March 24, 1936. N. A. NEWELL 2,034,825

METERING ASSEMBLY

Filed May 17, 1932 2 Sheets-Sheet 1

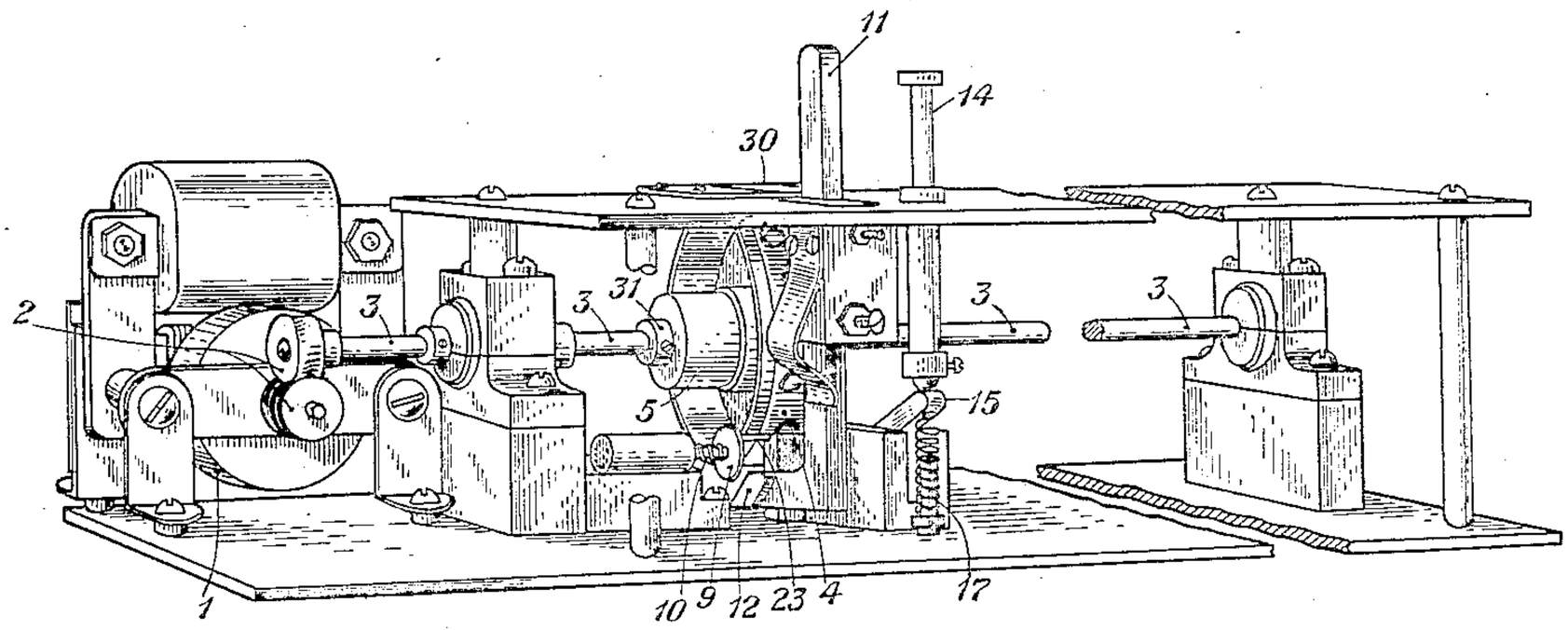

Fig. 1

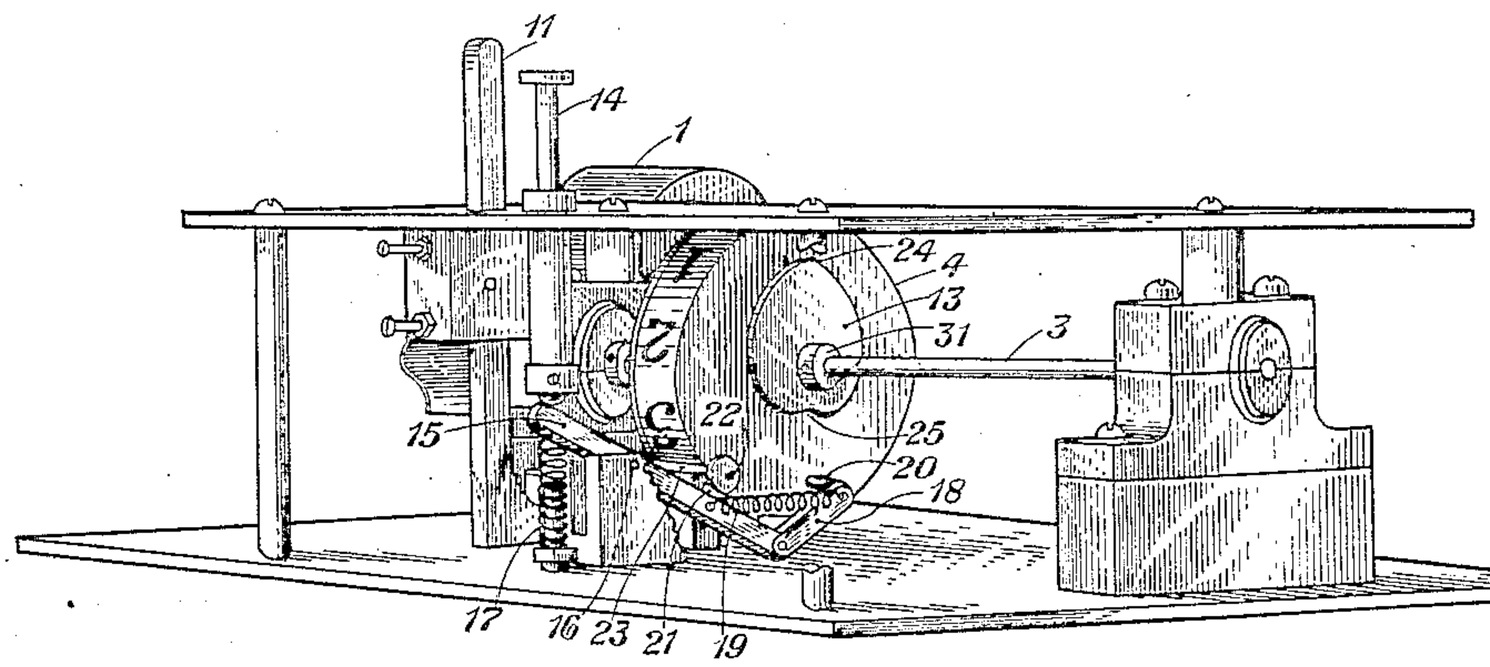

Fig. 2

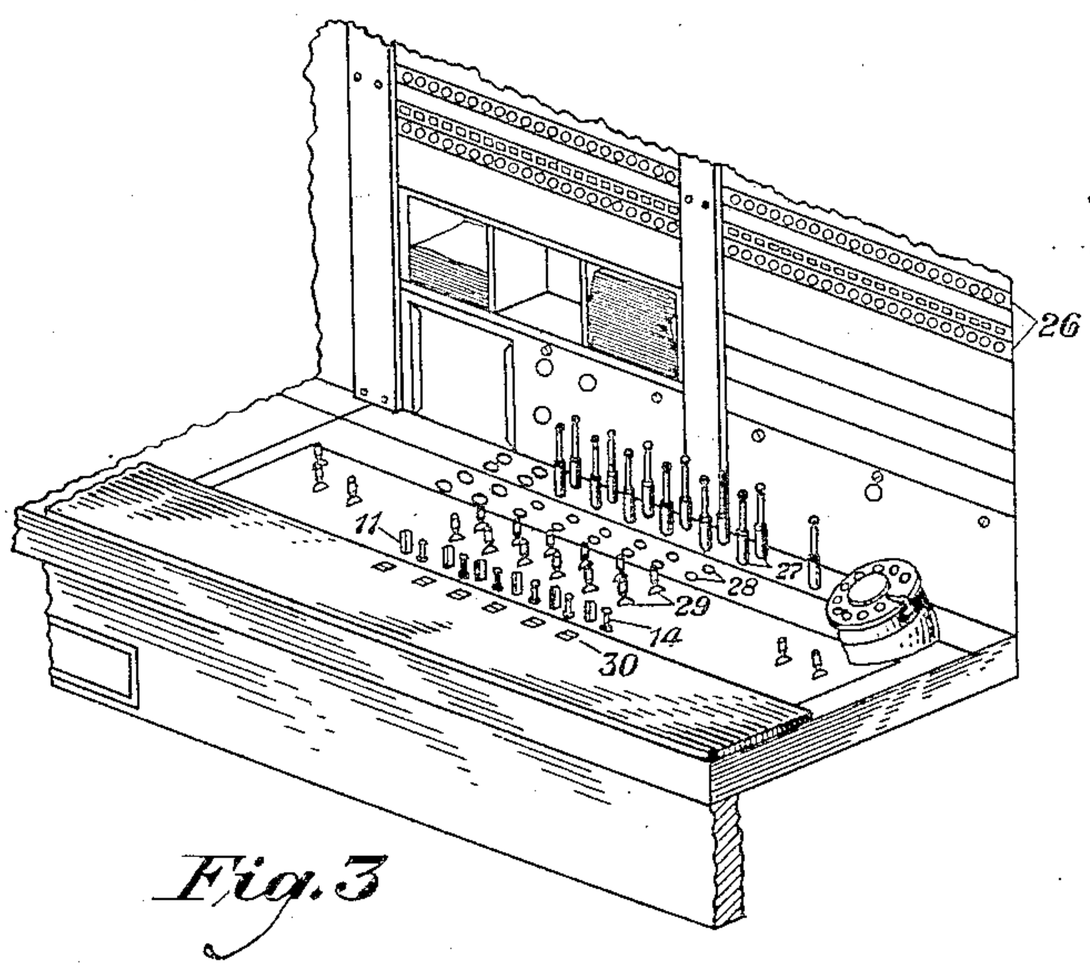

Fig. 3

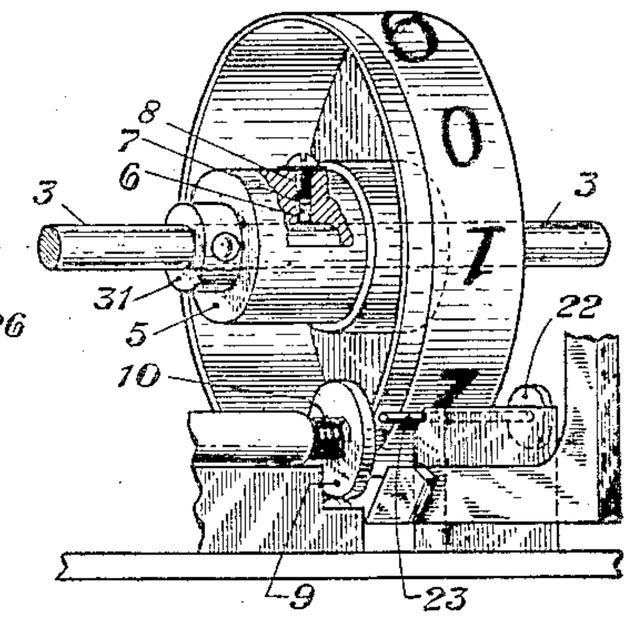

Fig. 4

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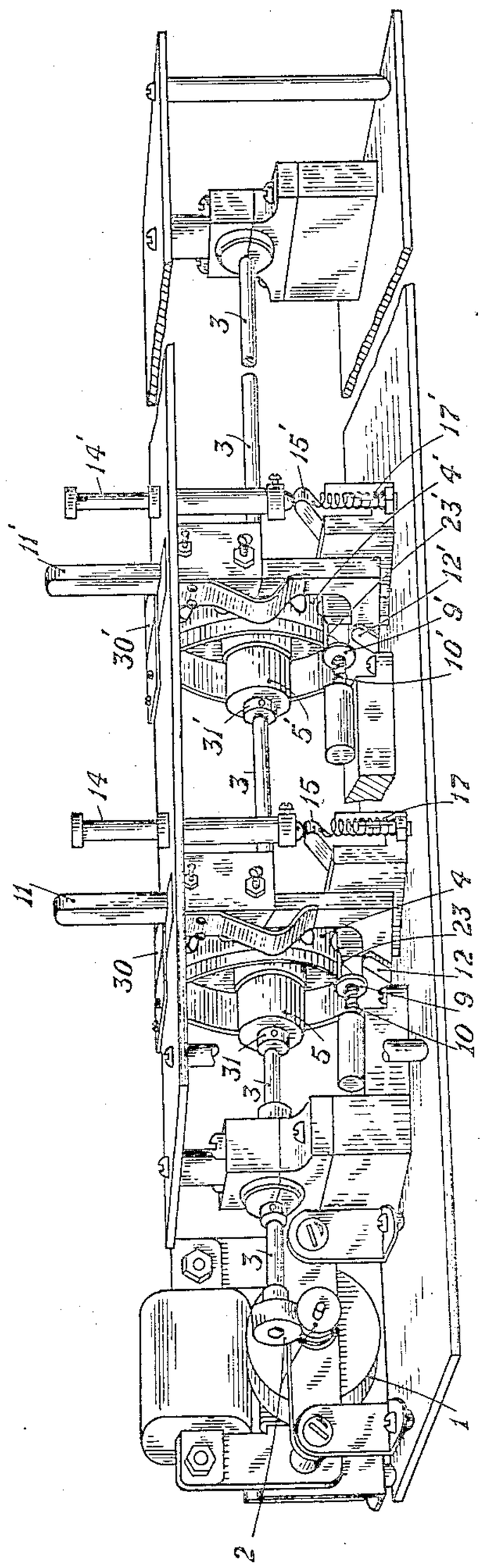

Fig. 5

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METERING ASSEMBLY

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Application May 17, 1932, Serial No. 611,896

16 Claims. (Cl. 161—15)

This invention relates to drive assemblies, and more particularly to motor drive assemblies adapted for use in connection with elapsed time registers associated with the switchboards of a telephone system to measure the elapsed time of telephone connections.

One object of the invention is to provide a simple and efficient group drive assembly for a motor, for example, in which the individual rotatable elements associated with the common driving shaft may be effectively associated with said shaft to cause their rotation and effectively disassociated therefrom to prevent their rotation, as desired.

Another object of the invention is to provide an individual elapsed time register for each cord circuit of a telephone switchboard for measuring the elapsed time of each connection completed by the use of the corresponding cord circuit, a plurality of said registers being associated with a common, constantly rotating, driving shaft and each individual register being provided with means for starting, stopping and restoring it to normal, as desired.

Another object of the invention is to provide an inexpensive and efficient register adapted for use in connection with such timing systems.

Other objects and features of the invention will be apparent from the detailed description hereinafter set forth.

In the drawings, Figure 1 shows a perspective view, from one side, of the drive assembly with a motor being shown as the driving source and the dial wheel of an elapsed time register being shown as the rotatable element; Fig. 2 shows a perspective view from the other side of said drive assembly; Fig. 3 illustrates a telephone switchboard position showing the manner in which one specific embodiment of the invention is associated with the equipment of a telephone system; Fig. 4 illustrates the manner in which the individual rotatable elements may be associated with the common driving shaft; and Fig. 5 illustrates in detail the manner in which a plurality of the rotatable elements may be associated with each other to form a drive assembly.

In Figs. 1, 2 and 5 a motor 1 is illustrated as the driving source. This motor is of the constant speed synchronous type and is adapted by means of the worm gear 2 to rotate the common driving shaft 3 at a speed of one revolution every 30 minutes, for example. Two of the rotatable elements are indicated at 4 and 4'. In the embodiment shown each rotatable element is the dial wheel of an elapsed time register adapted particularly for use in connection with a telephone switchboard for indicating the elapsed time of telephone connections. It is, of course, understood that any number of these rotatable elements may be mounted on the common shaft.

As shown, the register includes a dial wheel 4, the periphery of which is divided into 10 sections, for example, each section being divided into as many subdivisions as desired. The spider or hub 5 of the dial wheel is mounted on the common driving shaft 3 and is rotatably associated therewith by means of a ball bearing friction clutch illustrated in Fig. 4. This friction clutch includes a ball bearing 6 in a hole in the hub 5 and resting on the shaft 3. The bearing is pressed against the shaft by means of spring 7 which is held in place in the hole by set screw 8. Adapted to press against the rim of the dial wheel, when it is desired to maintain said wheel stationary, is a brake mechanism which includes a friction disc 9 supported by a slidable rod around which is wound a spring 10. When the brake mechanism is applied, the force exerted by said brake mechanism tending to prevent the rotation of the dial wheel is greater than the clutching force exerted by ball bearing 6 which is pressed against the rotating shaft 3 by spring 7 and which tends to cause the rotation of the dial wheel with the rotating shaft. As a result, the dial wheel remains stationary. Due to the fact that ball bearing 6 is free to turn in its hole, said ball bearing turns with the rotating shaft and thus reduces the drag or load on said shaft and the friction between the moving parts to a minimum. When the brake mechanism is released, the force exerted on ball bearing 6 by spring 7 is sufficient to cause said bearing to clutch the rotating shaft. As a result, the dial wheel rotates with the rotating shaft. The application and release of the brake mechanism is controlled by a brake control means which consists of a pivoted L-shaped bar 11. The end of the horizontal arm of this bar is wedge shaped as indicated at 12. The upper part of the vertical arm of this bar extends through a slot in the top of the frame, which incloses the entire assembly, so that the brake mechanism can be controlled from above. When the vertical arm is moved backward to release the brake mechanism, the horizontal arm is moved forward so that its wedge shaped end engages disc 9 of the brake mechanism and forces it away from the rim of the dial wheel in opposition to the force exerted by spring 10. When the vertical arm is moved forward to apply the brake mechanism, the horizontal arm is moved backward so that

its wedge shaped end is disengaged from said disc, which is again forced against the rim of the dial wheel by spring 10.

Each register also includes means for restoring it to its normal or zero position. This means includes a heart shaped cam 13 rotatably mounted on the common driving shaft and fixed to one side of the dial wheel, a push button 14, means controlled by the operation of the push button and adapted, when said button is operated, to press against said heart shaped cam, and means controlled by the operation of said button to release said brake mechanism. The bar member 15 which is pivoted at 16 is positioned beneath the push button in such a manner that when the button is pressed down its lower end presses against one end of said bar member. A spring 17 is positioned beneath this end of the bar member to return said end of the bar member and said push button to their normal position when said button is released. At the other end of said bar member is a pivoted arm 18. This arm is normally positioned at an angle with respect to bar member 15 by means of spring 19. At the free end of arm 18 is pivoted another arm 20 which extends toward the side of the dial wheel and is adapted to rotate freely on its pivot. On the inner side of arm 15 is fixed a wedge shaped member 21. Positioned above, and in alignment with wedge shaped member 21 is a disc 22 which is connected to and supported by a slidable rod 23. This rod passes under the dial wheel and its other end is in contact with disc 9 of the brake mechanism. Heart shaped cam 13 is fixed to the dial wheel in such a manner that when said dial wheel is in its zero position, the pointed end or apex 24 of the heart shaped cam is in alignment with the zero division on the periphery of the dial wheel. Arm 18 is positioned at such an angle that when the dial wheel is in its zero position, arm 20 is directly beneath the indented part 25 of the heart shaped cam. If the dial wheel is in any off-normal position and it is desired to restore it to its normal or zero position, push button 14 is pressed down. This causes the upper end of arm 15 to move downward and its lower end to move upward. The upward movement of the lower end of arm 15 causes wedge shaped member 21 to engage disc 22 which by means of connecting rod 23 disengages disc 9 of the brake mechanism from the rim of the dial wheel and thus permits said dial wheel to rotate freely during the restoring process. The upward movement of the lower end of arm 15 also causes arm 20 normally to press against the side of the heart shaped cam in a direction toward its axis, which causes said cam to rotate in either direction, depending upon which side of the indented part of the cam comes in contact with arm 20, until arm 20 comes to rest in the indented part 25 of the cam. The restoration of the cam to this position causes a rotation of the dial wheel to its zero position. If, in its upward movement, arm 20 should come in contact exactly with the pointed end or apex 24 of the cam, arm 18 is adapted to be momentarily pressed outward against the force exerted by spring 19. As a result the direction of the force exerted on the cam is momentarily changed, it now being exerted at a tangent thereto. This momentary change in the direction of the force moves the cam from this critical position and permits the further application of the force in its normal direction to continue to move the cam until it has rotated to its normal or zero position. When button 14 is released, spring 17 restores the button and arm 15 to their normal position. The restoration of arm 15 disengages wedge shaped member 21 from the disc 22 which in turn permits the reapplication of the brake mechanism to hold the dial wheel in its zero position.

As stated above, Fig. 3 illustrates the manner in which the drive assembly and the rotatable element may be used in connection with the equipment of a telephone system where said rotatable element constitutes a part of an elapsed time register for measuring the time of telephone calls. In said figure, 26 indicates the jacks associated with the switchboard, 27 the plugs of the cord circuits, 28 the signal and supervisory lamps and 29 the ringing, talking and monitoring keys. A constant speed synchronous motor and a single driving shaft, such as that indicated at 1 and 3, respectively, of Fig. 1, is provided for each switchboard position or for every two switchboard positions. Associated with the driving shaft is an elapsed time register individual to each cord circuit, for example, of the type illustrated in Figs. 1, 2 and 5 and described above. Individual to each register are means to control the starting and stopping of the corresponding register and means to restore the dial wheel of the corresponding register to its normal or zero position. This equipment is preferably located under the key shelf of the switchboard, the dial wheel of each register occupying a position corresponding to the position of the plug 27 of the cord circuit with which each register is to be used and being visible to the operator through windows in the key shelf indicated at 30. The bars 11 of the brake mechanism and the push button 14 of the restoring mechanism extend up through the key shelf and occupy the relative positions indicated in Fig. 3. Extending across each of the windows 30 is a hair line to permit the operator to make more accurate readings of the registers. Adjustable collars 31 are provided to hold the dial wheels in their proper positions with respect to the windows and to each other.

The switchboard illustrated in Fig. 3 is of the type used for establishing toll connections and the operation of the system will be described, for convenience, in connection with the establishment and timing of a toll connection. When the calling subscriber is connected with the toll operator, the operator identifies the calling subscriber and fills in the toll ticket. When the called subscriber answers, the operator operates the bar or key 11 which corresponds to the cord circuit used for the connection. As described above, this disengages disc 9 from the rim of the dial wheel. The ball bearing friction clutch now becomes effective to cause the rotation of the dial wheel with the constantly rotating driving shaft. The dial wheel continues to rotate during the duration of the call. At the termination of the call the operator restores key 11 to its normal position. As described above, this reapplies the brake mechanism and prevents any further rotation of the dial wheel. Since the dial wheel is very accurately calibrated with respect to the speed of rotation, the reading on the dial wheel under the hair line of the corresponding window 30 and visible through said window, indicates very accurately the elapsed time of the call. The operator after noting the elapsed time of the call fills it in on the ticket and operates push button 14 of the register. As described above, this momentarily releases the brake mechanism and forces arm 20 up against the heart shaped cam

13 which restores the dial wheel to its zero position. The operator then releases button 14 which reapplies the brake mechanism. If the operator is too busy when the call is terminated to record the elapsed time on the ticket, the operation of the push button may be delayed until the cord circuit is again required for use in establishing a call. A clock may be associated with the switchboard to record the time of day at which the call is made. Such a clock may, if desired, be driven by the same motor that operates the register.

Although the operation of the system has been described in connection with establishing and timing a toll connection, it should be understood that the apparatus and features thereof may be used to time any kind of telephone call and that the apparatus and features thereof may be used with other systems than a telephone system to time any operation, without departing from the spirit and scope of the invention. It is also to be understood that the drive assembly and the features thereof may be used in connection with other types of elapsed time registers and, in fact, with other types of rotatable elements than the dial wheels of elapsed time registers.

What is claimed is:

1. In combination, a motor, a plurality of rotatable elements, a common driving shaft rotated by said motor and adapted to rotate said rotatable elements, a brake means for each rotatable element adapted, when applied, to prevent the rotation of only the corresponding rotatable element, a clutch means for each rotatable element adapted to permit the rotation of said common shaft and the other rotatable elements when the corresponding brake means is applied and to cause the corresponding rotatable element to rotate with said common shaft when the brake means corresponding thereto is released, reset means for each rotatable element adapted to permit the rotation of the corresponding rotatable element through any part of a revolution or through any number of revolutions and adapted independently of said motor to restore the corresponding rotatable element without affecting the positions of the other rotatable elements to the position said corresponding rotatable element occupied prior to its rotation and a stationary reference individual to each rotatable element for indicating the position the corresponding rotatable element occupied prior to its rotation.

2. In combination, a continuously operated, constant speed motor, a plurality of rotatable elements, a common driving shaft which is rotated continuously at a constant speed by said motor and upon which said rotatable elements are mounted, a normally applied brake means individual to each rotatable element and adapted to maintain only the corresponding rotatable element stationary in a predetermined position, a stationary reference individual to each rotatable element for indicating the predetermined position of the corresponding rotatable element, clutch means individual to each rotatable element and adapted to permit the substantially free rotation of said shaft when the corresponding brake means is applied and to cause the rotation of the corresponding rotatable element with said shaft when the brake means corresponding thereto is released, means individual to each rotatable element for releasing and reapplying the corresponding brake means to start and stop the rotation of the corresponding rotatable element, as desired, and means individual to each rotatable element for restoring independently of said motor the corresponding rotatable element to its predetermined position without affecting the positions of the other rotatable elements.

3. In combination, a continuously operated, constant speed motor, a plurality of rotatable elements, a common driving shaft which is operated continuously at a constant speed by said motor and upon which said rotatable elements are mounted, a normally applied brake means individual to each rotatable element and adapted to maintain only the corresponding rotatable element stationary in a predetermined position, a ball-bearing friction clutch means individual to each rotatable element and adapted to permit the free rotation of said shaft when the corresponding brake means is applied and to cause the rotation of the corresponding rotatable element with said shaft when the brake means corresponding thereto is released, means individual to each rotatable element for releasing and re-applying the corresponding brake means to start and stop the corresponding rotatable element as desired, and means individual to each rotatable element and including a heart shaped cam fixed to one side of the corresponding rotatable element for simultaneously releasing the corresponding brake means and restoring the corresponding rotatable element to its pre-determined position.

4. A measuring device comprising, in combination, a driving shaft adapted to rotate continuously at a constant speed, a dial wheel mounted in a predetermined position on said driving shaft, means for rotating said driving shaft continuously at a constant speed, a normally applied brake means adapted to maintain said dial wheel stationary in said predetermined position, clutch means adapted to permit the substantially free rotation of said shaft when said brake means is applied and to cause the rotation of said dial wheel with said shaft when said brake means is released, means for releasing and re-applying said brake means to start and stop the rotation of said dial wheel, as desired, and reset means adapted to permit the rotation of said dial wheel through any part of a revolution or through any number of revolutions and to simultaneously release said brake means and restore said dial wheel independently of said driving shaft to said predetermined position.

5. A measuring device, comprising, in combination, a driving shaft adapted to rotate continuously at a constant speed, a dial wheel mounted in a predetermined zero position on said driving shaft, means for rotating said driving shaft continuously at a constant speed, a normally applied brake means adapted to maintain said dial wheel stationary in said zero position, a ball-bearing friction clutch means adapted to permit the substantially free rotation of said shaft when said brake means is applied and to cause the rotation of said dial wheel with said shaft when said brake means is released, means for releasing and re-applying said brake means to start and stop the rotation of said dial wheel, as desired, and means for simultaneously releasing said brake means and restoring said dial wheel to its normal, zero position.

6. A register comprising, in combination, a driving shaft adapted to rotate continuously at a constant speed, a dial wheel mounted in a predetermined zero position on said driving shaft, means for rotating said driving shaft at a constant speed, a normally applied brake means adapted to maintain said dial wheel stationary

in said zero position, a clutch means including a ball-bearing positioned between said dial wheel and said shaft to permit the substantially free rotation of said shaft when said brake means is applied and to cause the rotation of said dial wheel with said shaft when said brake means is released, means for releasing and re-applying said brake means to start and stop the rotation of said dial wheel, as desired, and means including a heart shaped cam fixed to one side of said dial wheel, for simultaneously releasing said brake means and restoring said dial wheel to its normal, zero position.

7. A register comprising, in combination, a driving shaft adapted to rotate continuously at a constant speed, a dial wheel mounted in a predetermined, zero position on said driving shaft, means for rotating said driving shaft continuously at a constant speed, a normally applied brake means adapted to maintain said dial wheel stationary in said zero position, clutch means including a ball-bearing positioned between said dial wheel and said shaft to permit the substantially free rotation of said shaft when said brake means is applied and to cause the rotation of said dial wheel with said shaft when said brake means is released, means for releasing and re-applying said brake means to start and stop the rotation of said dial wheel, as desired, a heart shaped cam rotatably mounted on said shaft and fixed to one side of said dial wheel in such position that its apex is in alignment with the zero position of said dial wheel, a rotatable bar member positioned in alignment with the indented part of said cam and opposite said apex, means for simultaneously releasing said brake means and causing said bar member to press against the side of said cam in a direction toward the axis thereof to restore said dial wheel from any off-normal position to its zero position, and means associated with said bar member and operative when said bar member presses exactly against the apex of said cam to cause said bar member to press against the side of said cam momentarily in a direction at a tangent to said cam.

8. Means for timing the duration of telephone connections established at a central switchboard by means of a plurality of link circuits comprising, in combination, a timing device, including a dial wheel, for each link circuit, a driving shaft common to said timing devices and adapted to rotate the dial wheels of said timing devices, a continuously operated, constant speed motor for rotating said driving shaft continuously at a constant speed, normally applied brake means individual to each timing device and adapted to maintain the dial wheel of only the corresponding timing device stationary in a predetermined position, a stationary reference individual to each timing device for indicating the predetermined position of the corresponding dial wheel, clutch means individual to each timing device and adapted, when the corresponding brake means is applied, to permit the substantially free rotation of said common shaft and, when said corresponding brake means is released, to cause the rotation of the corresponding dial wheel with said shaft to measure the elapsed time of each connection established by means of the corresponding link circuit, means individual to each timing device for releasing and reapplying the corresponding brake means to start and stop the rotation of the corresponding dial wheel, as desired, and reset means individual to each timing device and adapted to permit the rotation of the corresponding dial wheel through any part of a revolution or through any number of revolutions and to restore the corresponding dial wheel independently of said motor to its predetermined position without affecting the positions of the other timing devices.

9. Means for measuring the duration of telephone connections established at a central switchboard by means of a plurality of cord circuits comprising, in combination, a timing device, including a dial wheel, for each cord circuit, a driving shaft common to said timing devices and adapted to rotate the dial wheels of said timing devices, a continuously operated, constant speed motor for rotating said driving shaft continuously at a constant speed, normally applied brake means individual to each timing device and adapted to maintain the dial wheel of only the corresponding timing device stationary in a predetermined zero position, ball-bearing friction clutch means individual to each timing device and adapted, when the corresponding brake means is applied, to permit the substantially free rotation of said common shaft and, when said corresponding brake means is released, to cause rotation of the corresponding dial wheel with said common shaft to measure the elapsed time of each connection established by means of the corresponding cord circuit, and means individual to each timing device and including a heart shaped cam fixed to one side of the corresponding dial wheel for simultaneously releasing the corresponding brake means and restoring only the corresponding dial wheel to its normal, zero position without affecting the operation or positions of the dial wheel of the other timing devices.

10. In combination, a motor, a plurality of rotatable elements, a common driving shaft rotated by said motor and adapted to rotate said rotatable elements, a first means individual to each rotatable element adapted to cause the rotation of only the corresponding rotatable element with said common driving shaft and to prevent the rotation of only the corresponding rotatable element, as desired, while permitting the rotation of said common driving shaft and of the other rotatable elements, a second means individual to said first means for controlling its operation, a third means individual to each rotatable element and adapted to permit the rotation of the corresponding rotatable element through any part of a revolution or through any number of revolutions and independently of said motor to restore the corresponding rotatable element, without affecting the positions of the other rotatable elements, from any off-normal position to the position said corresponding rotatable element occupied prior to its operation and a stationary reference individual to each rotatable element for indicating the position the corresponding rotatable element occupied prior to its rotation.

11. In combination, a constant speed motor, a driving shaft rotated by said motor, a plurality of timing devices adapted to be operated by said shaft, a stationary reference individual to each timing device for indicating the amount of rotation of the corresponding timing device, means individual to each timing device for starting only the corresponding device into operation and for stopping only the corresponding device, as desired, without affecting the operation of the other timing devices, and means individual to each device and adapted to permit the operation of the corresponding device through any part of a revolution or through any number of revolutions and independently of said motor to restore the corre-

sponding device, without affecting the positions of the other devices, from any off-normal position to the position said corresponding device occupied prior to its operation.

12. In combination, a continuously operated, constant speed motor, a single driving shaft rotated continuously at a constant speed by said motor, a plurality of timing devices mounted on said shaft, each of said devices having a rotatable element which is adapted normally to remain stationary in a predetermined position while said shaft rotates, a stationary reference individual to each timing device for indicating the predetermined position of the corresponding rotatable element, means individual to each timing device for causing the rotatable element of the corresponding timing device to rotate with said shaft and for stopping the rotation thereof, as desired, without interfering with the rotation of said shaft, and means individual to each timing device and adapted to permit the rotation of the rotatable element of the corresponding timing device through any part of a revolution or through any number of revolutions and independently of said motor to restore the rotatable element of only the corresponding timing device, without affecting the positions of the rotatable elements of the other timing devices, from any off-normal position to said predetermined position.

13. Means for timing the duration of telephone connections established at a central switchboard by means of link circuits comprising, in combination, a motor, a driving shaft rotated by said motor, a plurality of timing devices, one for each link circuit, adapted to be operated by said driving shaft, a stationary reference individual to each timing device for indicating the amount of operation of the corresponding timing device, means individual to each timing device for starting only the corresponding timing device into operation to measure the elapsed time of each telephone connection established by means of the corresponding link circuit and for stopping only said corresponding device, and means individual to each timing device and adapted to permit the operation of the corresponding timing device through any part of a revolution or through any number of revolutions and independently of said motor to restore the corresponding timing device, without affecting the positions of the other timing devices, from any off-normal position to its zero position.

14. Means for timing the duration of telephone connections established at a central switchboard by means of link circuits comprising, in combination, a plurality of timing devices, one for each link circuit, a driving shaft common to said timing devices and adapted to operate said timing devices when said timing devices are effectively connected thereto, a stationary reference individual to each timing device for indicating the amount of operation of the corresponding timing device, a motor for rotating said driving shaft, means individual to each timing device for starting only the corresponding timing device into operation to measure the elapsed time of each telephone connection established by means of the corresponding link circuit and for stopping only said corresponding device, and means individual to each timing device and adapted to permit the operation of the corresponding timing device through any part of a revolution or through any number of revolutions and independently of said motor to restore the corresponding timing device, without affecting the positions of the other timing devices, from any off-normal position to its zero position.

15. Means for timing the duration of telephone connections established at a central switchboard by means of cord circuits comprising, in combination, a plurality of timing devices, one for each cord circuit, a driving shaft common to said timing devices and adapted to operate said timing devices when said timing devices are effectively connected thereto, a stationary reference individual to each timing device for indicating the amount of operation of the corresponding timing device, a continuously operated, constant speed motor for rotating said driving shaft continuously at a constant speed, means individual to each timing device for effectively connecting only the corresponding timing device with said shaft to measure the elapsed time of each talking connection established by means of the corresponding cord circuit and for effectively disconnecting only said corresponding device from said shaft to stop the operation of said corresponding device, and means individual to each timing device and adapted to permit the operation of the corresponding timing device through any part of a revolution or through any number of revolutions and independently of said motor to restore the corresponding timing device, without affecting the positions of the other timing devices, from any off-normal position tc its zero position.

16. In combination, a motor, a plurality of rotatable elements, a common driving shaft rotated by said motor and adapted to cause the rotation of said rotatable elements, a first means individual to each rotatable element for starting and stopping, as desired, the rotation of only the corresponding rotatable element without affecting the operation of the other rotatable elements, a second means individual to said first means for controlling its operation, and a third means individual to each rotatable element adapted to permit the rotation of the corresponding rotatable element through any part of a revolution or through any number of revolutions and operative independently of said motor to restore the corresponding rotatable element, without affecting the positions of the other rotatable elements, from any off-normal position to the position it occupied prior to its rotation, said first means being operative to release its corresponding rotatable element simultaneously with the operation of said third means.

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