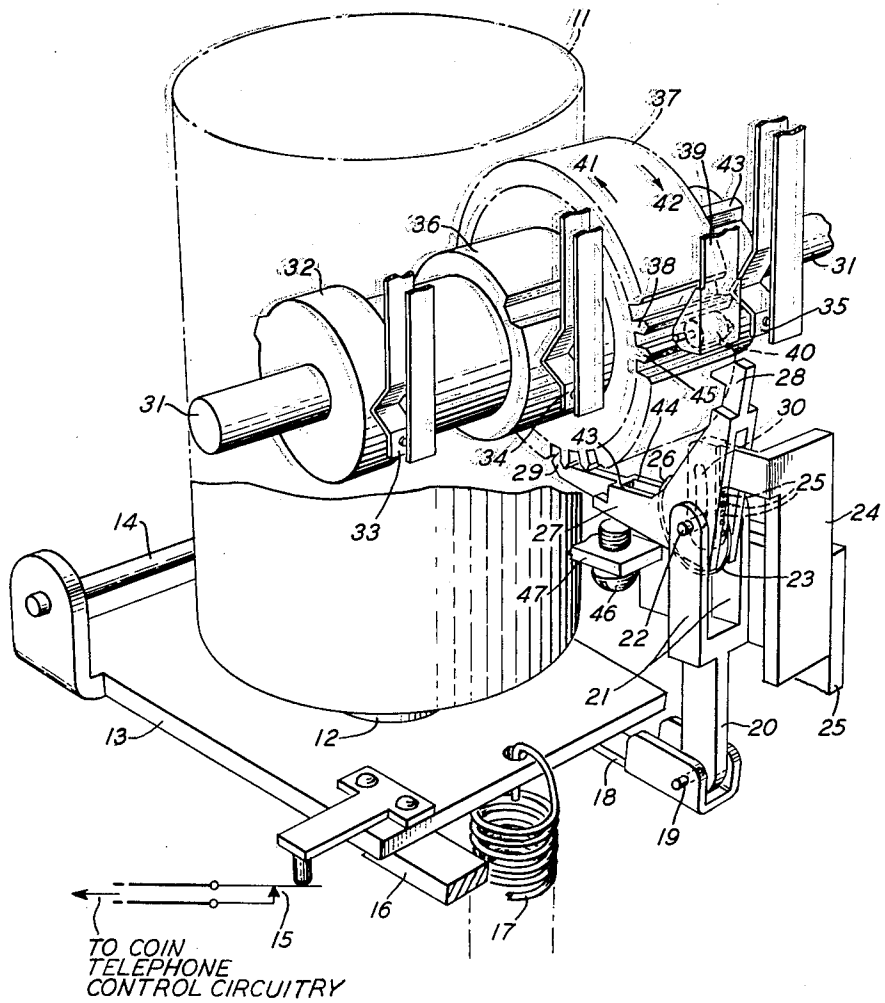
June 8, 1965 D. W. PEAT ET AL 3,187,594

COIN TOTALIZER POSITIVE INDEX MECHANISM

Filed July 11, 1962 2 Sheets-Sheet 1

FIG. 1



INVENTORS D. W. PEAT
L. A. STROMMEN
R. K. THOMPSON, JR.

BY Edwin B. Cave

ATTORNEY

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FIG. 3

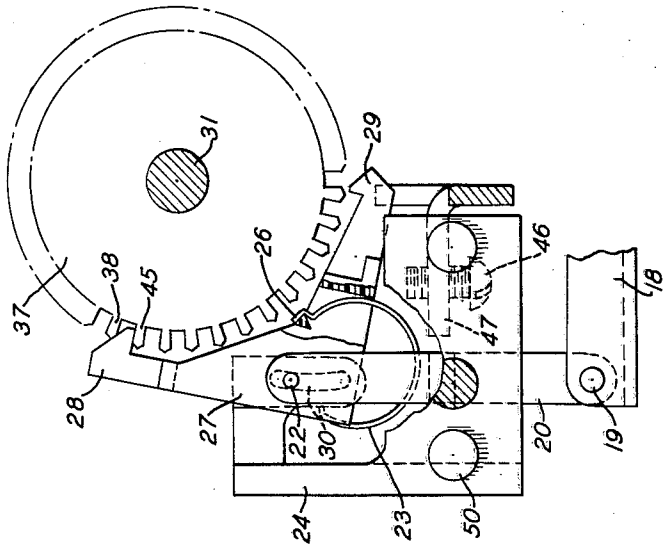
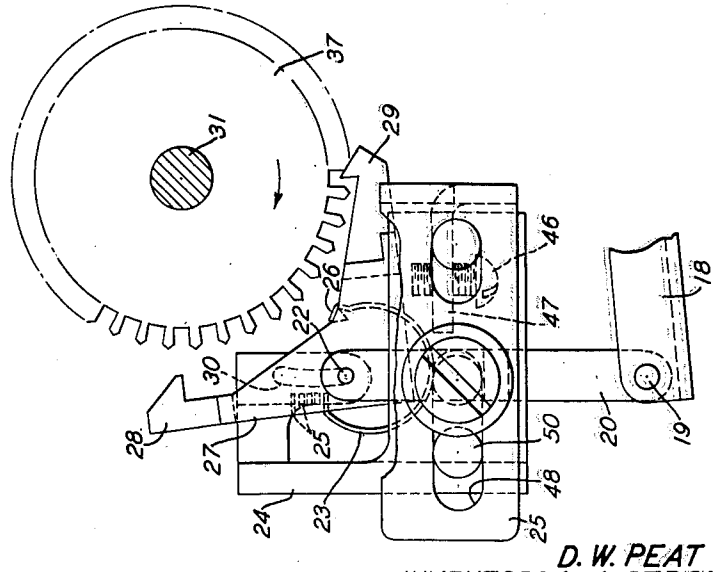


FIG. 2



INVENTORS D. W. PEAT
L. A. STROMMEN
R. K. THOMPSON, JR.

BY Edwin B. Cave

ATTORNEY

United States Patent Office

3,187,594

Patented June 8, 1965

3,187,594

COIN TOTALIZER POSITIVE INDEX MECHANISM

David W. Peat, Lawrence A. Strommen, and Richard K. Thompson, Jr., Indianapolis, Ind.; said Peat assignor to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York, and said Strommen and said Thompson assignors to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Filed July 11, 1962, Ser. No. 209,134

10 Claims. (Cl. 74—126)

This invention relates to coin-operated apparatus and more particularly to coin totalizer apparatus and its general object is to enhance the reliability of such equipment.

Coin-operated telephones typically include a means for measuring the value of each deposited coin, a means for storing information indicative of that value, a means for reading out the stored information on demand from a central office and control means for performing the necessary logic functions incident to the transmission of coin signals and the processing of other supervisory signals.

The measuring function may be performed by any one of a variety of so-called "coin chutes," all of which operate to apply various tests to determine whether deposited coins are genuine or spurious and to place each genuine coin in a particular coin channel or run corresponding to the denomination of that coin.

A well known technique employed in the storage function is to utilize the energy attained during the gravity drop of each coin in its assigned channel to rotate the shaft of a totalizer mechanism through an angle which corresponds in magnitude to the denomination of the coin. The totalizer shaft includes a plurality of cam surfaces each of which is used to operate a corresponding set of contacts. These contacts are a part of the electrical control circuitry which establishes the various operating sequences incident to the placing of a call, to the transmission of coin signals, to the termination of a call and to the collection of deposits.

The read out function is typically accomplished by rotating the totalizer shaft in the opposite direction back to some preselected normal or zero position. This reverse rotation of the totalizer shaft may be effected, for example, by the operation of a stepping electromagnet. For each angular increment of shaft rotation, a corresponding coin identification signal, initiated by the operation of contacts controlled by the stepping magnet armature, is applied to the line for transmission to the central office.

In the sequence of operations described above a persistent problem lies in the specific means employed in resetting the totalizer shaft back to its normal or zero position after the deposit of a coin or coins. A conventional method is to employ a simple pawl which is driven directly by the armature of the stepping electromagnet. The pawl is designed to engage a ratchet wheel which is mounted on the shaft. One difficulty with this approach is the lack of means for suitably adjusting the engaging and disengaging points of the ratchet wheel operating pawl. Such adjusting means are required if accurate compensation is to be provided for variations in operating conditions which may include the particular characteristics of the stepping electromagnet, the amount of current flowing in the circuit, and the changes in the circuit components and mechanical components which occur as the result of aging and wear.

Another problem in known totalizer mechanisms is the tendency to drive the totalizer shaft, during the reset operation, in angular increments which are either slightly less or slightly more than a preselected magnitude. Inasmuch as the totalizer mechanism is the heart of the

control means for a coin telephone, it is essential that the information stored by the totalizer shaft be read out with the greatest possible accuracy. Although various approaches have been employed in an attempt to achieve the desired level of accuracy, these approaches have in general led to the development of mechanisms which are unduly complex and accordingly accuracy has been achieved only at the cost of some loss in reliability. Additionally, mechanisms which heretofore have been employed in rotating the shaft of a totalizer back to its index position have been unduly heavy and cumbersome which has led to the employment of electromagnetic drivers with undesirably large power requirements.

Accordingly, a specific object of the invention is to increase the accuracy of coin totalizer apparatus.

Another object of the invention is to eliminate totalizer shaft overshoot which may occur when a totalizer shaft is being driven in incremental angular steps back to a preselected zero position.

A further object is to reduce the power which is required to step a totalizer shaft back to a zero position.

These and other objects are achieved in accordance with the principles of the invention by the employment of a bifurcated pawl which is used to drive a totalizer shaft back to a zero position in incremental angular steps by successively engaging and disengaging a ratchet wheel which is mounted on the totalizer shaft.

A particular aspect of the invention resides in the dual function of a bifurcated pawl, hereinafter referred to as a pawl to rotate a ratchet wheel and to stop the rotation of the wheel both abruptly and accurately. In accordance with the invention, the pawl is pivoted about a suitably placed shaft. The shaft is in turn connected to the armature of the stepping electromagnet by a link member. When the stepping electromagnet operates, movement of the armature is not employed directly to force engagement of the driving end of the pawl with the ratchet wheel but is instead translated into a shift in the position of the pivot point of the pawl.

It is a feature of the invention that after the pivot point of the pawl has been shifted through a preselected distance a pawl spring acts to drop the driving end of the pawl into the center of the depression between adjacent teeth on the ratchet wheel. With the driving end of the pawl engaged in the ratchet wheel, the totalizer shaft is driven through a preselected angular increment of rotation as the stepping magnet armature returns to its normal position. Before the completion of the full throw of the armature, however, the pawl spring lifts the driving end of the pawl from the ratchet wheel and as the pivot point of the pawl moves through a preselected point, the arresting end of the pawl is meshed into engaging contact with the ratchet wheel and the shaft is brought to an abrupt but accurate stop.

Another aspect of the invention relates to the cooperative relation between the pawl mechanism described above and a small centering roller which is spring loaded to follow the outside contour of the ratchet wheel as it rotates. The roller imparts a slight impeding force to the wheel during its rotation which force is at its maximum when the roller is precisely positioned between two adjacent ratchet wheel teeth. Thus, any very slight variation in positioning which may result from the operation of the pawl mechanism is in effect corrected by the operation of the spring-loaded roller.

Also, in accordance with the invention, a slotted guide block member is employed to define the limits of travel of the pivot point of pawl as it is moved by the action of the stepping electromagnet armature and its connecting link. The operation of the pawl may be adjusted in a number of ways. For example, means are provided for adjusting one of the anchor positions of the pawl

spring. Additionally, the position of the guide block and the position of the armature with respect to the ratchet wheel are both adjustable. Further, the position of an adjusting screw, which protrudes from the guide block bracket, may be varied to control the point at which the pawl strikes the screw as the pivot point of the pawl is being shifted from the driving position to the arresting position. The exposed length of the adjusting screw contributes to the determination of the precise point at which the pawl shifts.

Accordingly, one feature of the invention resides in a substantially symmetrical two-ended pawl which is employed to drive a ratchet wheel through successive precise angular increments.

Another feature relates to the combination of a pawl-driven ratchet wheel and a spring-loaded centering roller.

An additional feature of the invention pertains to the plurality of adjusting means employed to control the cooperative relation between a ratchet wheel and a dual function driving pawl.

These and other objects and features will be fully understood from the following detailed description of an illustrative embodiment of the invention and from the appended drawing in which:

FIG. 1 is a perspective view of a coin telephone totalizer shaft reset mechanism in accordance with the invention;

FIG. 2 is a side view of the mechanism shown in FIG. 1 with the pawl in the arresting position; and

FIG. 3 is a side view of the mechanism shown in FIG. 1 with the pawl in the driving position.

Shown in FIG. 1 is a stepping motor which includes coil 11 and pole face 12 which is mounted for cooperative relation with armature 13. Armature 13, biased by spring 17, is pivotally mounted on shaft 14. Mounted in spaced relation to coil 11 is a totalizer shaft 31. Bearings for shaft 31 are provided by an alignment frame (not shown) which also provides a housing and a mounting for armature 13 and for coil 11. Mounted on totalizer shaft 31 are switch operating cams 32, 36 and 43 together with respective spring-loaded contacts 33, 34 and 35. Such totalizer cam operated contacts typically form a part of coin telephone circuitry which controls the various operating sequences incident to the placing of a call. Circuitry of this type is well known in the art, as shown, for example, in Patent 2,883,463, issued to W. D. Goodale, Jr. et al., April 21, 1959.

Also mounted on totalizer shaft 31 is ratchet wheel 37. As in conventional coin telephone totalizers, the fall of coins in a coin chute (not shown) is translated into a rotational force which turns totalizer shaft 31, together with cams 32, 36 and 43 and ratchet wheel 37, in the direction of arrow 41. Such translation is typically effected by a so-called "coin arm," one form of which is disclosed in the Goodale patent, cited above. The angle through which shaft 31 is rotated is indicative of the value of the deposited coin or coins. For example, a rotation of 10 degrees may indicate a deposit of five cents, in which event the deposit of a quarter would be indicated by a 50 degree rotation.

Shaft 31 is designed for rotation in incremental steps, each step being equal to the angular separation between adjacent teeth such as 38 and 45. The incremental nature of the movement of the shaft is aided by ratchet roller 40 which is spring-loaded by spring member 39 into continuous contact with ratchet wheel 37. Ratchet roller 40 is designed to fit precisely in the center of the gap between adjacent teeth such as 38 and 45 and accordingly the restraining force exerted on ratchet wheel 37 is at a maximum when ratchet roller 40 is so centered.

Movement of armature 13 is translated into rotational movement of wheel 37 and shaft 31 by armature extension 18, connecting link 20, and toggle 27. Connecting link 20 is pivotally mounted with respect to armature extension 18 by pivot pin 19. At its opposite or driving end

connecting link 20 terminates in a yoke 21. The ends of yoke 21 are in turn affixed to pivot pin 22 which rides in a slot 30 in a guide block member 24. Guide block member 24 is secured to supporting bracket 25.

Pawl 27 is a double-ended pawl, which includes an upper or driving pawl 28 and a lower or arresting pawl 29. The center portion of pawl 27 is split into two arms 43 and 44 which are in parallel spaced relation. Pawl 27 is mounted for free pivotal movement on pivot pin 22. Pivotal movement of pawl 27 on pin 22 is in part controlled, however, by pawl spring 23. One end of pawl spring 23 is positioned in one of the holes 25 which are drilled in the edge of guide block 24 and the other end of spring 23 is affixed to a tab 26 which is integral with pawl 27. In the neutral or unoperated position driving pawl 28 is held away from the surface of ratchet wheel 37 by the action of spring 23. In this position wheel 37 is free to rotate in the direction of arrow 41, or clockwise as shown in FIG. 2. Arresting pawl 29 is shaped to permit the teeth of wheel 37 to ride over it so long as ratchet wheel 37 is turned in the clockwise direction.

Operation of the totalizer shaft resetting mechanism, which in effect is a reading out of the coin deposit information indicated by the rotational position of shaft 31, is initiated by the automatic application of current to coil 11 by means of control circuitry (not shown). At this point armature 13 moves upwardly into contact with pole face 12. Connecting link 20 is accordingly moved upwardly which shifts the position of pivot pin 22 in its accommodating guide slot 30. At a preselected point in the upward travel of the pivot point of pawl 27, which point may, for example, be at approximately one-half the full throw travel of pivot pin 22, the force of spring 23 drops driving pawl 28 into engaging contact with teeth on ratchet wheel 37.

The position of pawl 27 with respect to ratchet wheel 37 at this point is best shown in FIG. 3. The stepping motor is made self-interrupting through the operation of contacts 15. When current in coil 11 is interrupted, the restoring force of armature spring 17 pulls armature 13 back against stop 16. The downward force of armature 13, acting through armature extension 18, connecting link 20 and pivot pin 22, pulls pawl 27 down, thus rotating ratchet wheel 37 through an angle approximately equal to the angular distance between adjacent teeth. At a preselected point in the downward movement of pivot pin 22 in its guide slot 30 the force of pawl spring 23 tips pawl 27, disengaging driving pawl 28 and engaging arresting pawl 29, as shown in FIG. 2, which brings ratchet wheel 37 to an abrupt stop. It is at this point that the force of ratchet roller 40 is applied between adjacent teeth, thereby centering ratchet wheel 37 precisely with respect to its index position.

Successive operation of the resetting mechanism in the manner described resets totalizer shaft 31 to its zero position. Each movement of armature 13 is also employed to operate electrical contacts, similar to contacts 15, for example, which apply coin identification signals to the line for transmission to the central office.

In accordance with the invention a number of means are provided for adjusting the totalizer shaft reset mechanism. One such adjustment is provided by screw 46, best seen in FIG. 2 or FIG. 3, which is threaded into supporting member 47. As pawl 27 is moving from its driving to its arresting position, the outside surface of the lower leg of pawl 27 is designed to contact the end of screw 46. The precise point at which toggling takes place may be shifted slightly by changing the distance that screw 46 protrudes from supporting bracket 47. The mechanism can also be adjusted simply by bending armature extension 18 which controls the vertical position of pawl 27 with respect to ratchet wheel 37.

Means are also provided for shifting the lateral position of guide block 24 with respect to fixed bracket 25. Guide block 24 is secured to bracket 25 by means of

screw 50. The position of screw 50 with respect to bracket 25 may be shifted by movement in guide slot 48. Such adjustment in the position of guide block 24 may be used to shift the position of pawl 27 bodily towards or away from ratchet wheel 37.

It is to be understood that the embodiment disclosed herein is merely illustrative of the principles of the invention. Various other arrangements may be devised by persons skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In a coin totalizer including a shaft rotationally responsive to the deposit of coins, apparatus for resetting said shaft to a pivot position thereby to read out the coin deposit information indicated by the angular position of said shaft, said apparatus comprising, in combination, a ratchet wheel mounted in driving relation to said shaft, a bifurcated pawl mounted for pivotal movement about a pivot point having said first and second ends each formed for engaging relation with said wheel, said first end being formed for driving said wheel in a preselected direction of rotation and said second end being formed for blocking said wheel from rotating in said preselected direction, said first end normally being out of contact with said wheel and said second end normally being in contact with said wheel, means for shifting the position of said pivot point from its normal position, means responsive to the shift of said pivot point beyond a preselected distance for pivotally rotating said pawl whereupon said first end is brought into engaging, driving relation with said wheel and said second end is lifted clear of contact from said wheel, said rotating means being further responsive to a shift in said pivot point back to said preselected distance from its normal position whereupon said first end is lifted clear of said wheel and said second end is brought into engaging-arresting relation with said wheel.

2. Apparatus in accordance with claim 1 wherein said pawl rotating means includes a spring.

3. Apparatus in accordance with claim 1 wherein said shifting means includes an electromagnetic stepping motor having an armature, and a mechanical connecting link between said armature and said pawl.

4. Apparatus in accordance with claim 3 further including a pivot pin affixed to said link, said pin being a pivotal axis for said pawl, a guide block member, said guide block member including an enlongated slot as a guide for said pivot pin, said slot defining the limits of travel of said pivot point as the position of said pawl and its pivot point is shifted in response to the urging force of said armature as applied through said connecting link.

5. Apparatus for rotating a shaft in successive precise angular increments of predetermined uniform magnitude comprising, in combination, a ratchet wheel mounted on said shaft for driving relation therewith, the angular space between adjacent ones of the teeth on said wheel being equal to said predetermined magnitude, a bifurcated pawl mounted for rotation about a movable pivot point, and having a first end and a second end, said first end being formed for engaging-driving relation with said wheel, said second end being formed for engaging-arresting relation with said wheel, said first end being normally out of contact with said wheel and said second end being normally in contact with said wheel, means for shifting said pivot point in a first direction whereupon said pawl is rotated about said pivot point dropping said first end into engaging-driving relation with said wheel and lifting said second end clear of said wheel, means operative after the operation of said shifting means for reversing the direction of movement of said pivot point whereupon said wheel is rotated through an angular increment equal to said predetermined magnitude and means operative upon the completion of rotation of said wheel through said last named angular increment for rotating said pawl about said pivot point whereupon said first end is cleared from said wheel and whereupon said second end is dropped into engaging-arresting relation with said wheel thereby abruptly terminating the rotation of said wheel.

6. Apparatus in accordance with claim 5 including vernier centering means comprising a roller member formed for engaging relation between adjacent ones of the teeth on said wheel, said roller member being spring-loaded against the periphery of said wheel, said roller member thereby tracing the outer periphery of said wheel in cam follower fashion during the rotation of said wheel.

7. In a coin telephone coin totalizer including a rotatable shaft, said shaft being rotationally responsive to the deposit of coins in said telephone and being rotated thereby through an angle indicative of the value of deposited coins, apparatus for rotating said shaft in incremental steps back to a zero position comprising, in combination, a ratchet wheel mounted on said shaft for driving relation therewith, a bifurcated pawl mounted for pivotal movement about a pivot pin, a guide block member including an elongated bearing slot providing a bearing for and defining the limits of movement for said pivot pin in a direction substantially perpendicular to the axis of said pin, an electromagnet, an armature responsive to energization of said electromagnet, a link member connecting said armature to said pin thereby to translate movement of said armature into movement of the pivot point of said pawl in said slot, means including a spring member having one end thereof anchored on said guide block and the other end thereof anchored on said pawl responsive to the movement of said pivot point beyond a preselected distance along said slot from a normal rest position for pivoting said pawl about said pin whereupon one end of said pawl is dropped into engaging-driving relation between an adjacent pair of the teeth on said wheel, whereby upon the reversal of direction of movement of said pivot pin back toward said normal rest position said wheel is driven through an angle of rotation substantially equal to the angular separation between adjacent ones of said teeth, and means including said spring operative upon the shift of said pivot point back to said initial position for pivoting said pawl thereby to lift said one end clear of said wheel and to drop the other end of said pawl into engaging-arresting relation with said wheel whereby the rotation of said wheel is abruptly terminated.

8. Apparatus in accordance with claim 7 including first means for adjusting the degree of engagement between the ends of said pawl and said wheel including means for adjusting the position of said guide block with respect to said wheel.

9. Apparatus in accordance with claim 7 including means for adjusting the point of travel of said pivot point at which said first end of said pawl is dropped into engaging-driving relation with said wheel, said last named means including a plurality of holes in said guide block providing alternative anchoring locations for one end of said spring.

10. Apparatus in accordance with claim 7 including a ratchet wheel centering roller spring-loaded against the outer periphery of said wheel whereby upon the near approach of said wheel to a rest condition said roller is forced into the gap between a preselected adjacent pair of said teeth thus determining precisely the final rest position of said wheel.

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BROUGHTON G. DURHAM, *Primary Examiner.*

DON A. WAITE, *Examiner.*