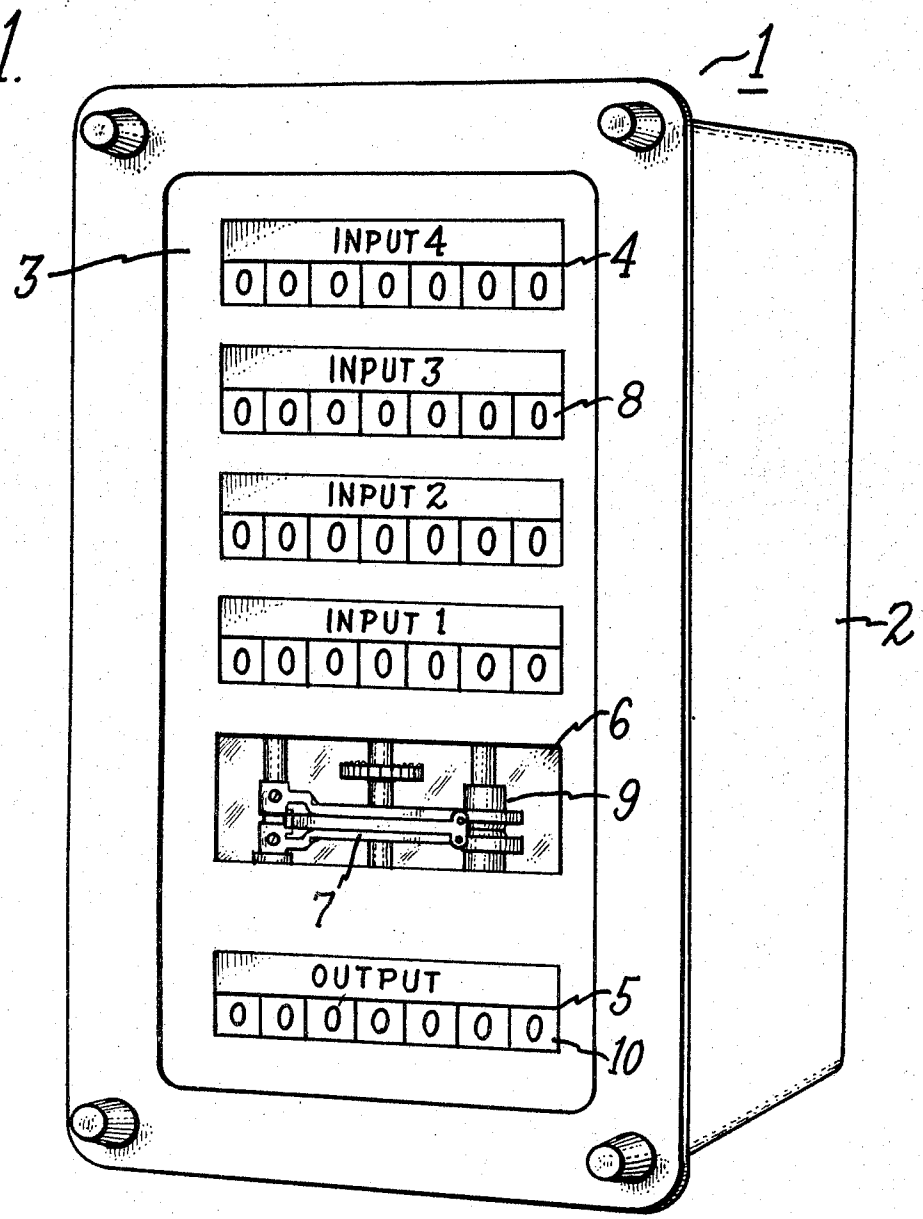
March 25, 1969 D. M. HAM ET AL 3,434,659

TAKE-UP TOTALIZING RELAY

Filed Jan. 30, 1967 Sheet 1 of 8

Fig. 1.



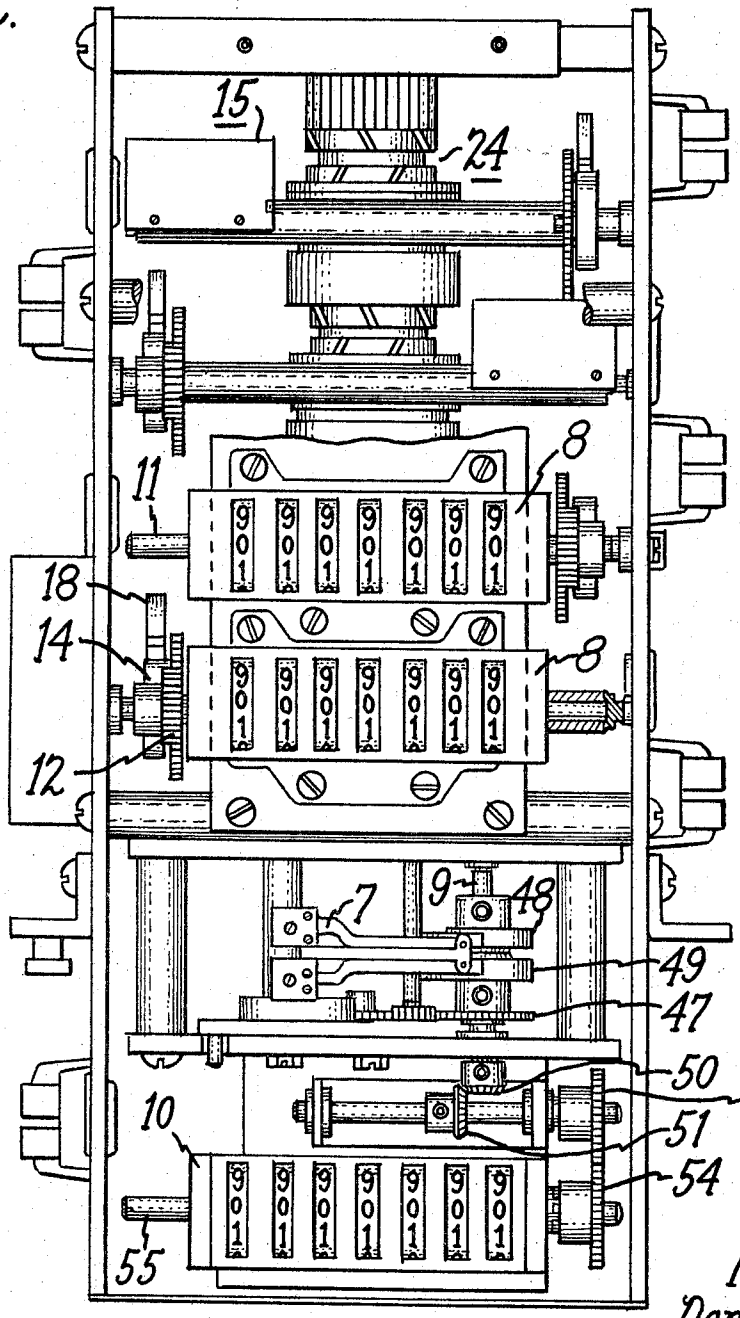
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TAKE-UP TOTALIZING RELAY

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Fig. 2.



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TAKE-UP TOTALIZING RELAY

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Fig. 3.

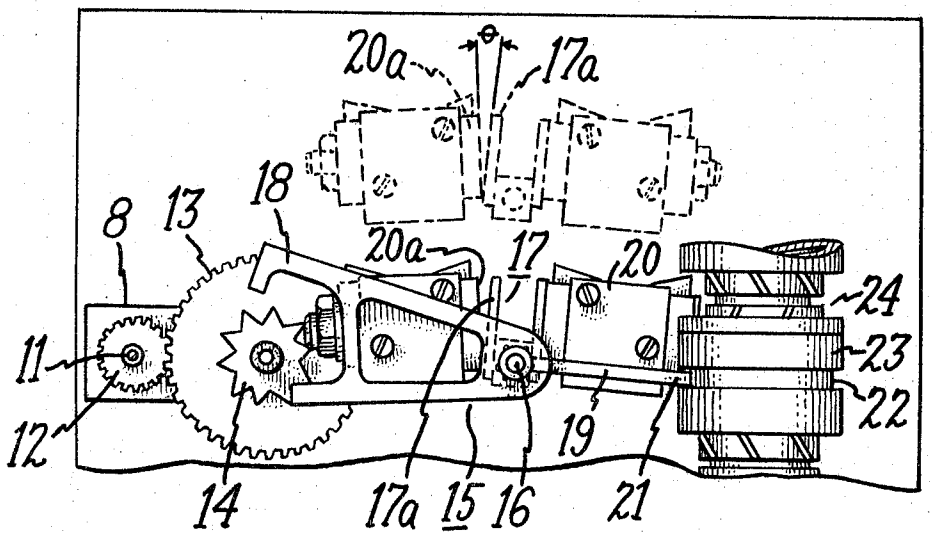
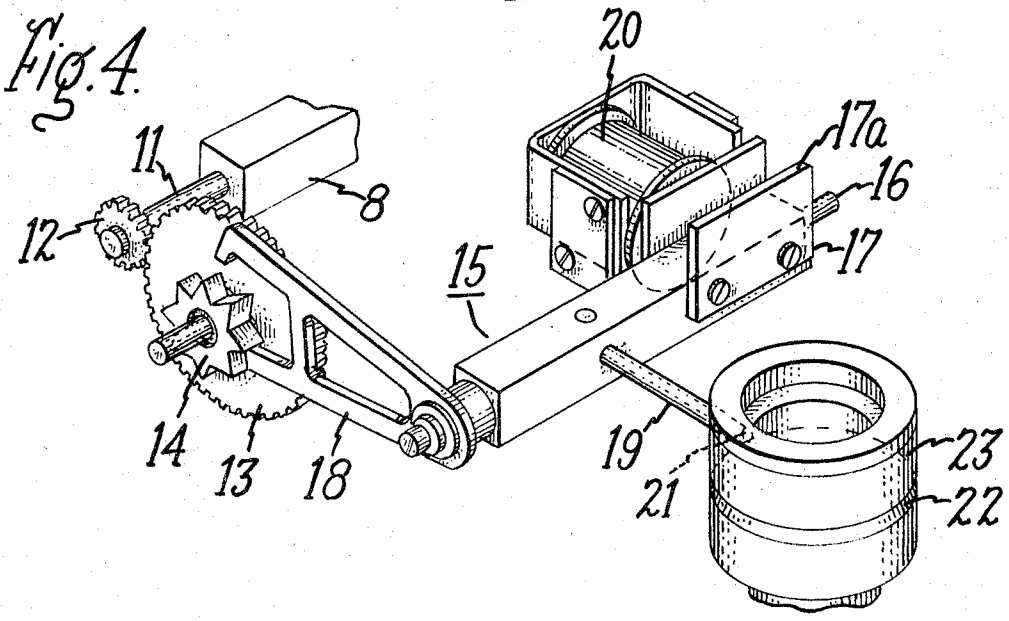


Fig. 4.



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TAKE-UP TOTALIZING RELAY

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Fig. 5.

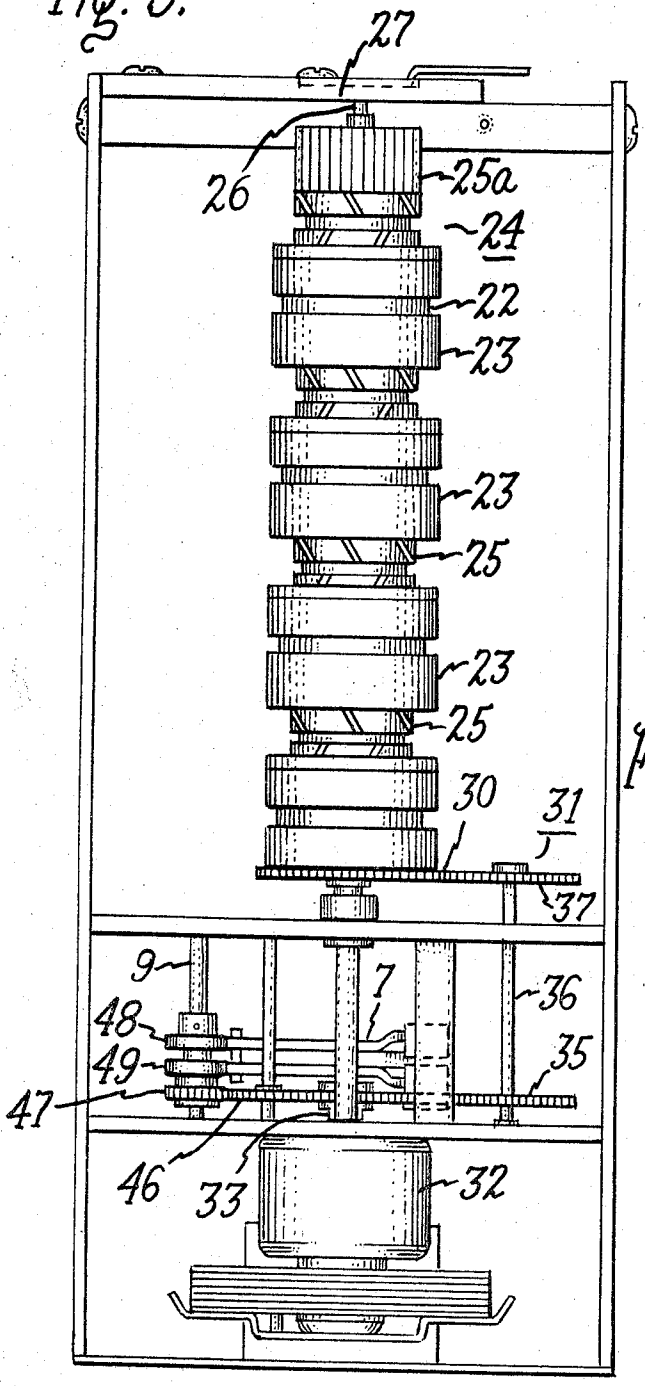
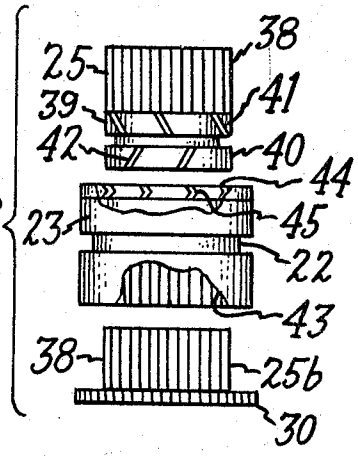


Fig. 6.



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TAKE-UP TOTALIZING RELAY

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Fig. 7.

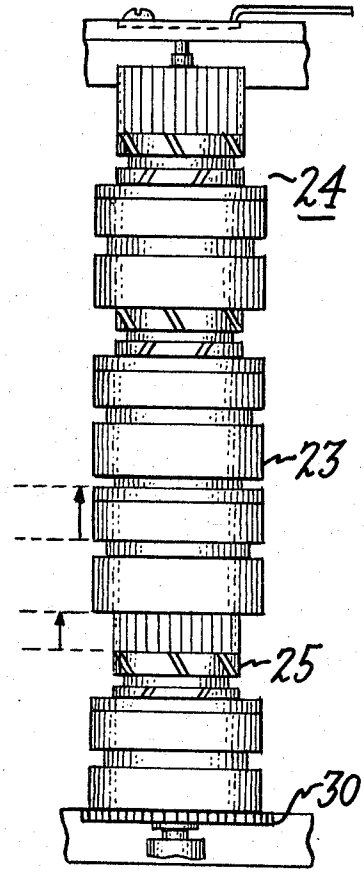
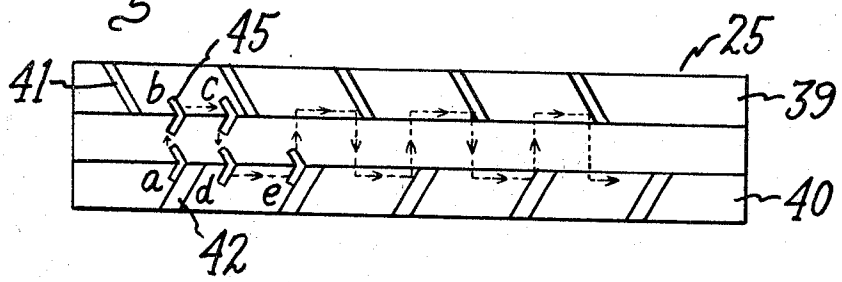


Fig. 8.



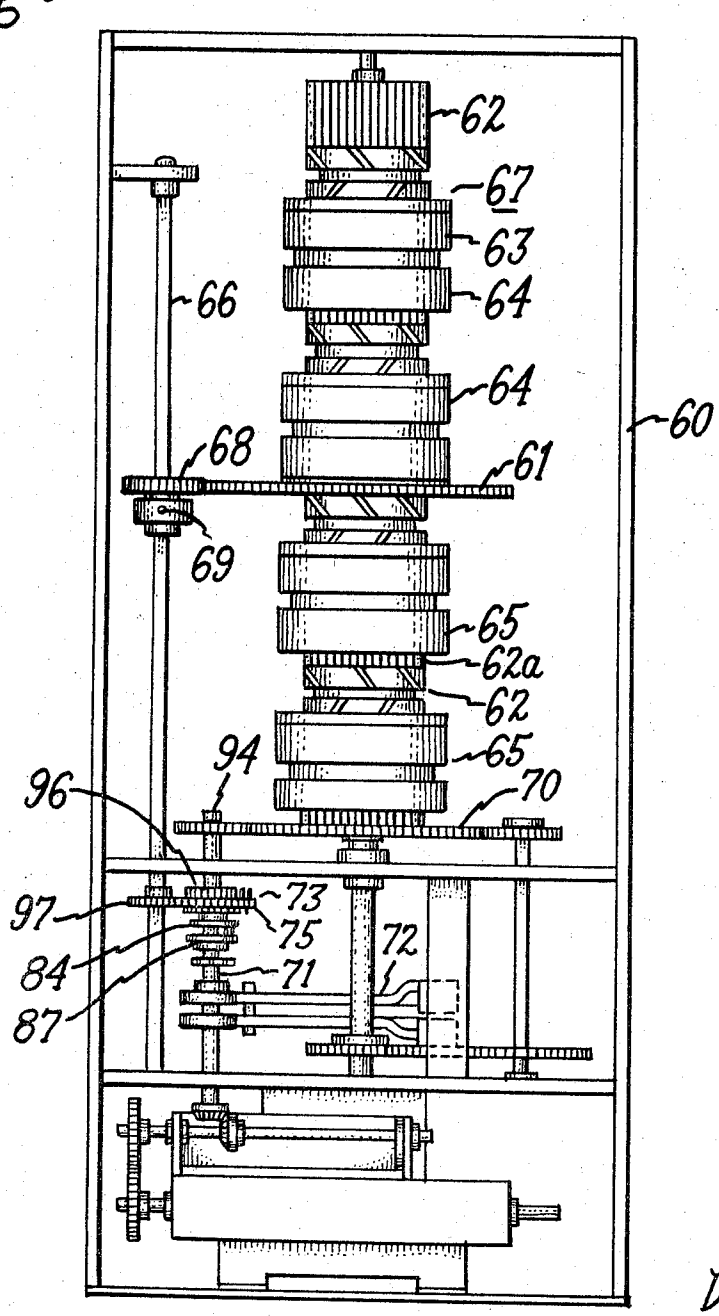
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Fig. 9.



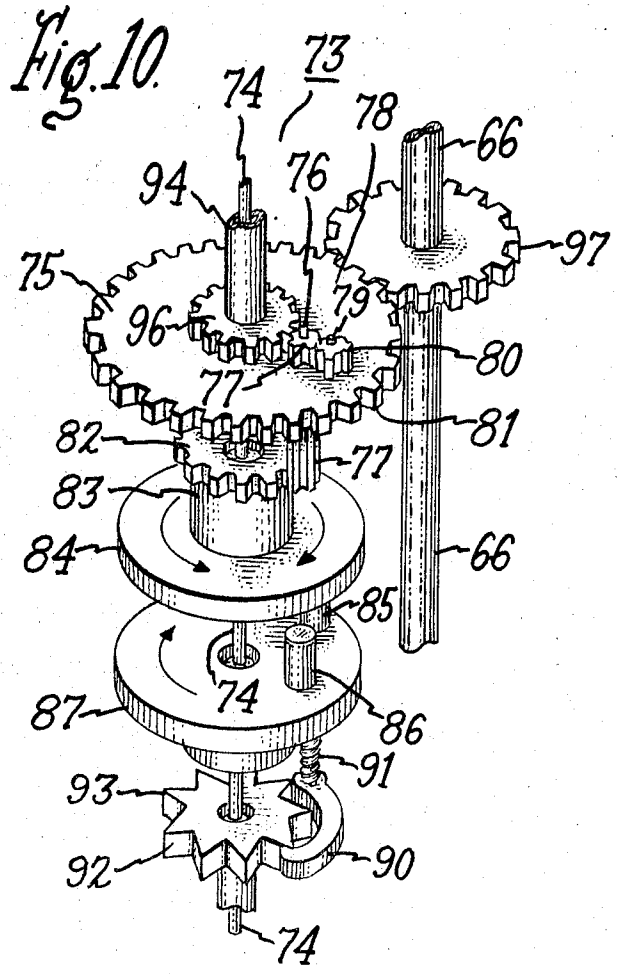
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TAKE-UP TOTALIZING RELAY

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Fig. 10.



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Filed Jan. 30, 1967 Sheet 8 of 8

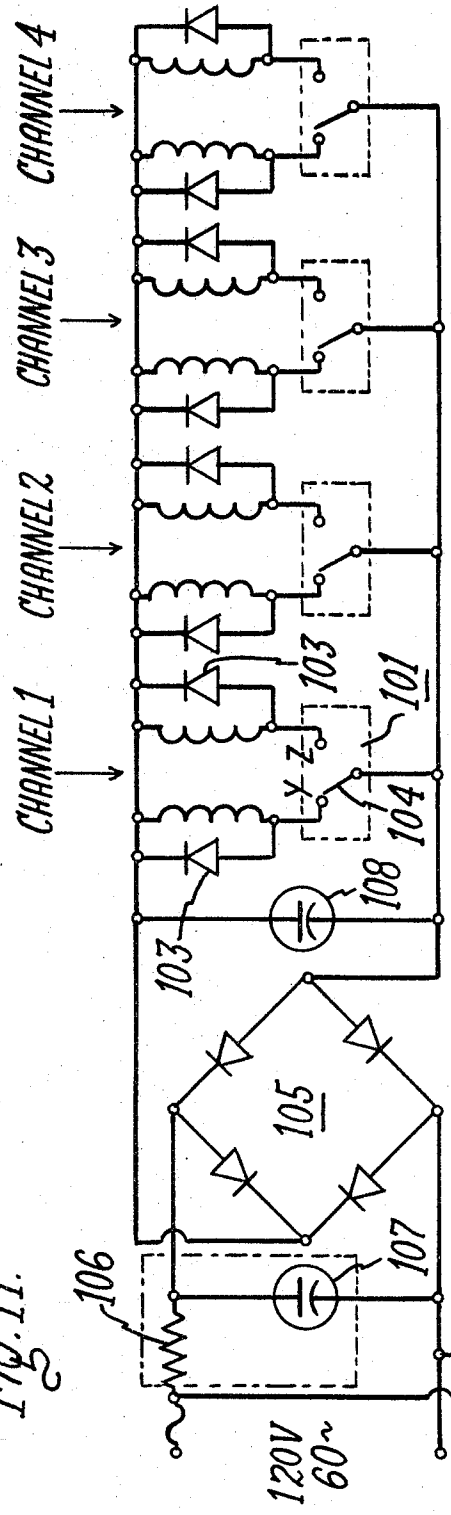


Fig. 11.

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United States Patent Office 3,434,659
Patented Mar. 25, 1969

3,434,659

TAKE-UP TOTALIZING RELAY

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Filed Jan. 30, 1967, Ser. No. 612,593
Int. Cl. G06m 1/24; B67d 5/22
U.S. Cl. 235—91
10 Claims

ABSTRACT OF THE DISCLOSURE

A totalizing relay for obtaining the totalized output from several metered systems. Electrical impulses from the meters are transformed into mechanical movement imparted to couplings in a coupling stack forming a totalizing shaft. This movement produces an increment of allowable escapement in the totalizing shaft which is taken up by a stalled-torque drive motor. A contact device responsive to motor rotation transmits impulses to another device which records the totalized output.

Background of invention

Totalizing relays or totalizers are used by electric utilities, for example, which provide electric power to large numbers of consumers for use in a multitude of circuits. Instead of having to obtain directly the demand indication from each watt-hour meter for each circuit served, the utility can use a totalizer which totalizes the demand from a number of metered circuits. In more complicated applications, the totalizer could itself provide an input to another totalizer which would totalize the output from a number of totalizers. Ultimately, the totalized output is recorded on a suitable device so that consumers can be charged according to their use. Other typical systems which can be totalized include gas, steam, water, petroleum, traffic, products on a conveyor, and weight. The only requirement is that the system being metered be proportional to the demand or flow in the system.

In an effective totalizer, a number of characteristic functions are desirable. The input must be able to be accepted by the totalizer at any time, as long as the inputs to particular channels do not exceed a predetermined maximum rate. Inputs must be able to enter at the same time. Also, the output impulses of the totalizer should be capable of being spaced at a desired rate. This is usually necessary when the totalizer output serves as an input for another device, such as a contact-operated demand meter, which may not be capable of receiving signals faster than a certain rate. Additionally, it may be desirable in certain applications to provide means to make some of the input channels subtractive, as where there may be other sources of power, for example, than that provided in the system by a utility. In such an arrangement the net power consumption for the entire system can be ascertained.

Prior art devices have generally utilized a cascaded differential gearing system to achieve totalization. However, this method has proved to be somewhat expensive and complex in that a rather intricate gearing arrangement is necessary and in that a drive mechanism must be provided for each input channel to drive the totalizer output.

Summary of invention

It is, therefore, an object of this invention to provide a totalizing relay having a simplified gearing system for achieving the totalized output.

It is another object of this invention to provide a totalizing relay having a single means for driving the totalized output from all input channels.

In accordance with my invention in one form thereof,

I provide a totalizer including a mechanism for each input channel, which upon the receipt of an input signal, allows a certain amount of escapement in the form of rotary motion to become available to a single constant torque potential such as a stalled-torque motor. The input mechanisms are interconnected in chain-like series fashion such that one end is fixed and the other end is connected to the stalled-torque motor. The free motion increments at the input are "taken-up" in the chain linkage as a result of a rotation of the stalled-torque motor. The totalized output is a result of the motor rotation and, as such, is directly dependent upon the amount of take-up.

Description of drawings

The invention will better be understood by the following description taken in connection with the accompanying drawings of a preferred embodiment in which:

FIGURE 1 is a perspective view of a totalizer according to a preferred embodiment of the present invention;

FIGURE 2 is a front elevation view of a portion of a totalizer according to this invention showing four channels, with the front plate removed, and other parts removed or broken away;

FIGURE 3 is a side view of a channel armature assembly;

FIGURE 4 is a perspective view of the armature assembly of FIGURE 3;

FIGURE 5 is a rear elevation view of the totalizer of FIGURES 1 and 2 showing the totalizing shaft;

FIGURE 6 is a detailed view of the individual male and female couplings comprising the totalizing shaft;

FIGURE 7 is a view of the totalizing shaft of FIGURE 5 wherein a pulse has been received and a shift of the female coupling has occurred;

FIGURE 8 is an illustrative view of a male coupling having infinite pitch radius;

FIGURE 9 is a rear elevation view of a subtractive type totalizer similar to FIGURE 5, showing the totalizing shaft with two subtractive channels;

FIGURE 10 is a perspective view of the differential gearing used especially for subtractive models; and

FIGURE 11 is a schematic wiring diagram of the circuit for the totalizer.

Detailed description

In FIGURE 1 the totalizing relay or totalizer **1** of a preferred embodiment of the present invention is shown. This totalizer **1** is used for totalizing the simultaneous demand of several individually metered circuits. A meter, such as a watt-hour meter (not shown), is installed in each circuit to be totalized, and each watt-hour meter is equipped with a contact device. Each contact device transmits to the totalizer electrical impulses proportional to a fixed amount of demand in the circuit. The totalizer totalizes the demand impulses—even when they are received simultaneously—and transmits the summation by means of an output contact device to a contact-operated type of demand meter, such as a printing demand meter (not shown), or to one channel of another totalizer. A three-wire operation has been found to be more accurate than other arrangements, but it is clearly understood that the present invention is not limited thereto. For purposes of example only, the totalizer **1** shown in FIGURE 1 is adapted to totalize the demand impulses from four meters.

The totalizer **1** is housed in a dust-proof casing **2** and includes a removable front panel **3** having a number of apertures or viewing windows therein. In the embodiment shown there are four input viewing windows **4** and one output viewing window **5**. There also may be an aperture **6** allowing direct access to an output contact device **7** if desired. Disposed within each input viewing window **4** is a cyclometer **8**. Each input circuit in the

totalizer 1 is equipped with one of the cyclometers 8, which records the number of impulses received in the circuit from the associated watt-hour meters. The shaft 9 which drives the output contact device 7 also drives a cyclometer 10, disposed in the output viewing window 5, which records the number of impulses which are transferred to the demand meter or similar device. The impulses registered on each input cyclometer 8 must agree with the watt-hour meter readings with which that circuit is coupled. The impulses registered on the output cyclometer 10 must be proportional to the sum of the input readings and the sum of the watt-hour meter readings. The impulses registered by the demand meters must agree with the impulses registered on the output cyclometer 10. Thus, it is possible to obtain a check on the performance of each part of the equipment back to the individual watt-hour meters.

FIGURE 2 shows the totalizer wherein the front panel 3 and other parts have been removed. Each input cyclometer 8 is drivingly mounted on a shaft 11 including a pinion 12. A gear 13 engages pinion 12 and includes a starwheel 14 connected thereto. An armature assembly 15, best seen in FIGURES 3 and 4, is provided to drive the starwheel 14 and gear 13 when an impulse is received in the input circuit so that the gear 13 will rotatably drive pinion 12 and shaft 11, thereby causing the cyclometer 8 to register the impulse. The armature assembly 15 consists of a shaft 16, an armature 17 consisting of two soft iron pole pieces 17*a*, a counter drive pawl 18, and a coupling shift rod 19. A pair of electromagnets 20 are provided to operate the armature assembly 15 for each input channel. The electromagnets 20 include pole pieces 20*a* and are mounted at an angle (see dotted lines in FIGURE 3) to the armature pole pieces 17*a*. An impulse into one of the input channels causes one of the electromagnets 20 of that channel to draw the armature 17 parallel to one electromagnet pole piece 20*a* whereupon the pawl 18 detents the starwheel 14 at either extremity of its travel. The detenting of the starwheel 14 causes rotation of shaft 11 so that the impulse is registered on the cyclometer 8 for that channel. Comparable angular movement is imparted by means of the armature shaft 16 to the shift rod 19, which results in a vertical displacement of the end 21 of the shift rod 19 to produce an increment of allowable escapement in a totalizing shaft, to be described next.

The end 21 of each shift rod 19 is disposed in a groove 22 in the outer surface of a female coupling 23 in a linkage which comprises a totalizing shaft 24. It is through the rotation of this shaft 24 that the output contact device 7 is allowed to operate. As seen in FIGURE 5, the totalizing shaft 24 comprises a stacked chain of alternately arranged male couplings 25 and female couplings 23 on a common shaft 26. The common shaft 26 extends from an upper frame 27 of the housing to a plate. A male coupling 25*a* at the top of the coupling chain is disposed adjacent the upper frame 27 and is fixed thereto so that it cannot rotate. Another male coupling 25*b*, best seen in FIGURE 6, at the bottom of the coupling chain is freely mounted on the shaft 26 and is connected to a gear 30 for rotation therewith. The male coupling 25*b* of the totalizing shaft 24 is driven through gear 30 and through a gear arrangement 31 by a synchronous stalled-torque drive motor 32. A motor shaft 33 drives a gear which drives a gear 35 on a shaft 36. The shaft 36 is thus caused to rotate and drives a gear 37 on shaft 36 which engages gear 30. Gear 30 is connected to coupling 25*b* for rotation therewith so that any available escapement in the totalizing shaft 24 is taken up whenever the motor shaft 33 is driven by the motor 32.

As seen in FIGURE 6, the male couplings 25 include a spline section 38 at one end and a pair of spaced parallel rows 39 and 40 of staggered teeth 41 and 42, respectively, at the other. The male couplings 25 are free to rotate, but are restrained from sliding along the shaft by suitable means such as E rings (not shown). The female couplings 23, include an internal spline section 43 at one end and a row 44 of V-shaped teeth 45 at the other end. A female coupling 23 straddles the adjacent ends of the male couplings 25, with the spline sections 38 and 43 making the connection at one side, and the V-shaped teeth 45 and one row 40 of staggered teeth 42 making the connection at the other side. Each female coupling 23 is restricted to relative axial motion with the male coupling 25 directly below by reason of the spline sections 38 and 43 but has both axial and radial relative motion with the male coupling 25 directly above. The present invention is not limited to the provision of V-shaped teeth 45 in the female coupling 23 and the inclination of the staggered teeth 41 and 42 in the male coupling 25, but they assume this particular geometry because it has been found to minimize the force required to shift against the stalled-torque motor 32, to be discussed next.

The circumferential groove 22 around the female coupling 23 is the means by which the shift force is applied. One end 21 of the armature shift rod 19 fits into the groove 22 to slide the female coupling 25 from one axial position to the other, as seen by the arrows in FIGURE 7. Totalization comes about through the interaction at the staggered teeth 41 and 42 and V-teeth 45 sections of the couplings, and can be more readily visualized by inspection of FIGURE 8, which shows the teeth 41 and 42 of the male coupling 25 as they would appear with an infinite pitch radius (a rack). Only one tooth 45 of the female coupling 23 is shown since its action is duplicated by all the other teeth. Position *a* indicates the situation that exists when the motor 32 is stalled. The force exerted by the stalled motor 32 is resisted by the reaction of the male tooth 41 and by the reaction between the male coupling 25*a* and its connection to the frame 27. An input to the armature assembly 15 results in moving the tooth 45 to position *b*. At this position the tooth 45 is free to advance an increment to position *c*, and the motor shaft 33 will rotate until position *c* has been reached, at which time resistance builds up again to stall the motor 32. Another input results in moving the tooth 45 from *c* to *d* which is also a free, angular travel position for the motor shaft 33, and the tooth 45 moves to position *e* whereupon resistance again builds up to stall the motor 32.

Each axial input, therefore, brings the teeth 45 into a free, angular travel position which frees the motor 32 until the next interference position is reached. Angular travel per axial input is a function of the number of teeth. Thus, for example, a coupling having 20 teeth will allow for 18° of freedom for each input. Stacking the couplings results in freeing the motor 18° for each input into the coupling chain, because the resisting force cannot build up to stall magnitudes until all the couplings are in an interference position. Those couplings which are in an interference position rotate without relative angular motions until the stalling condition is reached.

Referring again to FIGURE 5, the motor shaft 33 is drivingly connected by gear 46 to a gear 47 on the shaft 9. The shaft 9 includes a pair of lobed cam members 48 and 49 (see FIGURE 2) which rotate with the shaft 9 to operate the output contact device 7. The contact device 7 may be of any conventional type and the specific structural details form no part of the present invention. The function of the contact device 7 is to send out impulses which cause the registering mechanism of the contact-operated demand meters, such as a printing demand meter, to advance at a rate proportional to the speed and distance traversed by the stalled torque motor shaft 33. Thus, when the motor shaft 33 rotates, the lobed cams 48 and 49 will rotate to operate the contact device 7 whereupon an impulse will be transferred to the demand meter. Referring to FIGURE 2, the shaft 9 includes a bevel gear 50 which meshes with a bevel gear 51 to rotate

a shaft 52. A pinion 53 rotates with shaft 52 and drivingly engages a pinion 54 on a cyclometer shaft 55 to drive the cyclometer 10 and cause an output impulse to be registered.

It can be seen that the motor shaft 33 will continue to rotate as long as impulses are received at an input channel and that such rotation will result in a transfer of impulses to a suitable device. The only limitations are that the impulses must not be coming in at a rate faster than that which will assure accurate and complete mechanical transfer to the output contact device 7, and that the rate of impulse transfer of the output contact device must not be greater than the input capabilities of the printing demand meter or similar device. The former limitation is not a serious problem since the watt-hour meter or other device usually has a maximum output rate which will ensure adequate mechanical transfer of the impulse in the totalizer to the output contact device. The latter limitation can also be negated by the selection of suitable gear ratios for the gear arrangements of the totalizer or a synchronous motor speed that ensures a desired output impulse rate.

FIGURE 9 shows another embodiment of the totalizer 1 of the present invention which includes both additive and subtractive input channels so that a net totalized output can be ascertained. This type of totalizer 60 is especially useful when totalizing the demand for a company having a small amount of its own power generating equipment. Since the company's own power output comingles with the power provided by the utility, the subtractive channels must be included to separate this aspect of power from the total amount for billing purposes.

In the totalizer 60, including a totalizer shaft 67 with male couplings 62 and female couplings 63, a gear 61 is provided which may be connected to the spline section 62*a* of a male coupling 62 of any input channel for rotation therewith. Input channels 64 above and including that carrying the gear 61 are considered to be additive: input channels 65 below the gear 61 are considered to be subtractive. A vertically-oriented rotatable shaft 66 is disposed parallel to the totalizing shaft 67 and includes an adjustable gear 68 which can be fixed at any position along the length of the shaft 66 by manipulation of a suitable set screw 69. The gear 68 is positioned so that it is drivingly engaged by the gear 61 on the totalizing shaft 67. Rotation of the totalizing shaft 67 occurs upon receipt of an impulse at one of the input channels. If the impulse is received in one of the subtractive channels 65, only a portion of the totalizing shaft 67 below gear 61 will be able to rotate, thereby allowing a shaft gear 70, driven by the motor, to rotate. If, however, an impulse is received in an additive channel 64, then the totalizing shaft 67 will be freed so that both gears 61 and 70 can be caused to rotate by the motor. Thus, the subtractive gear 70 is rotated for both positive and negative pulses whereas the additive gear 61 is rotated for only positive pulses.

In order to make an operating shaft 71 of an output contact device 72 rotate so that only the net positive impulses are transferred to a demand meter, a differential gearing arrangement 73, seen in FIGURES 9 and 10, is provided which takes as its input the output from the subtractive gear 70 and the output from the additive gear 61. The differential gear arrangement 73 comprises a center shaft 74 about which a gear 75 is freely journaled. The gear 75 includes an eccentrically mounted freely rotatable pin 76 having a fixed pinion 77 journaled on each side of the gear 75. One side 78 of the gear 75 includes a second eccentrically mounted fixed pin 79 including a freely journaled pinion 80 engaging the pinion 77 on the first pin 76. The pinion 77 on the other side 81 of the gear 75 drivingly engages a gear 82 connected to a shaft 83 freely journaled on the center shaft 74. At the other end of the shaft 83 is a transfer disk 84 which rotates when the shaft 83 is rotated by the pinion 77. The transfer disk 84 includes an eccentric, downwardly-extending drive pin 85 on a face thereof which is adapted to engage an upwardly extending driven pin 86 eccentrically mounted on the upper face of an output disk 87 also freely journaled on the center shaft 74. The output disk 87 includes a pivotally-mounted eccentrically-oriented pawl 90 on the lower face thereof. The pawl 90 is biased by spring 91 to engage the teeth 92 of a ratchet 93 freely journaled on the center shaft 74. The ratchet 93 is fixed to the operating shaft 71 of the output contact device 72 for rotation therewith.

The output from the subtractive gear 70 on the totalizing shaft 67 is transmitted to the differential gear arrangement 73 through a shaft 94. Gear 70 engages a gear 95 fixed on shaft 94 to rotate the shaft. A second gear 96 fixed to the shaft 94 drivingly engages pinion 77. Rotation of the subtractive gear 70, then, causes rotation of the transfer disk 84. The gears are selected so that the transfer disk 84 is rotated in a counterclockwise direction a predetermined increment for each input impulse. The output from the additive gear 61 on the totalizer shaft is transmitted through shaft 66 to the differential gear arrangement 73. Gear 61 engages gear 68 fixed on the shaft 66 to rotate the shaft. A second gear 97 fixed on the shaft 66 drivingly engages the gear 75 so as to rotate the transfer disk 84 clockwise for positive input impulses. The gears are so chosen that the transfer disk 84 will be driven twice the increment at which it is driven by the subtractive gear 70 for each input impulse. Thus, for each impulse into a subtractive channel 65, the transfer disk 84 is driven counterclockwise one increment; and, for each impulse into an additive channel 64, the transfer disk 84 is driven counterclockwise one increment and clockwise two increments, or a net rotation of one increment in a clockwise direction. The arrangement of the pins 85 and 86 is such that, on a subtractive impulse, the pin 85 on transfer disk 84 moves one increment away from the pin 86 on the output disk 87. This serves to "store" the negative impulse. On a positive impulse, the pin 85 on the transfer disk 84 moves one increment toward the pin 86 on the output disk 87, thereby negating one negative impulse. When the two pins 85 and 86 are touching each other, subsequent positive impulses will cause the pin 85 to move the pin 86 and thereby cause the output disk 87 to rotate, whereupon the operating shaft 71 of the contact device 72 is caused to rotate through the action of the pawl 90 and ratchet 93, and contact transfer is effected.

There is a possibility that negative impulses will build up so that the pin 85 will back drive the pin 86 on the output gear 87. However, the possibility of a build up of such a large number of negative impulses is very small. If it should occur that the output gear is back driven, it can be seen that the pawl 90 will slip on the ratchet teeth 92 so that the operation of the contact device will be unaffected.

FIGURE 11 shows a schematic wiring diagram of the circuit for a four channel totalizer. The synchronous motor field 100 of the stalled-torque motor is connected across the power supply. A conventional three-wire contact device 101 mounted on each watt-hour meter or the like serves as the input regulator to each channel. A pair of electromagnets 20 are provided for each channel. Arc suppression diodes 103 are provided in parallel with the electromagnetic coils 20 for arc suppression of the contact devices 101. Upon receipt of an input impulse at an input channel, occurring when a contact 104 in a contact device 101 changes from Y to Z, the corresponding electromagnets 20 are caused to vary their magnetic state whereupon the associated armature assembly 15 shifts. The electromagnets 20 are provided for D.C. operation and, thus, a full wave rectifier 105 is included. The resistor 106 and capacitor 107 filter out most of the high frequency spikes and the capacitor 108 reduces the ripple from the output of the rectifier 105. The circuit may be used for both additive and subtractive models of the totalizer.

We have thus described a totalizer for obtaining a totalized demand from a number of metered circuits. Impulses into a number of input circuits are converted into mechanical motion by an armature assembly through actuation

of an electromagnet. Each armature causes movement of an associated coupling on a totalizing shaft so that a certain amount of escapement is available which can be taken-up by rotation of the shaft by a stalled-torque motor. Rotation of the motor shaft also causes rotation of a shaft which operates a contact device that transfers impulses to another device such as a printing demand meter. If desired, the totalizer may be separated into additive and subtractive input channels. For subtractive applications, a differential gearing arrangement is included to provide for the transferring only of the net positive impulses into the totalizer.

As has been previously mentioned, other typical systems which can be totalized by the present totalizer include gas, steam, water, petroleum, traffic, products on a conveyor, linear distance, weight, etc. In such systems, all that is necessary is that pulse signals be produced by contact-making devices as attachments to commercially available meters such as gas meters, steam flow meters, mass flow meters, conveyor weighing meters, or production counting signals.

While the present invention has been described with specificity, it is the aim of the appended claims to cover all such equivalent variations as come within the true spirit and scope of the foregoing disclosure.

What is claimed as new and which it is desired to secure by Letters Patent of the United States is:

1. A totalizer for totalizing the demand of several metered systems comprising:

(a) means for each metered system for converting an electrical impulse to mechanical motion;

(b) a totalizing shaft comprising a chain of stacked coupling members;

(c) said converting means being connected to said totalizing shaft;

(d) said converting means, upon receiving an electrical impulse, acting on said coupling members to produce an increment of allowable escapement in said totalizing shaft in the form of rotary motion;

(e) rotary drive means drivingly connected to said totalizing shaft for taking up the allowable escapement therein; and

(f) means responsive to the rotation of said rotary drive means for indicating the amount of take-up.

2. The totalizer as recited in claim **1** wherein the totalizing shaft comprises a coupled chain of alternately stacked male and female coupling members, one female coupling member being provided for each metered circuit, and said converting means, upon receiving an electrical impulse, acting to move one of said female coupling members to produce an increment of allowable escapement in said totalizing shaft in the form of rotary motion.

3. The totalizer as recited in claim **2** wherein the male coupling members comprise hollow cylindrical members having an external spline section at one end and a pair of external spaced parallel rows of staggered teeth at the other end, and wherein the female coupling members comprise cylindrical members having an internal spline section at one end and a row of staggered teeth at the other end, each of said female coupling members having the spline section thereof coupled to the spline section of the subjacent male coupling member for relative axial motion therewith, and having the row of staggered teeth thereof coupled to the rows of staggered teeth of the male coupling member directly above for relative axial motion and relative rotary motion therewith.

4. The totalizer as recited in claim **3** wherein a male coupling member is fixed from rotation at the top of the totalizing shaft and another male coupling member is free for rotation at the bottom of the totalizing shaft, said rotary drive means being drivingly connected to the bottom male coupling member and rotatably driving said coupling member to take up any allowable escapement in the totalizing shaft whereupon further rotation of the bottom coupling member is resisted by the top coupling member and by reaction between the rows of staggered teeth of the male and female coupling members of the totalizing shaft in an interference position.

5. The totalizer as recited in claim **1** wherein said rotary drive means comprises a synchronous stalled torque motor including a rotary shaft.

6. The totalizer as recited in claim **1** wherein a first gear arrangement drivingly connects said rotary drive means with said motion responsive means.

7. The totalizer as recited in claim **1** wherein said means responsive to the rotation of said rotary drive means comprises a cyclometer for registering the totalized demand of the several circuits.

8. The totalizer as recited in claim **1** wherein said means responsive to the rotation of said rotary drive means comprises a contact device for converting rotary motion into electrical impulses and for transmitting the impulses to another device.

9. The totalizer as recited in claim **1** wherein the impulses from some of the metered circuits are considered to be negative and the impulses from the other metered circuits are considered to be positive, and wherein means are provided to transmit to the means responsive to the rotation of said rotary drive means rotary motion characteristic of only the net positive impulses received by the totalizer.

10. The totalizer as recited in claim **9** wherein said transmitting means comprises a differential gear arrangement drivingly connected to said means responsive to the rotation of said rotary drive means, and wherein a second gear arrangement is provided so drivingly engaged by said totalizing shaft as to be driven only when a positive impulse is received by said converting means, said second gear arrangement and said rotary drive means being drivingly connected to said differential gear arrangement.

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U.S. DEPARTMENT OF COMMERCE

PATENT OFFICE

Washington, D.C. 20231

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,434,659 March 25, 1969

Donald M. Ham et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, after line 39 insert -- vided with a device for transmitting electrical impulses to the totalizer pro- --.

Signed and sealed this 31st day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR
Commissioner of Patents