this arrangement, cam plate 12 is prevented from rotating even if rotation

is transmitted thereto through spring 9 from gear 8 and the energy of rotation is stored in spring 9 as it is charged.

Cam plate 12 is formed at its edge with protrusions 12A at which it gradually increases in diameter and valleys 12B in which the diameter sharply decreases from an adjacent maximum diameter portion. There are two protrusions 12A and two valleys 12B disposed in diametrically opposed positions with respect to shaft 10.

16 is a switch for causing motor 3 to stop rotating after it has rotated through a predetermined angle upon receipt of a pulse generated by pulse generating means A', B' of meter M each time the quantity of flow reached a predetermined level. The switch 16 is controlled by a cam 17 secured to shaft 5.

In FIG. 2, two follower pins 19 connected to two arms 18 respectively are shown as being in contact with the periphery of cam plate 12, the follower pins 19 being disposed in diametrically opposed positions and adapted to be actuated simultaneously by one protrusion 12A and one valley 12B of cam plate 12.

Each arm 18 is secured to one of two lever plates 21 each pivotally connected to a shaft 20. Each lever plate 21 has secured thereto contact levers 22 each for one of the rows of control elements 2A disposed on the periphery of each digit wheel 2. The two control elements disposed in diametrically opposed positions on the periphery of each digit wheel 2 are simultaneously sensed by contact levers 22, and a numeral is represented by the combination of the six code bits. The two lever plates 21 are connected to each other by a spring 23 so that the follower pins 19 thereof may be maintained in pressing engagement with the periphery of cam plate 12. A gear 24 secured to cam plate 12 is connected, through an intermediate gear 25 and a wheel 26, to a gear 27 for the digit wheel 2 for digits in the lowest position of a decimal numeral.

The aforementioned mechanism operates as follows: Cam plate 12 shown in FIG. 2 is maintained stationary by the arm 13B of control lever 13 being locked by one of pins 14 and 14' or pin 14, for example. Contact levers 22 are normally maintained in engagement with the peripheries of digit wheels 2. Motor 3 shown in FIG. 1 angularly rotates each time it receives a pulse from meter M and the rotation is transmitted, through worm 3B, worm wheel 4, pinion 6 and stepped gear 7, to the gear 8A of energy storing means 8. Shaft 5 rotates as worm wheel 4 and pinion 6 rotate, so that switch 16 is actuated by the cam 17 secured to shaft 5 after motor 3 has rotated through a predetermined angle to thereby stop motor 3.

Rotation of gear 8A results in cam portion 8B rotating therewith, so that control lever 13 is slightly pivoted about shaft 11 through arm 13A. However, arm 13B is still in locking engagement with pin 14, so that cam plate 12 is prevented from rotating and the energy of rotation of gear 8A is stored in spring 9 and charges the same.

After a predetermined number of pulses have been sent to motor 3, the cam portion 8B of energy storing means 8 rotates through 180° and the arm 13B of control lever 13 is brought to a position in which it is released from locking engagement with pin 14. Thus, cam plate 12 is released from locking engagement with arm 13B and rendered to free to rotate quickly by the action of spring 9. At this time arm 13B is released from locking engagement with pin 14 but immediately

brought into locking engagement with pin 14' which is disposed in a position diametrically opposed to that of pin 14 and slightly differing in distance from shaft 10. Cam plate 12 stops rotating after rotating through 180° when arm 13B is brought into locking engagement with pin 14'.

When cam plate 12 rotates, the follower pins 19 secured to arm 18 are brought into engagement with the valleys 12B at the periphery of cam plate 12, so that the two lever plates 21 are urged by the biasing force of spring 23 to rotate about the respective shafts 20 and contact levers 22 are brought out of engagement with the peripheries of digit wheels 2. At this time, rotation of cam plate 12 is transmitted, through gears 24, 25, 26 and 27, to the digit wheel 2 for the digits in the lowest position. Contact levers 22 are thus momentarily released from engagement with the digit wheel when the latter rotates, so that little resistance is offered to the rotation of the digit wheel.

Upon completion of rotation of digit wheel 2, the pin 14' on cam plate 12 is brought into locking engagement with arm 13B and cam plate 12 stops rotating. By this time, follower pins 19 have been brought into engagement with the protrusions 12A at the periphery of cam plate 12 again, so that contact levers 22 are brought into engagement with the peripheries of digit wheels 2 again. As aforementioned, contact levers 22 are maintained in engagement with the peripheries of digit wheels 2 almost all the time except for a short interval of time in which digit wheel or digit wheels 2 are rotated. This permits read-out of the value to be made possible at all times.

Further angular rotation of motor 3 is stored in spring 9 to charge the same. When the arm 13B of control lever 13 is released from engagement with pin 14' on cam plate 12 after control lever 13 is pivoted about shaft 11, cam plate 12 is suddenly brought to a rotation again. Arm 13B is in a position in which it engages pin 14 at this time, so that cam plate 12 stops rotating when arm 13B is brought into locking engagement with pin 14 following the rotation of cam plate 12 through 180°.

FIG. 3 shows cam plate 12 in an exploded perspective view which is rotated intermittently by energy storing means 8 through 180° as aforementioned. The gear 24 integral with cam plate 12 is maintained in meshing engagement with intermediate gear 25 formed on its periphery with smaller width teeth along its entire extent, so that intermediate gear 25 also rotates intermittently through 180°. Intermediate gear 25 is also formed on its periphery with a plurality of sets of larger width teeth in positions which are disposed diametrically opposed to each other. Wheel 26 is formed on its periphery with alternately disposed larger width and smaller width teeth, the smaller width teeth being maintained in meshing engagement with the teeth of gear 27 secured to the digit wheel 2 for digits in the lowest position of a numeral and the larger width teeth being maintained in meshing engagement with the two sets of larger width teeth 25A on intermediate gear 25. Thus, the wheel 26 is advanced a distance corresponding to one pitch between the adjacent two larger width teeth each time intermediate gear 25 makes one-half revolution (180°), and the rotation of wheel 26 is transmitted to gear 27 through the smaller width teeth on wheel 26 so as to rotate digit wheel 2. The rotation of wheel 26 for a distance corresponding to one pitch between the adjacent two larger width teeth corresponds to the ro-

tation of digit wheel 2 for a distance between the two coded symbols, so that one-half revolution of cam plate 12 advances digit wheel 2 a distance between the two coded symbols. The use of gears for transmitting rotation from cam plate 12 to digit wheel 2 ensures that the angular rotation of cam plate 12 taking place instantaneously is transmitted positively and smoothly to digit wheel 2, and this feature is advantageous in transmitting the rotation of cam plate 12 at high speed.

FIG. 4 shows a modification of the control lever drive mechanism in which an eccentric cam groove 28 is provided in energy storing means 8 and the arm 13A (not forked) of control lever 13 is maintained in engagement in groove 28 in place of providing cam portion 8B for energy storing means 8 and forked arm 13A for holding the same. Also, a control slider 29 formed with projections 29A, 29B and 29C may be used in place of control lever 13 as shown in FIG. 5, with one projection 29A being maintained in engagement in a groove 30 formed in the periphery of energy storing means 8 and the other two projections 29B and 29C being disposed such that cam plate 12 is held therebetween. When this is the case, pins 31 and 31' are connected to opposite side surfaces of cam plate 12 and extends in opposite directions. When disposed in the indicated position, control slider 29 moves upwardly as energy storing means 8 makes one-half revolution, and projection 29B is released from engagement pin 31 and projection 29C is brought into engagement with pin 31'. Thus, cam plate 12 stops after making one-half revolution (180°).

FIG. 6 shows another modification of the control lever drive mechanism in which the arm 13B of control lever 13 shown in FIG. 2 is modified such that it is similar to the forked arm 13A engaging cam portion 8B in being forked in shape and having arm ends P and Q. Cam plate 12 is provided with a single pin 32 in addition to contact bar control protuberances 12a and valleys 12b. Either one of arm ends P and Q is maintained in engagement with pin 32 at all times. When arm 13A and hence arm 13B is pivoted by the rotating cam portion 8B of energy storing means 8, arm end P maintained in engagement with pin 32, for example, is released from engagement with pin 32 and permits cam 12 to rotate instantaneously as aforementioned. As soon as cam 12 rotates, the other arm end Q disposed in the path of rotation of pin 32 is engaged thereby, thus stopping cam 12 after it has made one-half revolution. In the embodiment shown, a control projection may be provided in a cam secured to cam plate 12 in place of the pin 32 connected to cam 12.

FIG. 7 shows another embodiment of the invention in which motor 3 is controlled by a printed rotary switch in place of switch 16 and cam 17 shown in FIG. 1. In FIG. 7, 33 is a triple ring printed contact portion provided on side plate 1', and 34 a movable contact portion provided on one side of stepped gear 7 for rotation therewith, printed contact portion 33 and movable contact portion constituting a printed rotary switch.

In FIG. 8, printed contact portion 33 is shown as comprising a plurality of outer contacts 35 and a plurality of inner contacts 36 arranged in two rings, and a single ring-shaped common contact 37 disposed in the inner ring for inner contacts 35. The group of outer contacts 35 and the group of inner contacts 36 are identical in number and spaced apart equidistantly from one another in the respective rings, with contacts belonging to the same contact group being electrically

connected to one another. Contacts of the outer and inner group are arranged such that they are not aligned radially of each other but opposite end portions of outer and inner contacts overlap one another radially.

In FIG. 9 and FIG. 10, three contacts 38, 39 and 40 are provided in movable contact portion 34 and disposed on the same diameter of stepped gear 7. As shown in FIG. 10, contacts 38, 39 and 40 are carried by resilient supports 38A, 39A and 40A respectively projecting outwardly of contact portion 34. When stepped gear 7 rotates, contact 38 slides along the outer contact group 35 of printed contact portion 33, contact 39 along the inner contact group 36 thereof and contact 40 along common contact 37. Thus, contact 40 is maintained in engagement with common contact 37 at all times and contacts 38 and 39 alternately come into engagement with contacts 35 and 36 when stepped gear 7 rotates. However, contacts 38 and 39 are at the same time in engagement with contacts 35 and 36 at end portions of contacts 35 and 36.

When stepped gear 7 rotates, the movable contact portion provided thereon also rotates. If the contact 38 of movable contact portion 34 is in engagement with one of the group of outer contacts 35 and contact 39 is out of engagement with any of the inner contacts 36 at this time, motor 3 will rotate when contact 38 is maintained in engagement with one contact 35 and stop rotating when contact 38 is out of engagement with the contact 35. Since end portions of contacts 35 and 36 overlap one another radially, contact 39 is maintained in engagement with one of contacts 36 when contact 38 is out of engagement with the contact 35 to be readily for receiving the next following pulse transmitted from the meter. This eliminates the unstable condition of both contacts 38 and 39 being out of engagement with contacts 35 and 36. This is also the case when motor 3 rotates through a predetermined angle upon receipt of the next following pulse and contact 39 is brought out of engagement with the contact 36.

In the embodiment just described, a printed rotary contact mechanism is used with a change-over switch of the transfer type in place of a combination of a cam and contacts of the leaf type. This eliminates the need to assemble and adjust parts for the contact mechanism and ensure that the change-over switch of the transfer type functions positively. This is also effective to prevent the phenomenon of chattering from taking place when the level of supplied voltage is reduced. Also, the absence of a cam is conducive to elimination of variations in the load and balancing of the torque. There is a sufficiently high pressure available in the contacts.

Slide contacts 38, 39 and 40 may be staggered with one another with respect to the diametrical extent of gear 7 without being placed on the same diameter as shown. This eliminates the need to arrange contacts 35 and 36 to be disposed such that their end portions radially overlap one another to ensure that either slide contact 38 or 39 is maintained in engagement with any one of contacts 35 and 36.

FIG. 11 shows a modification of the printed contact portion in which dash-and-dot lines 41 and 42 indicate the path of movements of movable contacts 38 and 39 respectively. In the path of movement 41 of movable contact 38, outer contacts 35 are disposed equidistantly from one another and inner contacts 36 each extend radially outwardly between two adjacent outer

contacts. Thus, insulating resin portions of a printed contact board 43 are each interposed, with a small margin, between outer contacts 35 and extensions 36C of inner contact disposed therebetween along path of movement 41. This is also the case with the path of movement of movable contact 39, in which extensions 35C of outer contacts 35 each extend radially inwardly between two adjacent inner contacts 36, and insulating resin portions are each interposed, with a small margin, between inner contacts 36 and extensions 35C. As a result, movable contacts 38 and 39 only slide along the printed contact portions and rarely slide along the resin portions, so that production of waste material due to wear of the resin and consequently soiling of the contacts thereby can be minimized.

The outer and inner contacts are constructed such that they each have side edge portions 35D and 36D which overlap radially. This arrangement is effective to prevent the occurrence of an unstable state in which both movable contacts 38 and 39 are out of engagement with the outer and inner contacts.

In FIG. 12, when follower pin 19 is brought into engagement with one of the valleys 12 at the periphery of cam plate 12, a movable contact 22A of contact bar 22 is brought into engagement with a fixed contact 43 as shown in broken lines. As cam plate 12 rotates, follower pin 19 moves from this position and reaches one of the protuberances at the periphery of cam plate 12. If there is no control element 2A on the corresponding periphery portion of digit wheel 2, then contact bar 22 is brought to a solid line position at this time, so that movable contact 22A is spaced apart from fixed contact 43. If there is a control element 2A on the corresponding periphery portion of digit wheel 2, then contact bar 22 is brought to a dash-and-dot line position, so that movable contact 22A is in engagement with fixed contact 43. It is to be noted that the position in which movable contact 22A is in engagement with fixed contact 43 when contact bar 22 is in the broken line position is displaced from the position in which movable contact 22A is in engagement with fixed contact 43 when contact bar 22 is in the dash-and-dot line position. That is, the point of contact between the two contacts shifts, and a wiping action is performed at this time. The wiping action is effective to remove a coat of oxide or sulfide from the contacts and prevent dust from being piled thereon, thereby providing for achieving good engagement between the contacts.

In the present invention, a solenoid may be used, in place of motor 3 rotating angularly through a predetermined angle for each pulse, for rotating the first rotating means each time a pulse is received from the meter.

What I claim is:

1. An integrating counter comprising drive means adapted to be actuated by electric signals from a meter, digit wheel means comprising a predetermined number of digit wheels adapted to be driven by said drive means and including a lowest order digit wheel, first rotating means adapted to be angularly rotated by said drive means, second rotating means adapted to be rotated intermittently, energy storing means comprising a spring connecting said two rotating means and adapted to store the energy of rotation of the first rotating means, sensing means adapted to generate output signals in accord with the degree of angular rotation of each digit wheel, and control means adapted to release the second rotating means and cause the same to rotate

instantaneously by the action of the spring when the first rotating means has been rotated through a predetermined angle and means connecting the lowest order digit wheel to the second rotating means for concurrent instantaneous rotation therewith upon the release of said second rotating means.

2. An integrating counter comprising drive means adapted to be actuated by electric signals from a meter, digit wheel means comprising a predetermined number of digit wheels adapted to be driven by said drive means, first rotating means adapted to be angularly rotated by said drive means, second rotating means adapted to be rotated intermittently, energy storing means comprising a spring connecting said two rotating means and adapted to store the energy of rotation of the first rotating means, sensing means adapted to generate output signals in accord with the degree of angular rotation of each digit wheel, and control means adapted to release the second rotating means and cause the same to rotate instantaneously by the action of the spring when the first rotating means has been rotated through a predetermined angle, wherein said drive means adapted to be actuated by electric signals from a meter is a motor adapted to be rotated through a predetermined angle through a change-over switch of the transfer type, said change-over switch of the transfer type is a printed rotary switch comprising a movable contact portion provided in a part rotating with said motor and a printed contact portion provided in a fixed portion, said printed contact portion comprising a common contact and a plurality of contact groups each comprising a number of contacts arranged annularly, the contacts of said contact groups being electrically connected to one another, said movable contact portion comprising a plurality of movable contacts adapted to be alternately brought into engagement with said contacts of said printed contact portion, said movable contacts corresponding to the contact groups each being brought into engagement at end portions with the adjacent contacts of the contact groups of the printed contact portion.

3. An integral counter comprising drive means adapted to be actuated by electrical signals from a meter, digit wheel means comprising a predetermined number of digit wheels adapted to be driven by said drive means, first rotating means adapted to be angularly rotated by said drive means, second rotating means adapted to be rotated intermittently, energy storing means comprising a spring connecting said two rotating means and adapted to store the energy of rotation of the first rotating means, sensing means adapted to generate output signals in accord with the degree of angular rotation of each digit wheel, control means adapted to release the second rotating means and to cause the same to rotate instantaneously by the action of the spring when the first rotating means has been rotated through a predetermined angle, a gear train including a worm and a worm wheel and interposed between said drive means and said first rotating means for transmitting the rotation of the drive means to the first rotating means, a cam portion provided in the first rotating means, a control lever adapted to engage said cam portion to be controlled thereby, a cam plate provided in said second rotating means, a plurality of engaging elements provided in said cam plate and adapted to engage said control lever for causing the cam plate to rotate intermittently and to stop rotating,

control elements on the periphery of said digit wheels, and a plurality of lever plates adapted to engage cam portions of said cam plate and carrying contact levers engageable with said control elements on the periphery of the digit wheel, said lever plate being pivoted by said cam portions to release the contact levers from engagement with the digit wheels when said second rotating means rotates instantaneously and to bring the contact levers into engagement with said digit wheels when the instantaneous rotation of the second rotating means finishes.

4. An integral counter comprising drive means adapted to be actuated by electric signals from a meter, digit wheel means comprising a predetermined number of digit wheels adapted to be driven by said drive means, first rotating means adapted to be angularly rotated by said drive means, second rotating means adapted to be rotated intermittently, energy storing means comprising a spring connecting said two rotating means and adapted to store the energy of rotation of the first rotating means, sensing means adapted to generate output signals in accord with the degree of angular rotation of each digit wheel, control means adapted to release the second rotating means and to cause the same to rotate instantaneously by the action of the spring when the first rotating means has been rotated through a predetermined angle, wherein said drive means is a motor adapted to be rotated through a predetermined angle through a change-over switch of the transfer type, said change-over switch comprising a printed rotary switch comprising a moveable contact portion provided in a part rotating with said motor and a printed contact portion provided in a fixed portion, said printed contact portion comprising a common contact and a plurality of contact groups each comprising a number of adjacent contacts, the contacts of said contact groups being electrically connected to one another, said moveable contact portion comprising a plurality of moveable contacts adapted to be alternately brought into engagement with said contacts of said printed contact portion, said moveable contacts corresponding to the contact groups each being brought into engagement at end portions with the adjacent contacts of the contact groups of the printed contact portion, wherein said printed contact portion comprises a group of outer contacts arranged in ring shape and electrically connected to one another, a group of inner contacts arranged in ring shape and electrically connected to each other, and an innermost ring-shaped common contact and said moveable contact portion

comprises a plurality of moveable contact each adapted to be brought into engagement with the contacts of one of said two groups and said common contacts, the contacts of the outer group extending between the contacts of the inner group and the contacts of the inner group extending between the contacts of the outer group to be disposed over insulating portions of the printed contact portion so that insulating portions disposed between the contacts along the paths of movement of the moveable contacts along the ring-shaped outer and inner contacts are minimized.

5. A counter comprising drive means actuated by electrical signals from a meter, first rotating means rotated by the drive means, second rotating means, energy storing means connected to said rotating means to store the energy of rotation of the first rotating means for a period corresponding to a predetermined angle of rotation of the first rotating means, control means acting at the end of said period to transfer the stored energy to the second rotating means to cause said second rotating means to instantaneously rotate through a predetermined angle, a plurality of digit wheels and means connecting said second rotating means with at least one of said digit wheels to cause said at least one digit wheel to rotate through a predetermined angle in response to each instantaneous rotation of the second rotating means, each of said digit wheels including a plurality of control elements around its periphery, a plurality of lever plates carrying contact levers engageable with said control elements on the digit wheels, and cam means connecting the second rotating means and the lever plates to release the contact levers from engagement with the digit wheels when said second rotating means rotates instantaneously and to bring the contact levers into engagement with the digit wheels when the instantaneous rotation of the second rotating means stops.

6. A counter as in claim 5 wherein said first rotating means includes a cam driven by said drive means and said second rotating means includes a cam plate driven intermittently through a predetermined angle of rotation in response to the rotation of the first rotating means through a predetermined angle of rotation.

7. A counter as in claim 5 wherein the control elements on the digit wheels comprise a plurality of coding elements extending radially outwardly from the circumference of each digit wheel and engageable by said contact levers.

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