March 16, 1937. I. C. OSTEN-SACKEN 2,073,756

TIMING MECHANISM

Filed March 10, 1936

FIG. 1

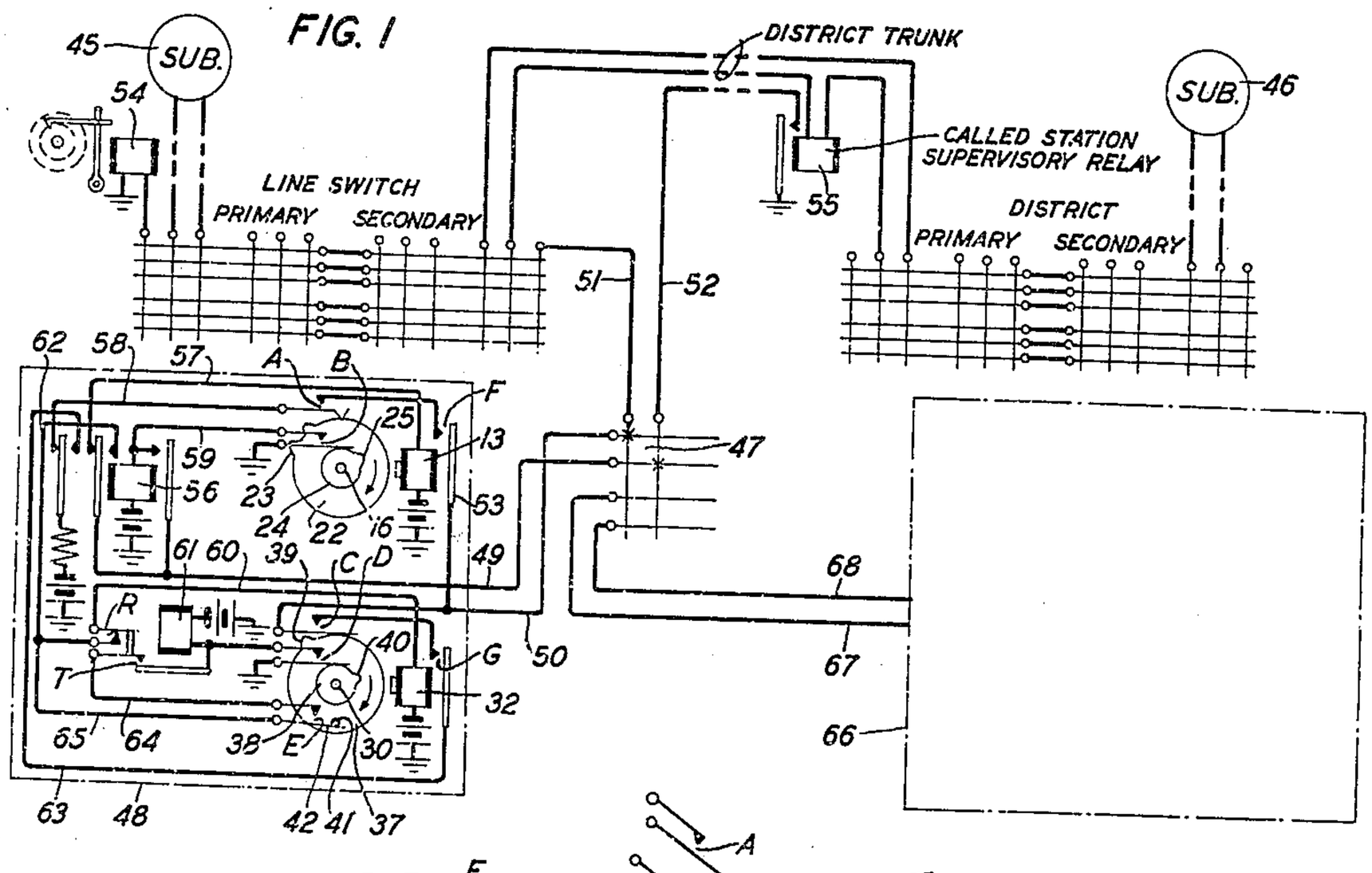
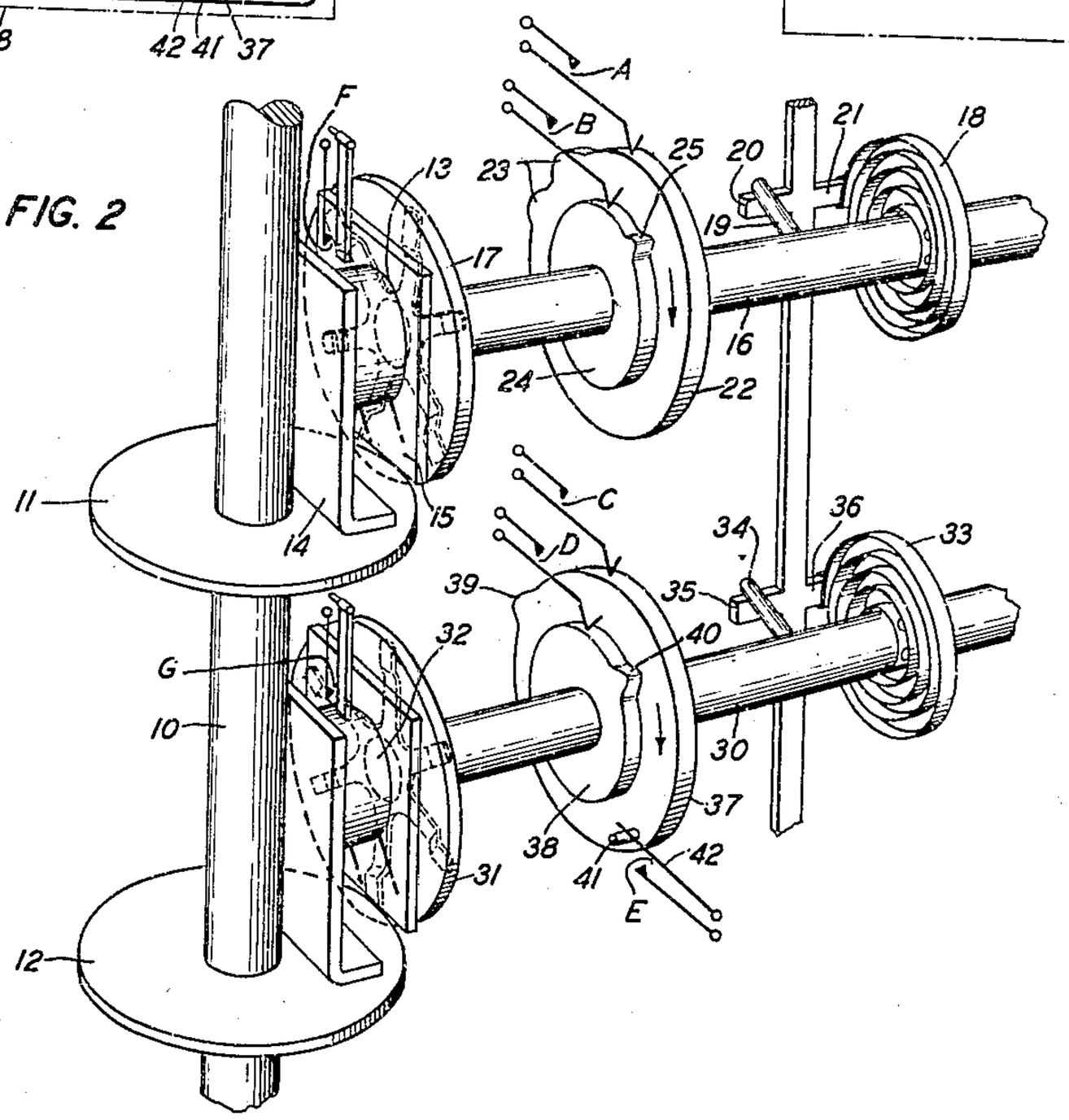


FIG. 2



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TIMING MECHANISM

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10 Claims. (Cl. 179—7.1)

This invention relates to timing mechanisms and particularly to devices of this character used for measuring intervals of conversation in a telephone system to determine thereby the appropriate charge for the service rendered. The invention is particularly applicable to zone calls where the charges for any overtime period may be different from the rate charges for the initial period.

An object of the invention is to simplify and improve devices used for measuring and indicating intervals of time to render them more accurate and reliable in their operation and to render them capable with only minor changes of assessing charges according to a variety of requirements with respect to initial and overtime charges.

The timing mechanism of this invention is particularly applicable for use with message register service disclosed in the copending application of F. J. Scudder, Serial No. 68,044, filed March 10, 1936.

In its preferred form, the zone timing mechanism has one timing element for measuring the initial period and a second timing element for measuring any overtime period, each element having electromagnetic means for associating its element with a shaft rotatable at constant speed. When the calling and called stations have been connected and the called party has answered, means are provided for engaging said shaft with an initial period timing element appropriate for the zone called. This initial timing element has rotatable cam means for closing a charging circuit the number of times required to secure the proper operation of the calling subscriber's message register. Just prior to the completion of the initial period the initial timing element controls the engagement of a rotatable overtime element to said shaft for the measurement of the overtime period. The overtime element has rotatable cam means for closing a charging circuit leading to the calling subscriber's message register to secure the proper charging for each overtime period. A biasing spring may be employed to restore the initial period timing unit to its normal position at the completion of the initial period and similar means may be employed to restore the overtime element to its normal position at the termination of each overtime period. Other features of the invention will appear hereinafter.

Referring to the drawing:

Figure 1 is a schematic representation of one form of this invention employed as a zone timing mechanism in a machine switching telephone system; and

Fig. 2 is a view in perspective of the zone timing mechanism.

Referring more particularly to Fig. 2 the timing device comprises a vertical shaft 10 rotating at constant speed on which are mounted a plurality of spaced discs 11 and 12. Suitably mounted adjacent discs 11 is an initial clutch magnet 13 the magnetic circuit for which comprises in part the angle piece 14 and the stationary plate 15. A suitably mounted rotatable shaft 16 has a disc 17 of magnetic material flexibly coupled thereto for angular movement when attracted by the magnet 13. The attraction of disc 17 by the magnet serves to bring discs 11 and 17 into engagement to cause the rotation of shaft 16 as long as magnet 13 is energized. Shaft 16 is biased to a definite normal position by a restoring spring 18 which normally holds pin 19 on shaft 16 against the stationary stop 20. One end of the coiled spring 18 is fastened to shaft 16 and its other end is fastened to a stationary supporting arm 21. Shaft 16 also carries a cam ring 22 having two projections 23 for closing twice the charging contacts A shortly after shaft 16 has been advanced from its normal position by rotation in a clockwise direction as viewed in Fig. 2. Another cam ring 24 mounted on shaft 16 has a projection 25 which when the shaft 16 has substantially completed a revolution serves to close spring contacts B. The clutch magnet 13 and shaft 16 with the associated apparatus may be utilized to measure the initial period of a telephone conversation, assuming that shaft 16 is rotated at such a speed that the initial period is terminated when projection 25 closes contacts B and the closing of contacts B at the end of the initial period may be employed to deenergize clutch magnet 13 and start the rotation of a similar device for measuring the overtime period, assuming that the telephone conversation to be timed is still continuing.

The overtime period may be measured by the rotation of a shaft 30 associated with shaft 10 in the same manner as shaft 16. Shaft 30 has flexibly mounted on one end thereof a disc 31 of magnetic material which when overtime clutch magnet 32 is energized will be attracted into engagement with disc 12 on shaft 10 to produce the clockwise rotation of shaft 30 as long as the engagement continues. Shaft 30 is also biased to a definite normal position by a coiled spring 33 which normally will cause pin 34 on shaft 30 to engage the stationary stop 35. One end of

spring 33 is fastened to shaft 30 and the other end to the stationary arm 36. Shaft 30 carries two cam rings 37, 38 adapted by projections 39, 40 to operate spring contacts C and D respectively. Cam 37 also carries a laterally projecting pin 41 which when the shaft 30 is in its normal position presses against spring member 42 to keep open the spring contacts E, but it will be obvious that contacts E will be closed as soon as cam 37 has advanced from its normal position.

It should also be noted that there is a pair of contacts F which will be closed when initial clutch magnet 13 is energized and the corresponding contacts G will be closed when overtime clutch magnet 32 is energized.

The manner in which the initial period shaft 16 and the overtime period shaft 30 may be utilized in the measurement of a particular conversation will now be described in connection with Fig. 1. The various connections and apparatus involved are not completely shown inasmuch as they do not constitute a part of this invention, but for a fuller description of message register circuits capable of employing the timing mechanism of this invention reference may be made to the above mentioned copending application of F. J. Scudder.

Referring to Fig. 1 it will be assumed that the call initiated by the calling station 45 is to a station served by an exchange outside the local area and that for such a called station 46 the calling subscriber's message register should be operated twice for the initial period and once for each overtime period. The calling subscriber's station 45 will be connected through the primary and secondary switches of the line switch through a district trunk and a district primary and secondary switch to the called subscriber's station 46. A decoder marker (not shown) acting from the office code information transmitted to it selects an idle timing mechanism which is applicable for the zone in which the called station exchange is located as will be understood from the above mentioned Scudder application. It may be assumed that the timing mechanism selected is the one in which magnet 13 controls the timing for the initial period and magnet 32 controls the timing for the overtime period. Hence the decoder marker serves to operate a suitable switching mechanism 47 to connect the control conductors 49, 50 of the selected timing mechanism 48 to the conductors 51, 52 individual to the district trunk utilized in establishing the connection between the calling and called stations.

It will be noted that the operation of switch 47 serves to establish a circuit between armature 53 of clutch magnet 13 and the winding of the calling subscriber's message register relay 54 which circuit may be traced from armature 53, conductors 50, 51, over the lowest operated contacts of the primary and secondary line switch cross-points, to the winding of the register relay 54, but relay 54 does not operate at this time since magnet 13 is deenergized and the contacts F are open. When the called station answers, the called station supervisory relay 55 is operated and pulls up its armature, thereby establishing a circuit from ground, the front contact relay 55, conductors 52, 49, left inner back contact relay 56, conductor 57 and winding of relay 13 to battery and ground. The closing of this circuit initiates the measurement of the initial period of the conversation by causing clutch magnet 13 to close contacts F and to start the rotation of shaft 16 which carries the cam wheels 22, 24. As will be noted from both Figs. 1 and 2 the cam wheel 22 will advance only a small amount from its normal position when projections 23 will cause two successive closures of the charging contacts A. Each time the contacts A are closed by the clockwise rotation of cam 22 from its normal position the message register relay 54 is operated by the closure of a circuit which may be traced from battery, left outer back contact relay 56, conductor 58, closed contacts A, closed contacts F, conductors 50, 51, primary and secondary line switches to winding of register relay 54, so that each closure of contacts A serves to operate the message register relay of the calling subscriber.

It will be assumed that the initial period is completed when cam wheel 24 has been rotated a sufficient extent to cause its projection 25 to close the spring contacts B. The closure of contacts B operates relay 56 over a circuit from battery, winding relay 56, conductor 59, closed contacts B to ground and the relay 56 thereupon locks up over a circuit from battery, winding relay 56, right front contact relay 56, conductors 49, 52 and front contact supervisory relay 55 to ground. The operation of relay 56 opens the energizing circuit for initial clutch magnet 13 previously traced through the left inner back contact relay 56, and magnet 13 thereupon disengages disc 17 from disc 11 to permit shaft 16 to be restored to its normal position by restoring spring 18. The return of cam wheel 22 to its normal position again closes charging contacts A but this does not affect the message register since the contacts F are now open.

The operation of relay 56 also initiates the starting of the timing mechanism for measuring the overtime period of the conversation by closing a circuit which may be traced from battery, winding overtime clutch magnet 32, conductor 60, closed contacts R of relay 61, conductor 62, left inner front contact relay 56, conductors 49, 52, contact supervisory relay 55 to ground. The energization of clutch magnet 32 closes its contacts G and causes disc 31 to engage disc 12 so as to start the clockwise rotation of shaft 30 which carries the cam wheels 37, 38. As soon as projection 39 on cam wheel 37 has advanced far enough to close the charging contacts C the calling subscriber's message register relay 54 is operated once over a circuit from battery, left outer front contact relay 56, conductor 63, closed contacts G, closed contacts C, conductors 50, 51, the primary and secondary line switches to the winding of the register relay 54. The advancement of cam wheel 37 also moves pin 41 away from the biased spring contact 42 and allows contact E to close for a purpose hereinafter described.

The first overtime period will be completed when cam wheel 38 has rotated a sufficient extent to permit its projection 40 to close contacts D. The closure of contacts D causes relay 61 to operate over a circuit from battery, winding relay 61 and contacts D to ground. Relay 61 in operating locks up over a circuit from battery, winding relay 61, contacts T, relay 61, conductor 64, closed contacts E, conductors 65, 62, left inner front contact relay 56, conductors 49, 52 and front contact supervisory relay 55 to ground so that relay 61 remains operated as long as contacts E remain closed in spite of the fact that contacts D will be opened again as soon as the restoring movement of shaft 30 has started.

The operation of relay 61 also opens its contacts R to break the previously traced energizing circuit for clutch magnet 32. Magnet 32 in releasing disengages discs 31 and 12 and allows shaft 30 to restore to its normal position under the action of restoring spring 33. Cam wheel 37 in restoring to normal again closes the charging contacts C but this produces no effect on the message register relay 54 since contacts G are open during the restoring movement.

If the conversation between the stations continues into a second overtime period with supervisory relay 55 remaining operated the arrangement is such as to start another clockwise rotative movement of shaft 30 to measure this second overtime period. Just prior to the instant shaft 30 has been restored to its normal position by spring 33, pin 41 on cam wheel 37 operates spring 42 to open the contacts E. The opening of contacts E opens the previously traced locking circuit for relay 61 and relay 61 in releasing opens contacts T and allows its contacts R to close. The closure of contacts R reestablishes the energizing circuit for magnet 32 and hence shaft 30 again starts rotating clockwise to measure the second overtime period. Shortly after its second rotative movement has begun, the charging contacts C are again closed to operate the message register relay 54 to secure the proper charging for the second overtime period. At the expiration of the second overtime period relay 32 will release to allow cam wheels 37, 38 to restore to normal, whereupon magnet 32 will again be energized for measuring the next overtime period, etc.

Whenever the calling subscriber hangs up, switching mechanism not shown herein but disclosed in the above mentioned Scudder application will operate switch 47 to disconnect the timing mechanism 48 from the conductors 51, 52 to restore the timing mechanism 48 to normal and permit its use for timing a subsequent conversation for which its initial and overtime charging rates are applicable.

It is to be understood that it is contemplated that there will be available a number of timing mechanisms similar to mechanism 48 and that suitable means may be provided for selecting an idle timing mechanism for measuring the duration of each zone call. It was also to be understood that there will be other groups of timing mechanisms available for selection, each group having initial and overtime charging rates different from those of mechanism 48, which, for example, makes a double charge for an initial period of five minutes and makes a single charge for each overtime period of three minutes. Thus, the timing mechanism indicated schematically by block 66 may comprise mechanism similar to mechanism 48 except that its initial cam wheel corresponding to wheel 22 operates the calling subscriber's message register relay six times for an initial period of five minutes by having six projections thereon corresponding to projections 23 and that its overtime cam wheel corresponding to wheel 37 operates the calling subscriber's message register relay three times for each overtime period or fraction thereof by having three projections corresponding to projections 39. The decoder marker when it has transmitted to it information showing that a timing mechanism such as mechanism 66 is applicable for the conversation to be measured will cause the operation of switch 47 to connect conductors 51, 52 to conductors 67, 68 leading to the charging contacts for mechanism 66 and to the winding of the clutch magnet which controls the rotation of the initial period cam wheel.

Still other embodiments of this invention are contemplated commensurate with the scope of the appended claims.

What is claimed is:

1. A timing device for measuring an initial period and an additional period comprising a driving member rotating at a substantially constant speed, a normally disengaged rotatable driven member, means for biasing said driven member to a normal position, an electromagnet for engaging said members at the beginning of said initial period, electrical contacts, means rotatable with said driven member for operating certain of said contacts when said driven member has advanced a predetermined distance from its normal position, a second rotatable driven member normally idle and biased to a normal position, means rotatable with said first driven member and effective when said first driven member has advanced to a position corresponding substantially to the termination of said initial period for causing said second driven member to be rotated at a substantially constant speed, and means rotatable with said second driven member and effective when said second driven member has reached a definite advanced position for operating certain of said contacts.

2. In a timing device for measuring an initial period and an additional period, the combination of a driving shaft rotatable at a substantially constant speed, a normally disengaged driven member, an electromagnet for controlling the engagement of said driven member with said shaft, electrical contacts, means responsive to the advance of said driven member through a predetermined distance for closing certain of said contacts, a second driven member normally disengaged from said shaft, means controlled by said first driven member effective when said first driven member has advanced to a position substantially corresponding to the termination of said second initial period for causing said second driven member to engage with said shaft, means responsive to the advance of said second driven member through a predetermined distance for closing certain of said contacts and means for biasing said driven members to their normal positions.

3. In a telephone system, mechanism for timing the duration of a telephone connection for which the subscriber is charged at a certain rate for a given initial period or fraction thereof and is charged at a certain rate for any overtime period, said mechanism comprising a driving member rotatable at a substantially constant speed, a rotatable driven member normally disengaged from said driving member, an electromagnet for engaging said members, means for energizing said magnet at the initiation of said telephone connection, electrical contacts for controlling a subscriber's charging circuit, means rotatable with said driven member for actuating certain of said contacts when said driven member has reached a predetermined advanced position, a second rotatable driven member normally disengaged from said driving member, means effective when said first driven member has advanced to a further position substantially corresponding to the elapse of said initial period for preventing further advancement of said first driven member and for engaging said driving member and said second driven member,

means rotatable with said second driven member for periodically actuating certain of said contacts at predetermined time intervals for the overtime period of said telephone connection, and spring means for biasing each of said driven members to its normal position.

4. In a telephone system, mechanism for timing the duration of a telephone connection for which the subscriber is charged at a certain rate for a given initial period or fraction thereof, and is charged at a different rate for any overtime period, said mechanism comprising a driving member rotatable at a substantially constant speed, a rotatable driven member normally disengaged from said driving member, an electromagnet for engaging said members, means for energizing said electromagnet at the initiation of said telephone connection, electrical contacts for controlling a subscriber's charging circuit, means rotatable with said driven member for actuating certain of said contacts when said driven member has reached a predetermined advanced position, a second driven member normally disengaged from said driving member, means effective when said first driven member has advanced to a further position corresponding substantially to the elapse of said initial period for disengaging said first driven member from and for engaging said second driven member with said driving member, spring means tending to restore each of said driven members to its normal position when disengaged from said driving member, means rotatable with said second driven member for actuating certain of said contacts when said second driven member has reached a predetermined advanced position, and means effective during an overtime period of sufficient duration for periodically disengaging said second driven member for said driving member and for reengaging said second driven member with said driving member after said spring means has restored said second driven member to its normal position.

5. A timing device for measuring the duration of a telephone conversation for which the subscriber is charged at a certain rate for a given initial period and is charged at a different rate for an overtime period, said device comprising a driving member, a rotatable driven member, an electromagnet for moving one of said members into engagement with the other of said members to cause said driven member to be rotated through a definite angle but not beyond said angle, electrical contacts for controlling a subscriber's charging circuit, means actuated by said driven member when advanced from its normal position for controlling certain of said contacts, a second rotatable driven member, means under the control of said first driven member for rotating said second driven member at a substantially constant speed effective after said first driven member has advanced to a definite position, said second driven member when advanced from its normal position also controlling certain of said contacts.

6. A timing device for measuring the duration of a telephone conversation for which the subscriber is charged at a certain rate for a given initial period and is charged at a different rate for an overtime period, said device comprising a driving member, a driven member normally disengaged therefrom and normally biased to a normal position, an electromagnet for engaging said members, electrical spring contacts, cam means rotatable with said driven member for actuating said contacts after said driven member has advanced from its normal position, means for causing the disengagement of said members after said driven member has reached a definite advanced position, a second rotatable driven member, a second electromagnet under the control of said first driven member for engaging said second driven member with said driving member to cause the rotation of said second driven member, other electrical spring contacts, cam means rotatable with said second driven member for actuating said other contacts after said second driven member has advanced from its normal position, and means for restoring said driven members to their normal positions when said magnets are deenergized.

7. A timing device for measuring the duration of a telephone conversation for which the subscriber is charged at a certain rate for a given initial period and is charged at a different rate for an overtime period, said device comprising a driving member, a rotatable driven member normally disengaged from said driving member, spring means for biasing said driven member to a normal position, an electromagnet for engaging said members, electrical contacts for controlling a subscriber's charging circuit, cam means rotatable with said driven member for closing certain of said contacts after said driven member has been advanced from its normal position, a second rotatable driven member, spring means for biasing said second driven member to a normal position, a second electromagnet for engaging said driving member and second driven member, a normally open energizing circuit for said second magnet, cam means rotatable with said first driven member for causing the closing of said energizing circuit when said first driven member has reached a definite advanced position and cam means rotatable with said second driven member for closing certain of said contacts after said second driven member has been advanced from its normal position.

8. A timing device for measuring the duration of a telephone conversation for which the subscriber is charged at a certain rate for a given initial period and is charged at a different rate for an overtime period, said device comprising a driving member, a rotatable driven member normally disengaged from said driving member, spring means for biasing said driven member to a normal position, an electromagnet for engaging said members, electrical contacts for controlling a subscriber's charging circuit, cam means rotatable with said driven member for closing certain of said contacts after said driven member has been advanced from its normal position, a second rotatable driven member, spring means for biasing said second driven member to a normal position, a second electromagnet for engaging said second driven member and said driving member, a relay, cam means rotatable with said first driven member for operating said relay to release said first magnet and to energize said second magnet, and cam means rotatable with said second driven member for closing certain of said contacts after said second driven member has reached an advanced position.

9. A timing device for measuring the duration of a telephone conversation for which a subscriber is charged at a certain rate for an overtime period, said device comprising a driving member, a rotatable driven member, spring means for biasing said driven member to a normal position, an electromagnet for engaging

said members, electrical contacts for controlling a subscriber's charging circuit, cam means rotatable with said driven member for operating certain of said contacts after said driven member has reached an advanced position from its normal position, a second rotatable driven member, spring means for biasing said second driven member to a normal position, a second electromagnet for engaging said driving member and said second driven member, a relay, other cam means rotatable with said first driven member for energizing said relay to release said first magnet and operate said second magnet, cam means rotatable with said second driven member for operating certain of said contacts after said second driven member has reached an advanced position, a second relay, other cam means rotatable with said second driven member for energizing said second relay to release said second electromagnet and still other cam means rotatable with said second driven member for releasing said second relay to reenergize said second magnet when said second driven member has been restored to normal.

10. A timing device for measuring the duration of a telephone conversation for which the subscriber is charged at a certain rate for a given initial period and is charged at a different rate for an overtime period, said device comprising a driving member, a rotatable driven member, spring means for biasing said driven member to a normal position, an electromagnet effective at the beginning of a telephone conversation period for engaging said members, a second rotatable driven member, spring means for biasing said second driven member to a normal position, a second electromagnet for engaging said driving member and said second driven member, normally open electrical spring contacts associated with said first driven member, and adapted to control a subscriber's charging circuit for an initial period, other normally open electrical spring contacts associated with said second driven member and adapted to control a subscriber's charging circuit for an overtime period, a relay, cam means rotatable with said first driven member for closing said first spring contacts after said first driven member has advanced a definite position from normal, other cam means rotatable with said first driven member for energizing said relay to release said first magnet and energize said second magnet, cam means rotatable with said second driven member for closing said second spring contacts after the advancement of said second driven member from its normal position, a second relay, other cam means rotatable with said second driven member for operating said second relay to release said second magnet after said second driven member has reached an advanced position to permit said second driven member to be restored to normal by its biasing means and still other cam means rotatable with said second driven member for releasing said second relay to reenergize said second magnet.

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