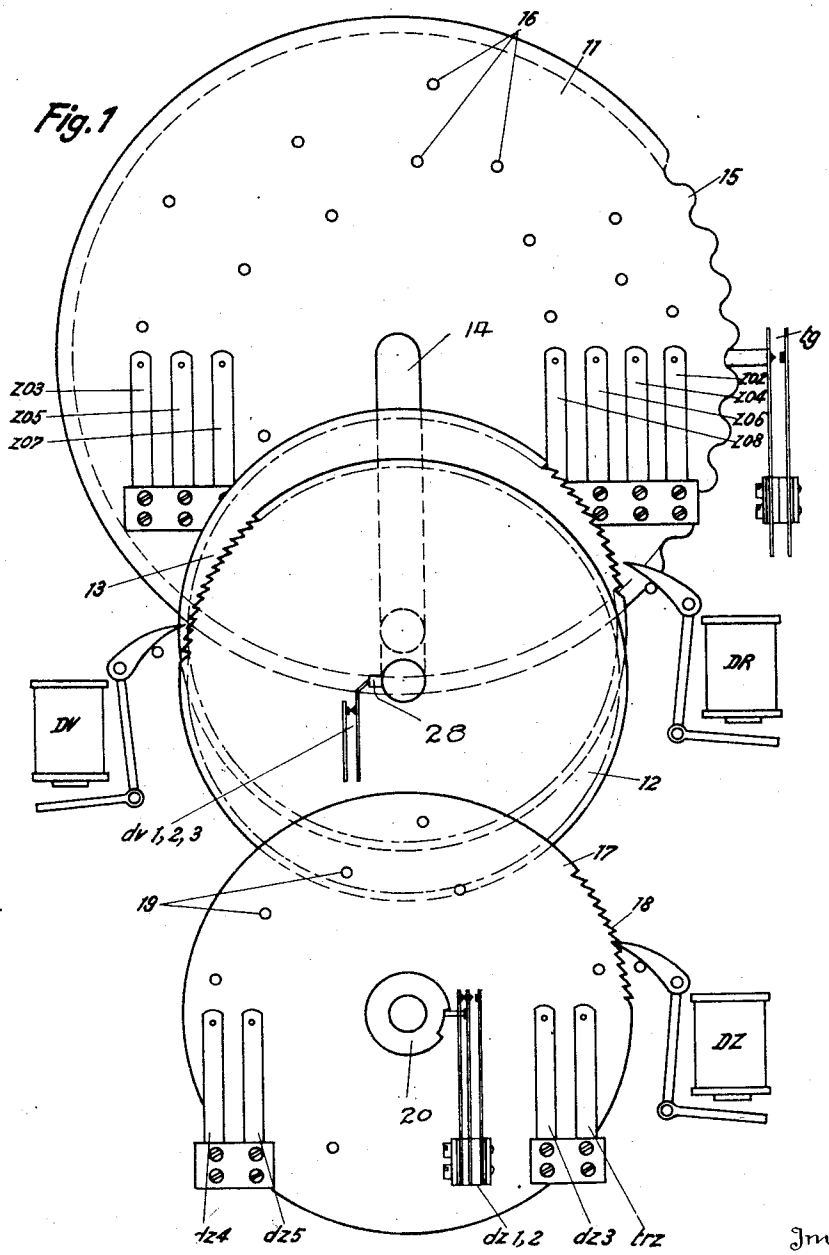
Nov. 16, 1937. O. MUCK ET AL 2,099,616

TIME AND ZONE METERING DEVICE

Filed Aug. 29, 1935 8 Sheets-Sheet 1

Fig. 1



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TIME AND ZONE METERING DEVICE

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Fig. 2

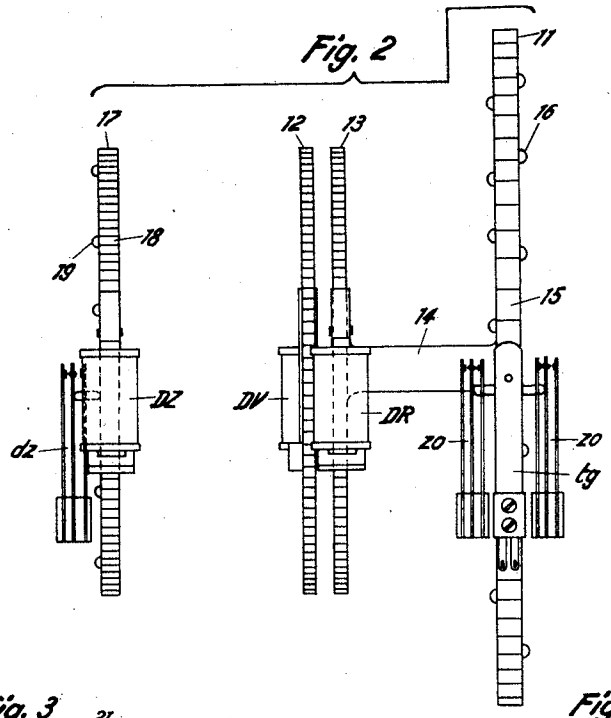


Fig. 3

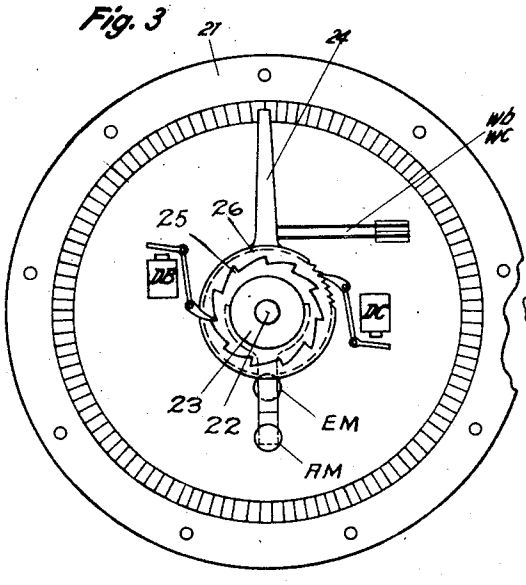
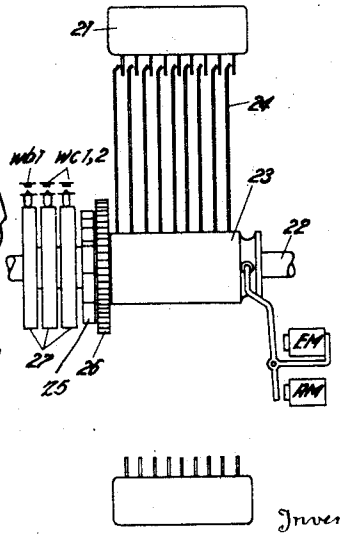


Fig. 4



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TIME AND ZONE METERING DEVICE

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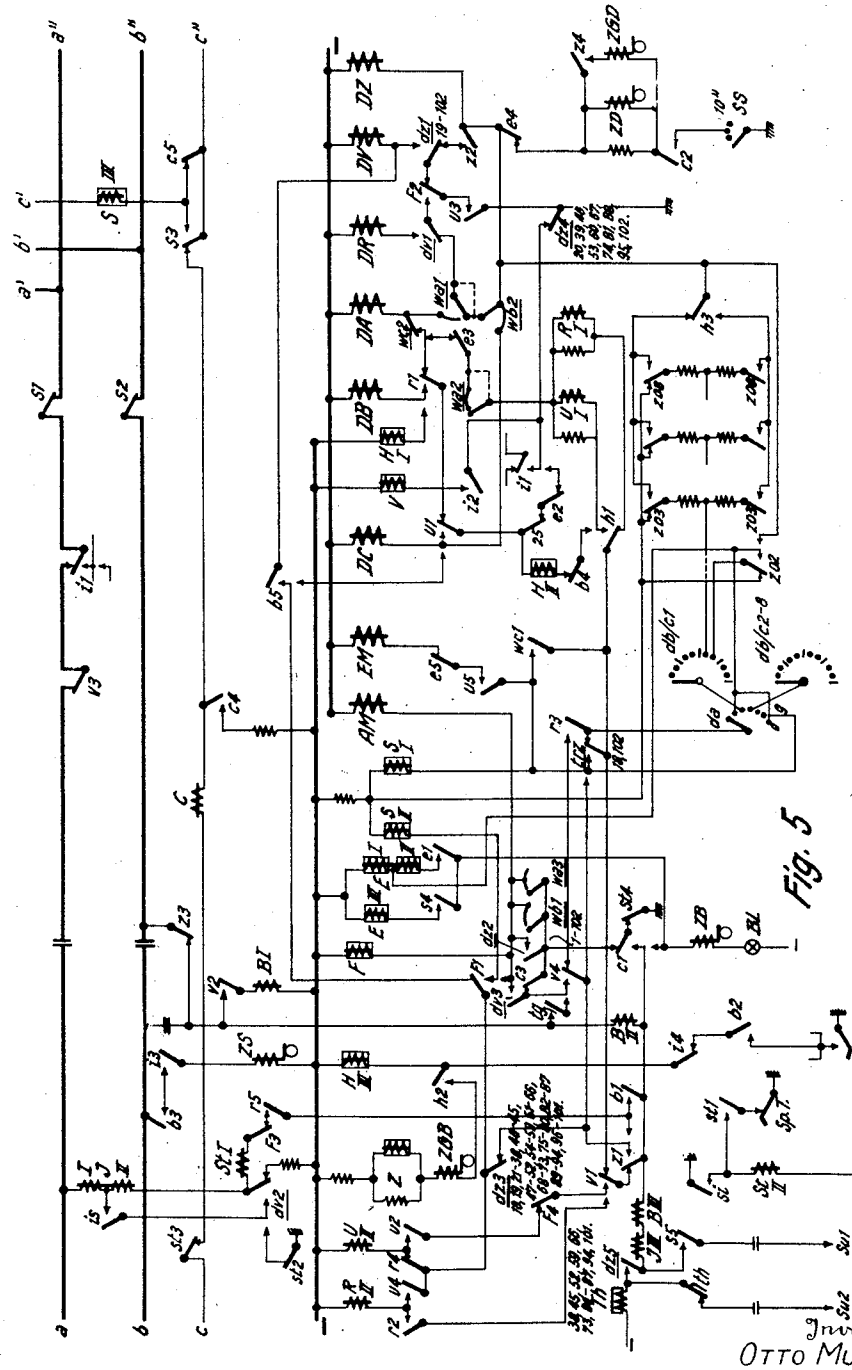

Fig. 5

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Fig. 6

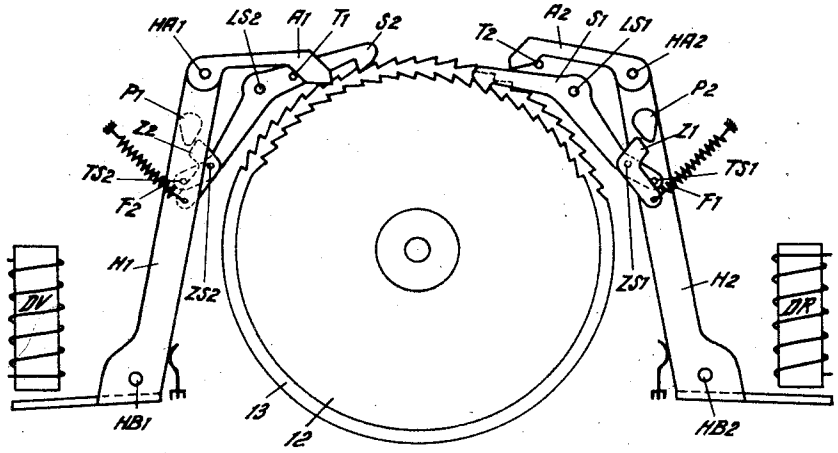
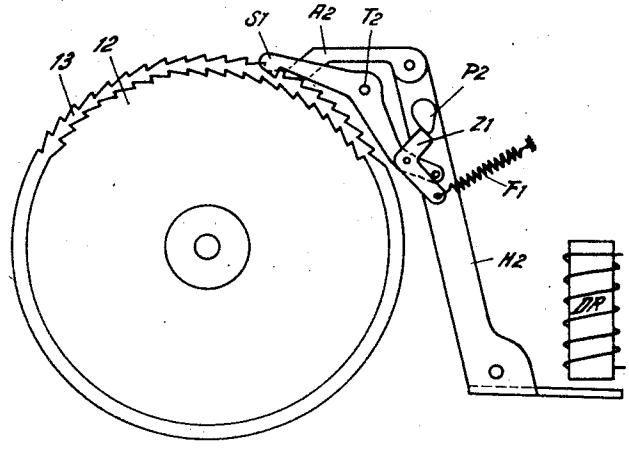


Fig. 7



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TIME AND ZONE METERING DEVICE

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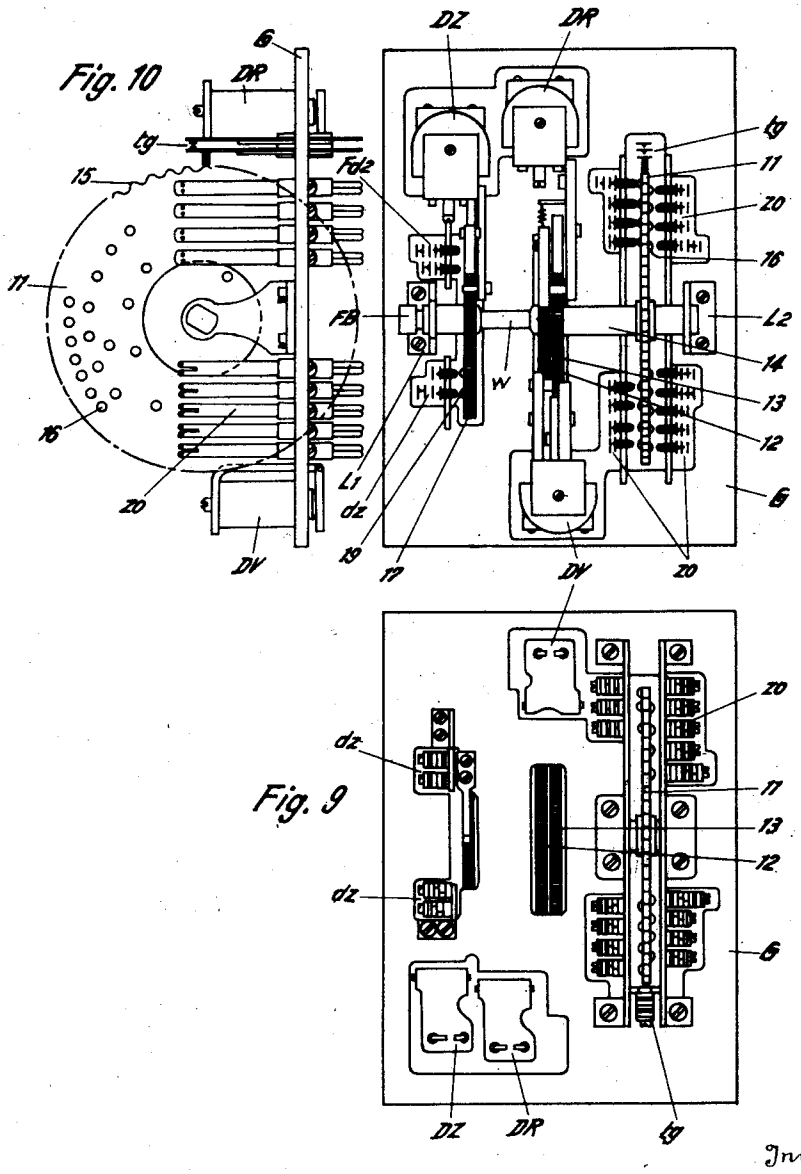
Fig. 8



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TIME AND ZONE METERING DEVICE

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Fig. 16

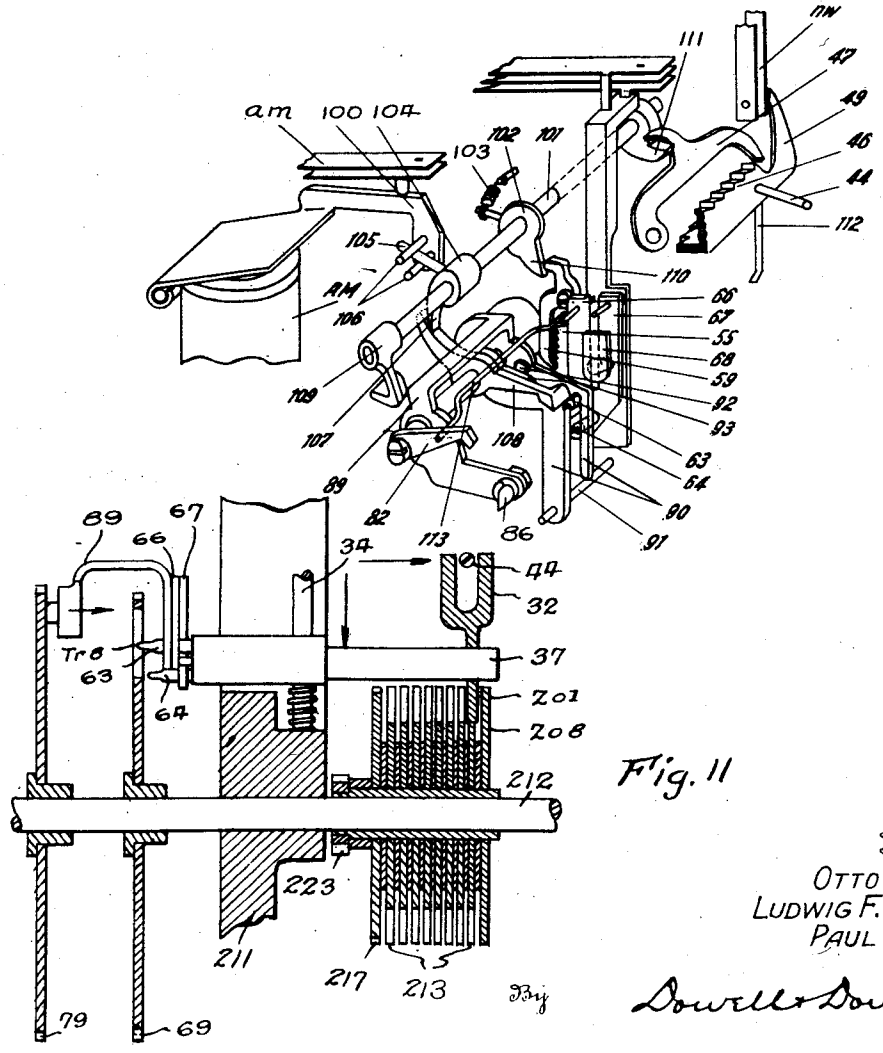

Fig. 11

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Fig. 12

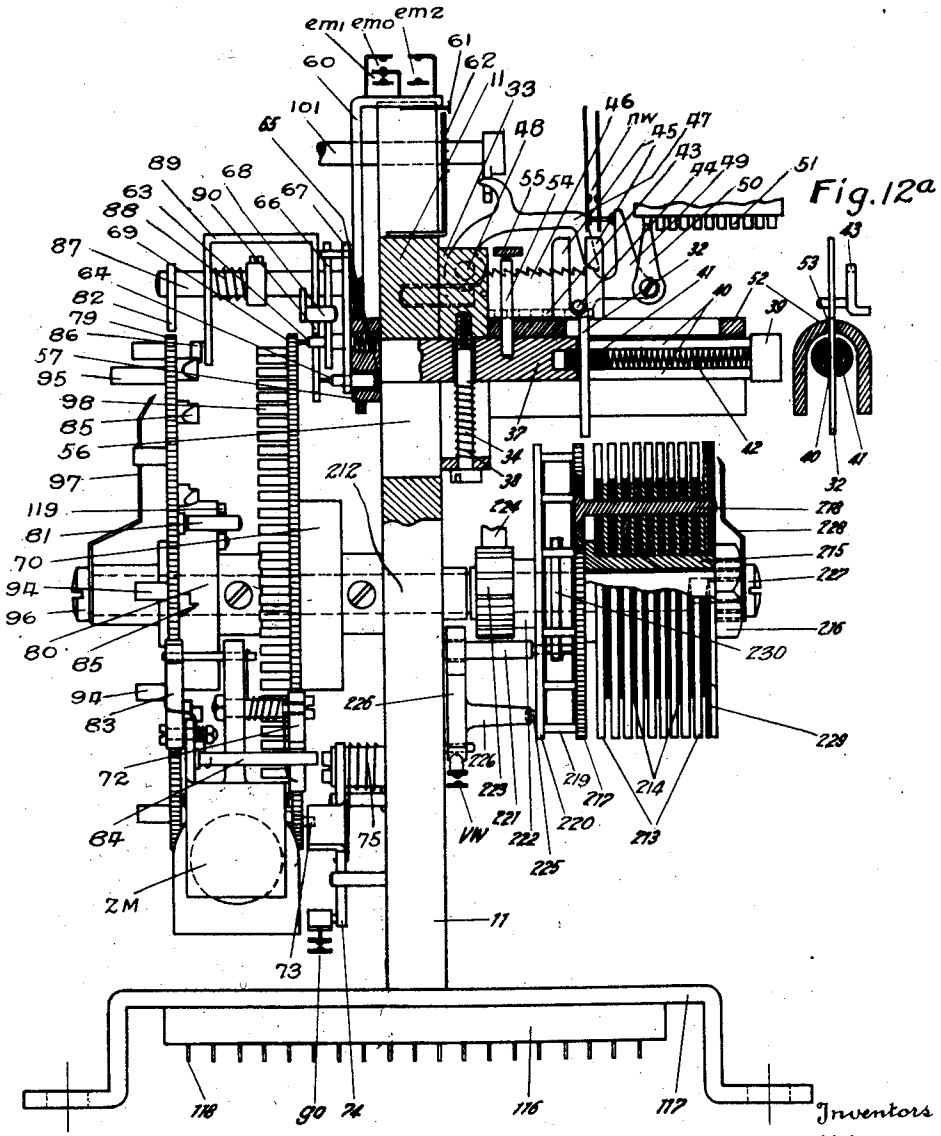

Fig. 12a

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Fig. 13

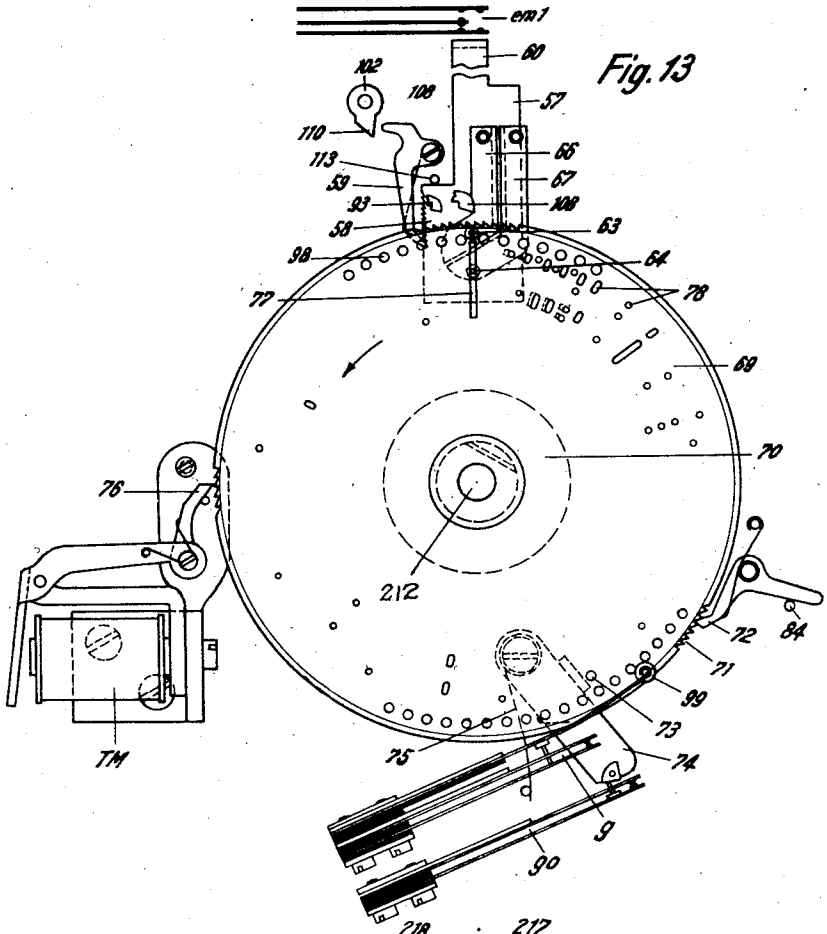


Fig. 14

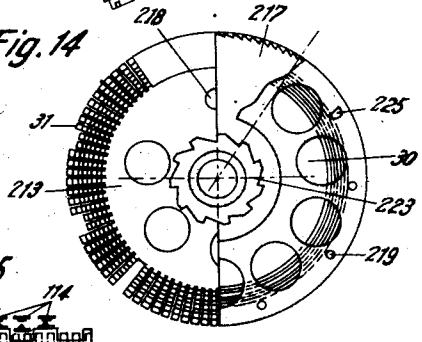
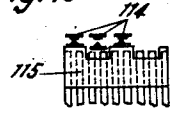


Fig. 15



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Patented Nov. 16, 1937

2,099,616

UNITED STATES PATENT OFFICE

2,099,616

TIME AND ZONE METERING DEVICE

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Application August 29, 1935, Serial No. 38,466
In Germany April 28, 1931

34 Claims. (Cl. 179—7.1)

This invention relates to a device for time and zone metering in telephone installations. These devices are provided for recording the charges to be made for calls, which charges are determined by the zone in which the called subscriber's exchange is situated and by the duration of the connection. The known devices of this type use a time switch arrangement which is constructed as a selector and which is provided with as many switch arms as there are zone values. All these switch arms are stepped periodically during the conversation so that at the end of the conversation a particular contact is marked by the switch arm of the particular zone which was selected by a zone determining device constructed as a simultaneous movement mechanism and is then discovered by a meter stepping mechanism which leads to a simultaneous transmission of numerical current impulses. The time switches of these known devices are thus necessarily bulky and necessitate a considerable amount of wiring between their large number of contacts and the meter stepping mechanism.

The object of the invention is to simplify considerably the known arrangements for time and zone metering.

The new meter stepping mechanism in accordance with the invention is energized for being stepped forward by a time switching device at the beginning or the end of a particular period of time and is provided with devices which, at each energization, allow a stepping to take place, the extent of which depends upon the "value" of the connection ascertained by a zone determining device. For this purpose, the meter stepping mechanism can send out current impulses directly for influencing the meter at each stepping. The individual steppings can be used, however, for storing the metering current impulses which, in that case, are sent out at the end of the connection sent out by the return movement of the meter stepping mechanism into the normal position.

Preferably, the meter stepping mechanism is constructed as a rotary disc provided with devices for determining the extent of its rotation which are arranged in a number of concentric rows corresponding to the number of zone values. These devices can limit the stepping of the meter stepping mechanism by electrical or mechanical control. Likewise, the energizations produced for the stepping can be produced by means of the periodically stepping time switch device by acting electrically or mechanically on the meter stepping mechanism.

By means of the invention, a time and zone metering device can be obtained in which there is no complicated wiring between the time switch device and the meter stepping mechanism. Also, the time switch device can itself be considerably simplified as it no longer has to be provided with a number of switch members corresponding to the number of zone values.

In particular, the invention allows the time switch device and also the meter stepping mechanism to be so constructed that on alteration of the tariff, that is to say, both when an alteration is made to the length of time at the expiration of which a charge is incurred and also in the units which are used for charging for the individual periods of time and for the various zones, a corresponding adjustment of the time switch device and/or the meter stepping mechanism can easily be undertaken.

In order that the invention may be thoroughly understood and be more readily carried into effect, two examples of construction in accordance therewith will now be described with reference to the accompanying drawings in which Figures 1 to 10 relate to a time-zone meter in which the meter stepping device is electrically influenced by a time switch device and by a zone determining device while Figures 11 to 16 relate to a time-zone meter in which the stepping device is influenced mechanically.

Figure 1 of the accompanying drawings is a diagrammatic front view of the time switch device and the meter stepping device.

Figure 2 is a diagrammatic side view of the time switch device and the meter stepping device.

Figures 3 and 4 show in side elevation and in section one of the selectors of the zone determining device.

Figure 5 shows the circuit for the time-zone meter.

Figures 6 and 7 show diagrammatically and in two positions a control device for the meter stepping device.

Figures 8 to 10 show the general front, rear

and side elevations respectively of arrangement of the time and meter stepping devices.

Figure 11 is a diagrammatic illustration of the time-zone meter of the second example of construction.

Figure 12 shows a section through the time-zone meter.

Figure 13 shows the meter stepping mechanism.

Figure 14 shows a detail of construction of a mechanical zone determining device.

Figure 15 shows a contact arrangement of the zone determining device, and

Figure 16 is a diagrammatic illustration in perspective of the control device for the meter stepping mechanism.

The meter stepping device (referred to in what follows as the "tariff member") of the example of construction illustrated in Figures 1 to 10 relating to an electrically operated arrangement consists of a rotatably mounted disc 11 (Figures 1 and 2) which can be driven in the forward direction through a driving member 12 and in the rearward direction through a driving member 13. A stepping magnet DV, the pawl of which can engage in teeth formed on the driving member 12, is provided for stepping the driving member 12. A similar electromagnet DR is provided for stepping the driving member 13. The two driving members 12 and 13 which are in the form of ratchet wheels are arranged on the sleeve 14 which also carries the disc 11. This sleeve also carries a cam 28 through which contacts *dv*1, 2 and 3 can be actuated.

In Figures 6 and 7, for the sake of clearness, the ratchet wheel 12 is shown smaller than the ratchet wheel 13. In practice, the two wheels are preferably of the same diameter.

The two wheels 12 and 13 are provided with the same number of teeth. The toothed wheel 12 serves for stepping the disc 11 in the clockwise direction and the toothed wheel 13 for stepping in the counter-clockwise direction. A check pawl S1 pivotally mounted on the pin LS1 engages with the ratchet wheel 12. The tail of the pawl S1 carries a lever Z1 pivotally mounted on the pin ZS1 and connected at one end to a spring F1 which pulls one arm of the lever Z1 against a pin TS1 on the pawl S1 and thus causes the pawl S1 to engage in the teeth of the wheel 12. The pawl S2 is constructed in the same way relatively to the wheel 13 as is clear from Figure 6 on the left hand side of which will be found references corresponding to those on the right hand side.

A driving pawl A1 pivotally mounted on the pin HA1 on a lever H1 forming an extension of the armature of the magnet DV is provided for stepping the wheel 12. The armature lever H1 is pivotally mounted on the pin HB1 and is moved on energization of the magnet DV. A spring normally holds the lever H1 in the illustrated position in which the pawl A1 bears on a pin T1 and is thus out of engagement with the teeth of the wheel 12. The stepping mechanism for the wheel 13 consisting of the armature lever H2 and the driving pawl A2 is constructed in the same manner as that for the wheel 12 as can clearly be seen from an inspection of the right hand side of Figure 6 where the parts have been given references corresponding to those on the left hand side.

It is clear that the driving pawl A1 for the wheel 12 lies close to the check pawl S2 for the wheel 13 and the driving pawl A2 lies close to the check pawl S1. The two ratchet wheels 12 and 13 and, therefore, the disc 11 are held against rotation in either direction by the two check pawls S1 and S2.

Stops P1 or P2 are arranged on the armature levers H1 and H2, one of which, on movement of the corresponding armature lever, abuts against the appropriate lever Z1 or Z2 and thus lifts the check pawl associated with it out of engagement with the appropriate wheel.

In Figure 7, the arrangement is shown in the position in which the armature of the magnet DR is about half attracted. During the first part of the movement of attraction, the stop P2 of the armature lever H2 abuts against the lever Z1 and forces it bodily towards the left so that the check pawl S1 is removed from the teeth of the wheel 12 while the driving pawl A2 slides down on the fixed pin T2 and comes into engagement with the teeth of the wheel 13. As the movement of attraction of the armature continues, the stop P2 clears the lever Z1 and when the armature is fully attracted, the check pawl S1 is again free from the influence of the stop P2 and engages with the teeth of the wheel 12. The check pawl S1 is thus only out of engagement with the wheel 13 during the stepping movement of the pawl A2. When the armature returns to the position shown in Figure 6, the stop P2 moves to the right until it abuts against the lever Z1 and causes this lever to move about its pivot ZS1 against the action of the spring F1. The check pawl S1 thus remains engaged while the driving pawl A2 is being disengaged.

The pawls A1 and S2 are actuated by the magnet DV in the same way as are the pawls A2 and S1 by the magnet DR. Whenever the disc 11 is stepped by one of the wheels 12 and 13, the check pawl associated with the other wheel is always removed out of engagement with the latter.

The disc 11 of the tariff member (Fig. 1) has teeth 15 formed in its periphery through which a contact *tg* can be actuated.

A number of series of cams 16 are arranged on the two faces of the disc 11. These cams are arranged so that one or the other of a corresponding number of sets of contacts *zo*3, *zo*5, *zo*7 and *zo*2, *zo*4, *zo*6, *zo*8 arranged on the front and on the rear sides of the disc can be actuated by them according to the angular disposition of the disc.

In the example shown in Figure 1, the cams 16 are arranged on the front side of the disc 11 in seven concentric rows, the cams in each of which can actuate one of seven different sets of contacts *zo*2 to *zo*8, which correspond to zone values 2 to 8. Cams and contacts are arranged in similar rows on the rear side of the disc 11 (see Figure 2) but the angular distance between the cams 16 on corresponding circles is different on the front and on the rear sides of the disc 11.

The angular distance between two cams on one circle corresponds to the meter units which are to be registered at the beginning of a particular period of time, for a call to the zone corresponding to that circle. More units have to be registered on the meter for a call of a certain duration to a particular zone during the day time than during the night. (For example, only two thirds of the day charge may be made at night.) The cams on one side of the disc 11 can thus correspond to the day tariff and the cams on the other side of the disc correspond to the night tariff, the relationship between the angular distances on the two sides being the same as that between

the units to be registered of corresponding day and night calls.

The cams can be fixed in suitable holes in the disc 11. The disc 11 can, however, be made up of a rim and a hub between which is fixed a stamped-out circular sheet metal disc. In this case, an alteration of the tariff only necessitates the replacement of a stamped disc by a new one.

The time disc 17 is arranged beside the tariff disc 11 and its stepping mechanism 12 and 13 and has ratchet teeth 18 on its circumference in which can engage the stepping pawl of a driving magnet DZ. This time disc 17 also carries several series of cams 19 arranged in concentric circles which can actuate contacts.

In Figure 1 four sets of contacts *dz*3, *dz*4, *dz*5 and *trz* are illustrated which are controlled by four circles of cams 19. Further sets of contacts such, for example, as the set *dz*1, 2 can be directly controlled by a cam disc 20 fixed to the disc 17. The cams 19 and the cam 20 serve for controlling the various contacts with special settings of the time disc 17 for carrying out the necessary switching operations.

The stepping switch mechanism illustrated in Figures 3 and 4 forms part of the zone determining device. This switch mechanism comprises a contact panel 21 with nine rows each of 110 contacts and a rotary selector 23 carrying nine switching arms 24 insulated from each other arranged on a shaft 22. The selector 23 is provided with two stepping wheels 25 and 26. The stepping wheel 25 has 11 teeth in which the driving pawl of a magnet DB can engage. When the wheel 25 is stepped through one tooth, the switch arm is moved over 10 contacts of the panel 21. The second stepping wheel 26 has 110 teeth in which the driving pawl of a magnet DC can engage. A number of cam discs 27 are also connected to the selector 23 with which sets of contacts *wb* and *wc* are in contact. These contacts are thus controlled by the cams 27 on rotation of the selector 23. When such a rotation is effected by the intermittent energization of one of the magnets DB or DC, the switch arms 24 move freely past the contacts on the panel 21. For establishing electrical contact between the switch arms 24 and the contacts, the selector 23 is axially displaced by the armature of a magnet EM so that the switch arms are pressed on to the contacts. The armature of the magnet EM is mechanically locked in its attracted position and is only released again on energization of a magnet AM.

For selection of one of the nine switch arms 24 of the selector 23, a usual 10-point step-by-step switch is used which is constructed in the ordinary way of well-known preselectors and is set by current impulses.

The circuit illustrated in Figure 5 shows the path of the current for the various stepping magnets and the necessary controlling relays of a time-zone meter which, for example, is connected in the connecting line connected to the contact bank of a first group selector leading to a second group selector. It is assumed that three series of current impulses are necessary for determining the zone which at the same time effect the setting of a second, a third and a fourth group selector. The emission of these current impulses simultaneously effects the setting of the selector of the zone determining device and indeed, the first series of current impulses controls the switch arm *da* of a 10-point stepping switch mechanism which is driven by the switching magnet DA, while the second series of current impulses influences the magnet DB of the selector illustrated in Figures 3 and 4 which steps the switch arms of the latter through 10 steps at each energization. The third series of current impulses then influences the magnet DC which steps the switch arms of this selector through single steps. The switch arms of the zone determining device are only diagrammatically indicated in the drawings. The switch arms 24 of the selector illustrated in Figures 3 and 4 are designated *db*/*c*1 and *db*/*c*2–8 in Figure 5. Only two such switch arms and corresponding series of contacts are indicated but in practice nine are provided.

The contacts, the references of which are underlined in Figure 5, are mechanically controlled by one of the above-mentioned stepping switch mechanisms. The contacts *wa*1, 2, and 3 represent contacts which are controlled by the shaft of the 10-point stepping switch mechanism which is stepped by the magnet DA. They are closed on the return of this selector to the normal position. The contacts *wb*1 and *wb*2 represent contacts which are thrown by the shaft of the 110-point selector on its leaving the normal position. The contacts *wc*1 and *wc*2 are only actuated by the shaft of this selector when a stepping is effected by the magnet DC. In the positions of rest into which the switch arms of this selector are stepped at various times by the magnet DB, the contacts *wc* remain in the normal position.

The contacts *dz*1–5 represent contacts which are actuated by the various cams 19 of the time disc 17. The figures appended to the reference *dz* indicate the positions in which these contacts are thrown.

The contacts *dv*1–3 are contacts which are reversed by the shaft 14 of the tariff device 11 when the latter moves out of the normal position. When the line *a*, *b*, *c* is seized by a first group selector arranged in advance of it, the holding relay C in the time-zone meter is energized in a circuit which runs from the first group selector (not illustrated), through the line *c*, the contact *st*3, the relay C, the contact *s*3, the line *c''* to the second group selector (not illustrated). The relay C thus responds and, through its contact *c*2, closes the following circuit for the magnet DZ of the time switch member:—

+, 10-second switch SS, contact *c*2, time meter ZD, contact *e*4, stepping magnet DZ,—

The contact *c*4 closes a holding circuit for the relay C so that the latter remains energized independently of the voltage in the line *c''* in the second group selector. The contact *c*5 disconnects the line *c'* from the line *c''* through which, for example, the outgoing connecting line can be seized by the distant exchange.

The 10-second switch SS closes the circuit for the magnet DZ every 10 seconds so that the time disc is stepped through one step every 10 seconds. This stepping is also used in order to prevent the time-zone meter being held engaged for an unnecessarily long time. As, in general, no charge is made for the time which elapses between the seizing of the time-zone meter and the instant at which the called subscriber removes his receiver, a subscriber can, as a rule, hold a valuable trunk line for an unrestricted period by means of an incomplete dialling operation. If this waste of engaged time is to be restricted to a maximum of three minutes, then at the eighteenth step of the time disc, the contact *trz* is thrown by a cam and thus the following energizing circuit for the cut-off relay S is closed:—

+, contacts *st*4, *c*1, *z*1, *v*1, *trz*, winding I of relay S,—

Relay S responds in this circuit, disconnects the line by the opening of its contacts *s*1, 2, and 3 whereupon the second group selector becomes seizable by means of the distant exchange over the lines *a'*, *b'*, *c'* through the contact *s*3. By means of the contact *s*4, the following energizing circuit is closed for the relay E:

+, contacts *st*4, *c*1, *s*4, winding III of relay E,—

while the contact *s*5 closes the following circuit for the buzzer Su1:

+, contacts *st*4, *c*1, winding III of relay B, winding III of relay J, contact *s*5, condenser, buzzer Su1

A deeper buzzing tone is thus produced in the windings I, II of the relay J which lie in the speaker line which informs the subscriber of the cutting off of the connection.

The relay E holds up during the closing of its contact *e*1 through its windings I, II, opens the impulse circuit for the setting of the zone determining device by means of its contact *e*2 and, through its contact *e*4, brings the time disc to rest. When the calling subscriber hangs up, all parts of the said switch mechanism which have been displaced return into the normal position in a manner which will be described in more detail later on.

The case will now be considered in which the subscriber sends out the various series of current impulses for making the connection within the above mentioned time. During each emission of current impulses, the relay J will be intermittently energized through its windings I, II in the following circuit:—

a-wire, relay J, windings I and II, contact *dv*2,—

By means of the contact *i*1, the current impulses are transmitted to the *a''*-wire and the selector of the zone determining device is also set. For this purpose, the contact *i*1 is formed as a double make contact and closes the following circuits:—

+, contacts *dz*4, *i*1, *s*1, wire *a''*

and

+, contacts *dz*4, *c*1, *e*2, *z*5, *u*1, *r*1, *wc*2, stepping magnet DA,—

The step-by-step energization of the magnet DA and, therefore, the step-by-step stepping of the switch arm *da* of the first selector of the zone determining device is effected by the current impulses. During the series of current impulses, the relay V is at the same time energized through the contact *i*2 which is slow to release and holds its armature attracted during the pauses between the various current impulses. At the end of the first series of current impulses, the relay V drops and, by means of the contact *v*1, switches in the relay R in the following circuit:—

+, contacts *st*4, *c*1, *z*1, *v*1, *h*1, winding I of relay R, contacts *wa*2, *e*3, *wc*2, magnet DA,—

Relay R responds and, by means of its contact *r*1, switches the stepping circuit over from the magnet DA to the magnet DB.

When, during the second series of current impulses, the relay V again responds, the circuit running through the winding I of the relay R is interrupted by the switching over of the contact *v*1 and, in its place, the following holding circuit is closed through the winding II of the relay R:—

+, contacts *st*4, *c*1, *z*1, *v*1, *r*2, winding II of relay R,—

During this second series of current impulses, a relay H is also energized through its winding I and prepares the circuit for the energization of the relay U. The relay H is slow to release and holds its armature attracted during the transmission of current impulses.

At the end of the second series of current impulses, which effect the stepping of the switch arm *db/c* in large steps, the relay V again drops, interrupts the holding circuit for the relay R with its contact *v*1 and, at the same time, through its contact *v*1, closes the following energizing circuit for the relay U:—

+, contacts *st*4, *c*1, *z*1, *v*1, *h*1, winding I of relay U, contacts *wa*2, *e*3, *wc*2, magnet DA,—

as well as the following holding circuit for the relay H:—

+, contacts *st*4, *c*1, *z*1, *v*1, *h*1, *b*4, winding II of relay H, contacts *v*1, *r*1, *wc*2, magnet DA,—

The relay U responds and, with its contact *u*1, switches the circuit over from the magnet DB to the magnet DC.

When, during the third series of current impulses, the relay V again responds, the holding circuit for the relay H is interrupted by the contact *v*1, while, on the other hand, the following holding circuit for the relay U is closed:—

+, contacts *st*4, *z*1, *v*1, *f*4, *u*2, winding II of relay U,—

At the end of the third series of current impulses, the relay V drops but again in a delayed fashion and with its contact *v*1 closes the following circuit for the magnet EM:—

+, contacts *st*4, *c*1, *z*1, *v*1, *wc*1, *u*5, *e*5, magnet EM,—

This circuit is closed during the time during which the relay U is de-energized. On being energized, the magnet EM presses the switch arms *db/c* of the zone selector (which is free to move during the stepping) on to the contacts of the contact bank. The armature of the magnet EM is mechanically locked so that the contact remains made also when the magnet is no longer energized. The contact *wc*1 lying in the energization circuit of the magnet EM is, similarly to the contact *wc*2, reversed in single steps during the stepping of the switch arm through the magnet DC.

A contact is now selected by the switch arm *db/c* selected by the setting of the switch arm *da*, this contact being connected to the zone contacts *zo*2 to 8. Only three of the zone contacts *zo*2 to *zo*8 are shown, but each of these is double, one for the day side and the other for the night side of the tariff switch. At this instant, the contacts are, however, at rest because the disc of the tariff switch has not yet been stepped. It is assumed that the zone 3, for example, corresponds to the connection determined by the three emitted series of current impulses so that the contact *zo*3 is selected by the switch arms *da* and *db/c*1. The following short circuit for the winding I of the relay S is now closed through the normal position of this contact:—

—, contact *zo*3, switch arms *db/c*1, *da*, contacts *trz*, *wc*1, winding I of relay S,—

In the absence of this short circuit, the relay S would be energized through its winding I and the connection would be cut off. This is always the case when the selected switch arm *db/c* comes on to a contact which is connected with none of the zone contacts, that is to say, when a connection to an exchange is selected which is not "zoned" and thus does not exist. In this case, the cutting off of the connection will be effected

by the time-zone meter and the line will become disengaged.

During all the time taken by the setting of the zone determining device, the time disc is stepped every 10 seconds. If, after the setting of the zone determining device, the meter device given when the called subscriber answers is not received within three minutes after the seizing of the time-zone meter, then, as has already been explained above, the time switch, at the eighteenth step, will actuate the contact *trz* by means of a cam so that the short circuit for the winding I of the relay S is interrupted and so that the relay S responds and cuts off the connection.

The bringing into action of the meter when the desired subscriber answers is effected in known fashion by switching current on to the *b''* line in the subsequently arranged selector. In this way the relay B is energized in the following circuit:—

+, contacts *st4*, *c1*, winding II of relay B, contacts *z3*, *s2*, *b''*,—

In the known arrangements of time-zone meters, the meter can be prevented from being brought into operation if the calling subscriber dials "1" in quick succession. This possibility is prevented by the special arrangement of the relay B provided for bringing the meter into operation. Through a contact *v2* of the relay V which is energized during an emission of current impulses by the calling subscriber, a second winding I of the relay B is switched in in opposition to the winding II of this relay connected to the *b''*-wire. The result of this is that with a small alteration of the potential at the common switching point of the two windings, the relay B is made to respond with certainty.

The relay B is thus energized as a result of the indication that the meter is to be brought into operation and, by means of its contact *b1*, closes the following energizing circuit for the relay Z:—

+, contacts *st4*, *c1*, *b1*, meter ZGB, relay Z,—

This relay Z is through parallel switching and forward connection delayed in its response by resistances so that it only responds when the impulses for setting the meter into operation are of sufficient length. At the same time, a test is made through the contact *b2* of the relay B as to whether the day or night tariff is in operation. During the night, the switch N is reversed so that the following circuit is closed for the winding III of the relay H through the contact *b2*:—

+, contacts *n*, *b2*, *i4*, winding III of relay H,—

which maintains itself through its own contact *h2* and, with its contact *h3*, switches the zone testing circuit on to the contacts *zo3* to *zo8* on the night side of the time disc. The relay Z, by the opening of the contact *z3*, opens the circuit for the relay B and also, by means of its contact *z1*, closes a holding circuit for itself. A relay interrupter formed by the relays R and U is also switched in by means of the contact *z1* in the following circuit:—

+, contacts *st4*, *c1*, *z1*, *dz3*, *r4*, winding II of relay U,—

The relay interrupter now, by means of the contact *u2*, effects the accelerated stepping of the time switch DZ into the position **18** through the following circuit:—

+, contacts *u3*, *f2*, *dz1*, *z2*, magnet DZ,—

During the release of relay B, the stepping magnet DV of the tariff switching mechanism is energized once in the following circuit:—

+, contacts *st4*, *c1*, *z1*, *dz3*, *f1*, *b5*, magnet DV,—

The disc of the tariff switch gear is thus switched through one step and the contacts *dv1*, *dv2* and *dv3* are reversed.

In the position **18** of the time disc, the contact *dz3* is opened by a cam and the relay interrupter is thus disconnected. The time disc is now stepped every ten seconds through the 10-second switch SS.

At the nineteenth step of the time disc, the contact *dz1* is reversed and thus, the stepping circuit controlled by the contact *u3* of the relay interrupter is transferred from the magnet DZ to the magnet DV which effects the forward connection of the tariff member. At the 20th step of the time switch, the contact *dz3* is again closed and the relay interrupter is thus again brought into operation. A rapid stepping of the magnet DV and, therefore, of the tariff member is now effected by the contact *u3* and, indeed, until the zone contact *zo3* mechanically selected by a cam is reversed. When this contact is reversed, the following circuit for the magnet DZ is closed:—

+, contacts, *st4*, *c1*, *z1*, *v4*, *r3*, switch arm *da*, switch arm *db/c*, contacts *zo3*, *h3*, magnet DZ,—

The time switch is thus stepped through one step on to the twenty-first step at which the contact *dz3* is again opened so that the relay interrupter is disconnected and no further stepping of the tariff member takes place. At the beginning of the conversation, the tariff member is, of course, stepped to an extent which corresponds to the basic charge for the selected zone.

The extent to which it is thus stepped is, for example, that corresponding to a conversation of a duration of up to three minutes. At the expiration of three minutes, the tariff member must, therefore, be further stepped. For this purpose, the contact *dz3* through which the relay interrupter consisting of the relays R and U is switched is again closed, in the position **39**, by the time switch which, during this period, has been stepped every 10 seconds by the switch SS. The contact *u3* then again causes an intermittent energization of the magnet DV of the tariff member which is stepped until one of its cams reverses the selected zone contact *zo3*. The following stepping circuit for the magnet DZ of the time disc is then again set up:—

+, contacts *st4*, *c1*, *z1*, *v4*, *r3*, switch arm *da*, switch arm *db/c1*, contact *zo3*, *h3*, magnet DZ,—

The time disc is stepped through one step into the position **40** in which the contact *dz3* is opened so that the relay interrupter is switched out and the stepping of the tariff members is thus interrupted.

Now, at the conclusion of any minute of the conversation, a further charge becomes due to be made. For this purpose, the time switch causes the tariff member to be stepped in the positions **46, 53, 60, 67, 74, 81, 88, 95.**

In order to warn the speaking subscriber of the further charge to which he will be liable at the conclusion of the initial time allowance, the following buzzing circuit is closed by a cam of the time disc shortly before this charge becomes due, that is to say, before the tariff member is stepped:—

+, contacts *st4*, *c1*, winding III of relay B, winding III of relay J, contacts *dz5*, *th*, condenser, *Su2*

A higher buzzing tone is thus transmitted

through the speaker wires. The contact *dz*5 is closed in the positions 38, 45, 52, 59, 66, 73, 80, 87, 94, 101. By the closing of the contact *dz*5, a thermal relay T*h* is energized which, through the opening of its contact *th*, imposes a limit on the duration of the signal.

At the conclusion of the maximum allowable time of conversation, at the expiration of 12 minutes, for example, the time disc arrives in the position 102. In this position, the contact *trz* is fully reversed by a cam of the time disc so that the double make contact is actuated. In this way, the following energizing circuit is closed for the disconnecting relay S:

+, contacts *st*4, *c*1, *z*1, *trz*, winding I of relay S,—

Relay S responds and, in the manner described above, causes the call to be cut off.

If the conversation ends before the expiration of the maximum allowable period, then, in known manner, when the calling subscriber hangs up, current is switched on to the *a* wire in the group selector acting as a metering indicator. As a consequence, the relay J is energized in the circuit:—

a-wire, windings I and II of relay J, contacts *dv*2, *st*2,+

The relay J short circuits its winding II by means of its contact 15 and thus strengthens the current flowing through the *a*-wire whereby the calling subscriber, in known fashion, is prevented from breaking the connection with the first group selector. The contact *i*3 prepares the meter repeater circuit while the relay V is energized through the contact *i*2 if the time disc is not exactly in a position in which the tariff member can be stepped. The following circuit is thus established:—

+, contacts *dz*4, *i*2, relay V,—

The contact *v*4 prepares the energization of the relay B and at the same time causes the relay F and the release magnet AM to be energized in the following circuit:—

+, contacts *st*4, *c*1, *z*1, *v*4, *dv*3, relay F,—and magnet AM,—

On attraction of its armature, the magnet AM releases the mechanical locking of the armature of the magnet EM so that the switch arms *db*/*c* are removed from the contact bank and thus the zone testing circuit is interrupted. The relay F responds and closes the following circuit with its contact *f*1 for the relay interrupted and for the energization of the relay S:—

+, contacts *st*4, *c*1, *z*1, *v*4, *dv*3, *f*1, *r*4, winding II of relay U,—and contact *f*1, winding II of relay S,—

Contact *f*2 switches the stepping circuit intermittently closed by the contact *u*3 over to the magnet DR which now effects the step by step return movement of the tariff disc into the normal position. Relay S, by opening of its contacts *s*1, *s*2, *s*3, cuts off the connection. The relay E is then energized through the contact *s*4 as follows:—

+, contacts *st*4, *c*1, *s*4, winding III of relay E,—

and maintains itself through its contact *e*1. The contact *e*2 opens the circuit for setting the zone device into operation and the contact *e*4 interrupts the time disc stepping circuit.

During the stepping of the tariff member into the normal position, the contact *tg* is mechanically actuated by the teeth on the periphery of the tariff disc and, each time it is closed, energizes the relay B in the following circuit:—

+, contacts *st*4, *c*1, *z*1, *v*4, *tg*, winding II of relay B,—

At each response the relay B closes the following meter circuit through its contact *b*3:

—, meter ZS, contacts *i*3, *b*3, *b*-wire

In order to reach the normal position, the disc of the tariff switch mechanism has to be moved back through the same angular amount as it was stepped forward during the conversation. The number of times the contact *tg* is closed thus corresponds to the number of the units of charge chargeable in accordance with the duration of the conversation and the selected zone.

When the tariff disc reaches its normal position, the contacts *dv*1, *dv*2, *dv*3 are again returned into the illustrated normal position. The contact *dv*1 interrupts the stepping of the magnet DR. The contact *dv*2 interrupts the energization circuit of the relay O which releases and thus also de-energizes the relay V. By the interruption of the circuit for the relay J, the prearranged first group selector is disconnected in known fashion so that the circuit for the relay C is also interrupted. After release of the relay C, the following energization circuit for the relay F is closed:—

+, contacts *st*4, *c*1, *dz*2, relay F,—

which again effects the energization of the relay S, winding II. The magnet DA of the first selector of the zone determining device is now stepped into the normal position by means of the relay interrupter through the following circuit:—

+, contacts *u*3, *f*2, *dv*1, *wa*1, magnet DA,—

In the normal position, the contact *wa*1 is reversed and thus the stepping circuit for the magnet DC is closed in the following circuit:—

+, contacts *u*3, *f*2, *dv*1, *wa*1, *wd*2, magnet DC,—

When the switch arms *db*/*c* reach the normal position, the contacts *wb*1 and *wb*2 are reversed. The following stepping circuit for the time disc is now closed by the contact *wb*2:—

+, contacts *u*3, *f*2, *dv*1, *wa*1, *wb*2, magnet DZ,—

When the time disc has also returned to the normal position, the contact *dz*2 is opened and thus the energization circuit for relays F and S is interrupted. All the switch means and relays are now back again in the normal position.

It can happen that certain exchanges only have two characteristic figures, the dialling of which is to determine the "value" of the zone to which it belongs. In this case, after the time zone meter is seized, only the switch arm, *da* is set by the emission of the second series of current impulses, the switch arms *db*/*c* being only incompletely set by being stepped through large steps. In order that the zone may be properly determined in this case, when the relay B and therefore the relay Z have been energized, the switch arms *db*/*c* are stepped through one additional step. During the time during which the relay B is de-energized, the following energizing circuit for the magnet DC is closed for a short time:—

+, contacts *st*4, *c*1, *z*1, *dz*3, *f*1, *b*5, *u*1, magnet DC,—

At this instant, the relay U still holds its armature attracted because, due to the incomplete setting of the zone determining device, it remains energized until energization of the relay Z. The zone contact of such an exchange is therefore always closed during the first step

of the decade determined by the two-figure call number.

If all the exchanges that can be selected have only two-figure call numbers as is, for example, the case when the time-zone meter is connected behind a second group selector of a main exchange, then the selectors DA, *da* are dispensed with and only a single switch arm *dc/c* has to be provided. The contacts *wa1* and *wa2* must then be bridged in the manner indicated in dotted lines.

If a call is made within the local zone or to a service station, then there is no charge to be made according to the length of the conversation but only a single basic charge. The exchanges of service stations have, for example, a 1 or a 0 as the first effective figure of their call number. In this case, on release of the relay V after emission of the first series of current impulses which acts on the time-zone meter, the relay E is energized in the following circuit:—

+, contacts *st4*, *c1*, *z1*, *v1*, *trz*, *da*, winding I of relay E,—

The relay E closes a holding circuit with its contact *e1* through its windings I and II and, with its contact, *e4*, interrupts the stepping circuit for the time disc DZ. If then, the meter is subsequently brought into operation by energization of the relays B and Z, as already described, the magnet DV is energized once through the contact *w5* until release of the re'ay B, so that the tariff disc is moved one step out of the normal position. When the connection is broken, the tariff disc must, therefore, be switched back through one step into the normal position so that only one unit of charge is made through the contact *tg*.

There may be regulations to the effect that for calls between the various exchanges situated in a particular zone, the zone 2 for example, only two local units are to be charged for an unrestricted time of conversation both during the day and during the night. For this purpose, the contact *zo2*, which is reached with a particular setting of the zone determining device, is connected in such a way that on reversal of this contact by means of the cam of the stepped tariff disc, not only is the time disc stepped through one step for bringing the tariff disc to rest, but the relay S is also at the same time energized through its winding I so that no further stepping of the time disc takes place under the influence of the 10-second switch SS. The tariff disc cannot, therefore, be stepped further and, at the end of the connection, only a number of metering impulses corresponding to this setting of the tariff disc, two, in the present example, can be transmitted.

If, for any reason, the tariff disc when stepped fails to test any zone contact at all, it is stepped into its zero position by the magnet DV. In this zero position, the fault relay *St* is energized in the following circuit:—

+, contacts *st4*, *c1*, *z1*, *r5*, *f3*, winding I of relay *St*, contact *dv2*,—

Relay *St*, with its contact *st1*, closes a holding circuit through its winding II, breaks the seizing circuit for the relay C by means of its contact *st3* and, by opening the contact *st4*, interrupts the basic time-zone meter circuit. This relay *St* is also energized through the contact *si* when the time-zone meter fails to act with certainty.

The stepping of the time disc when the called subscriber answers from position 18 to position 20 at 10-second intervals without influencing the tariff disc allows the calling subscriber to hang up in the case of error so that it is only the charge for a local conversation which becomes due to be made. The tariff disc is, in this case, only stepped through a single step when the called subscriber answers. If, however, the calling subscriber delays hanging up for more than 20 seconds, then as described, the tariff disc will be stepped to the basic extent determined by the dialled zone.

In the described example of construction, the units of charge incurred during the conversation were stored by the tariff disc and were only transmitted to the calling subscriber's meter at the end of the connection. This is not, however, necessarily the case in accordance with the invention. The switching steps can indeed be arranged to take place so that the transmission of the meter impulses to the calling subscriber's meter is effected when the tariff disc is stepped by the contact *tg* without any storing of the meter impulses.

Clearly, special metering switches can be connected in the various circuits of the time-zone meter for statistical purposes. Thus, when the time-zone meter is seized by the prearranged first group selector, the lamp BL and the meter ZB are energized through the contact *c1* so that the number of calls is recorded.

In the circuit in which the time disc is stepped under the influence of the 10-second switch SS, is connected a meter ZD which indicates the time during which the time-zone meter remains seized. A meter ZGD can also be connected to this circuit through the contact *z4* of the relay Z energized after the meter is brought into operation and which records the duration of the conversation.

The meter ZGB lies in the energization circuit of the relay Z and, at each energization of the relay Z, is energized and therefore marks up the number of times the meter is effectively brought into operation. The meter switch ZS lies in the meter impulse circuit through which the meter impulses are transmitted to the *b*-wire and marks up the number of transmitted current impulses. By means of these five meter switches, all information necessary for statistical purposes can be obtained.

The general arrangement of the time and meter stepping device for the time and zone determining device with a time and tariff device is shown in Figures 8 to 10.

A stationary shaft W is mounted in two bearings L1 and L2 on a base plate G. The time disc 17 is movably mounted on the shaft W in the neighbourhood of the bearing L1 and can be stepped by means of an electromagnet DZ. On the side faces of the time disc 17, cams 19 are arranged which control the sets of contact springs *dz*. These sets of contact springs are also fixed on the base plate G.

The tariff disc 11 is arranged on the shaft W in the neighbourhood of the bearing L2 and has on both side faces cams 16 which control the sets of contact springs *zo*. The tariff disc 11 has teeth 15 on its periphery for actuating the sets of contact springs *tg*. The two stepping ratchet wheels 12 and 13 are connected to the tariff disc 11 through the sleeve 14 and are provided with oppositely disposed teeth. The wheel 12 is stepped by the magnet DV and the wheel 13 by the magnet DR.

A grease cap FB serves for lubrication of the various bearings on the shaft W.

In order that the space occupied by the whole arrangement may be made relatively small, the

base plate G is formed with cut out portions through which the stepping wheels, the tariff disc, the driving magnets and the sets of contact springs project.

In the time-zone meter illustrated in Figures 11 to 16, the stepping of the zone value is effected by means of a mechanical zone determining device.

If three series of current impulses are necessary for determining the zone, then the zone determining device must be arranged so as to have 1000 different settings. A device is therefore provided which will be referred to as the "criterion carrier" which consists of a number of discs 213 (Figures 11 and 12) mounted on a sleeve 215. The discs are separated by distance pieces 214 and are firmly pressed against a stop on the sleeve by means of a nut 216. The sleeve 215 is connected to a toothed wheel 217 from which projects a pin 218 passing through holes in the discs 213 and thus preventing them from rotating relatively to the toothed wheel. The toothed wheel 217 is also connected by means of pins 219 to a disc 220. A clock spring is arranged between the toothed wheel 217 and the disc 220 and has one end fixed to the disc 220 while the other end is hooked on to a pin 221 which is arranged on the base plate 211. The plate 220 carries a further sleeve 222 on which a toothed wheel 223 is fixed. This toothed wheel 223 has 11 teeth while the toothed wheel 217 has 121 teeth. The toothed wheel 223 can be stepped by the pawl 224 of a magnet not illustrated in the drawings, while the toothed wheel 217 can be stepped by another magnet not shown in the drawings. The assembly constituted by the toothed wheels 223 and 217 and the discs 213 is freely movable on a fixed shaft 212 mounted in the base plate 211 and, in the normal position, is held by means of the clock spring 230. The normal position is determined by a projection 225 which abuts against a projection 226 pivotally mounted on the base plate. As this assembly is displaceable on the shaft 212, it is held against displacement by a screw 227 inserted in the free end of the shaft. A pointer 228 is also preferably connected to the fixed shaft by means of the screw 227 so that the degree of displacement of the criterion carrier can be read off a scale arranged on the disc 229.

Each disc 213 has 121 teeth 31. The teeth can be of different lengths and eight different lengths are provided, each length corresponding to one of the eight different zone values. The teeth are milled over the whole circumference of the disc while the lengths are determined by stamping of concentric circles in the upper surface of the discs (Figure 14).

The teeth 31 of the disc 213 can be cut to the required length by means of a pair of nippers or other similar tool. As there are always several exactly similarly constructed time-zone meters in an exchange, it is only necessary to carry out this work by hand on the disc of one of them. This disc can then be used as a template for all the other devices which are milled in a simple manner as a bunch. In this way, an exact matching of the discs of all devices is obtained so that the testing need only extend to a single device.

The provision of 121 teeth on each disc which is advantageous for the stepping of the criterion carrier in large and small steps has the advantage that the position of rest between the large step stepping and the small step stepping can be used for the evaluation. This is in particular necessary when, in a network of connections, a particular exchange can only be reached by passing through a particular operator, and, for establishing a connection to an operator's station, a smaller number of series of current impulses, 2 for example, is required than for the determination of the distant zone. For simplification of the circuits for bringing the zone determining device into operation, contacts are controlled by the criterion carrier. As soon as the criterion carrier leaves its position of rest when the large switching steps are effected by the toothed wheel 223, the movable stop 226 is released and rotates through a small angle so that the contact *vw* is closed. The rods 219 which connect the disc 220 to the toothed wheel 217 and the casing of the clock spring are so arranged that in each position of rest which occurs between two large steps of the criterion carrier, they may actuate a contact which is not illustrated in the drawings. This contact thus remains, after the displacement of the criterion carrier in large steps, in the same position in which it finds itself in the normal position of the criterion carrier. It is only when the criterion carrier is rotated by the small step stepping effected through the toothed wheel 217 and its associated electromagnet, by an amount which is smaller than the angular distance between two positions of rest, that the pin 219 releases the contact which moves into its working position.

In order to prevent an undesired backward rotation of the criterion carrier under the influence of the clock spring during and after the setting, a check pawl may be provided which is in engagement with the teeth of the toothed wheel 217.

For determining the tooth length corresponding to the selected setting, a feeler member 32 is provided. This feeler can carry out two movements. By the first movement, a disc 213 of the criterion carrier is selected, that is to say, a selection takes place from 10 groups each of 100 possible settings. The second movement, which takes place in a direction radial to the disc 213, serves for establishing the length of the tooth corresponding to a particular setting selected from the selected group of 100. A special guide is provided for making possible this two-fold movement of the feeler member 32. A vertical guide pin 34 on which is mounted a carrier 37 which can be moved downwards against the action of a spring 38 is mounted in a bearing 33 fixed to the base plate 211. The forward end of the carrier 37 is made hollow and is closed by a screwed on cap 39. This end of the carrier 37 is also provided with a slot 40 which passes right through it and through which passes the feeler 32. The carrier 37 is also surrounded by a protecting shield 52 which is fixed to the bearing 33 and is slotted at 53 for the passage of the feeler 32. The feeler 32 is formed with a bearing 41 which slides in the hollow part of the carrier 37 and is under the influence of a spring 42. The feeler 32 can thus move longitudinally relatively to the carrier 37 with the carrier in a direction at right angles to that longitudinal direction.

For stepping the feeler along the carrier 37, a rack 43 is provided on which there is a pin 44 which lies in the forked end 45 of the feeler 32. The stepping pawl of an electromagnet which is not illustrated can engage with the rack 43. The upper part of the rack 43 has teeth 46 in which

a check pawl 47 which is pivotally mounted on the pin 48 on the bearing 33 can engage.

The rack 43 is provided at its right hand end with a projection 49 forming a stop which, in the normal position of the rack, holds a contact *nw* open. When the rack makes its first step under the action of the unillustrated electromagnet, this contact *nw* is closed. The stop 49 also has resilient switch arms 50 fixed to it which, on movement of the rack, wipe over the contacts of a stationary contact bank 51 fixed in a suitable manner to the base plate 211. In this way, a special circuit can be closed at each step made by the rack 43. This arrangement for closing various circuits plays no part in the operation of the device for estimating the value of a particular setting of the criterion carrier.

The setting of the feeler 32 is thus effected by stepping the rack 43 which carries the feeler with it. As the rack and feeler move to the right, the compression spring 42 is energized and the return movement is prevented by the check pawl 47 which engages in the teeth of the rack 46. The first step brings the feeler 32 above the extreme left hand disc 13, the carrier 37 remaining at rest.

The radial movement of the feeler 32 is effected through a projection 54 from the carrier 37 against which bears the armature 55 of an unillustrated electromagnet. When this electromagnet is energized, the carrier 37 and the feeler 32 are pressed downwards so that the lower end of the feeler moves downwards towards the criterion carrier. This downward movement continues until the feeler encounters a resistance, that is to say, until it abuts on the head of the tooth 31 (the length of which depends upon the unit of value) of the selected disc 213 of the criterion carrier. The length of this engaging movement of the feeler member 32 thus corresponds to the particular unit of value. As is clear from the drawings, in the normal position, the forked projection of the feeler 32 lies on the upper surface of the shield 52 so that the feeler cannot return into that position before the selecting movement is carried out.

The carrier 37 projects through a slot 56 in the base plate 211 and on the far side of the base plate has a projection 57 which is connected to a rack 58 (Figure 13). A check pawl 59 fixed on the base plate 211 engages in this rack 58 and prevents the carrier 37 from being lifted by the spring 38. The pitch of the teeth of this rack 58 corresponds exactly to the units of the value to be determined so that it is not necessary for the length of the various teeth in the discs 213 to be absolutely accurate as long as it is within the limits of the length corresponding to a unit of value. The correct position of the carrier 37 is, indeed, always determined by the engagement of the pawl 59 in the rack 58. The rack could, naturally, be fixed and the check pawl be arranged on the projection 57.

A bent rod 60 carrying an indicator 61 is fixed to the projection 57. This indicator 61 moves over a scale 62 on the base plate 211 so that the determined value can be read off directly. Instead of or in addition to a scale and a pointer, a contact arm and as many fixed contacts as there are units of value could be provided. In that case, a circuit would at any time be closed corresponding to the ascertained value through which a tariff device can be electrically controlled.

In the example of construction now being described, the tariff device is directly and mechanically controlled by means of the zone determining device. For this purpose, two pins 63 and 64 are provided on the projection 57 of the carrier 37 which are under the influence of springs 65. Each of these pins 63 and 64 has a disc 66 or 67 fixed to move with it. The armature 68 of an unillustrated electromagnet moves in front of these discs and in each of its positions holds one of the discs 66, 67 back against the action of a spring 65 so that at any time only one pin 63 or 64 can project. In Figure 12, the armature 68 lies in front of the disc 67 and, consequently, holds back the pin 64. The pin 63, on the other hand, is free and bears against a meter stepping device 69 which is constructed as a storing wheel.

The wheel 69 is freely mounted on the shaft 212 which traverses the base plate 211. It is provided with a spring housing 70 which is fixed on the shaft 212. The spring in this housing tends to rotate the storing wheel 69 in the direction indicated by the arrow in Figure 13 but such rotation is prevented by the check pawl 72 which is resiliently pressed into engagement with the teeth 71 formed in the periphery of the storing wheel. A pin 73 is also provided on the storing wheel 69 which, in the normal position, bears against a movable stop 74 mounted on the base plate and holds this stop against the action of a spring 75. The projection 74 acts on a contact *go* which is reversed when the storing wheel 67 reaches its normal position. An electromagnet TM is also provided which, by means of the stepping pawl 76 which engages in the teeth 71 of the storing wheel 69, rotates the wheel 69 against the action of the clock spring in the casing 70.

There is a radial slot 77 in the storing wheel 69 which, in the normal position of the storing wheel, lies in front of the pins 63 and 64 on the carrier 37. This slot does not reach quite as far as the circumference of the storing wheel so that, in the normal position of the carrier 37, the upper pin 63 cannot engage in the slot. If, however, the carrier 37 is depressed, then the pin 63 comes in front of the opening of the slot 77 and engages in the slot unless prevented from doing so by the armature 68. A number of concentric rows of holes 78 are provided in the storing wheel 69, each of which corresponds to a particular value determined by the height of the carrier 37. The holes in these rows 78 are spaced at various angles over the storing wheel 69. The angular distance between two neighbouring holes in a row corresponds to a particular unit of value. For example, for seven different zone values corresponding to the selector setting, with the described arrangement, 14 different rows of holes are provided. The first seven of these rows of holes correspond to the seven tariffs for the different zones. The second seven rows of holes are for the purpose of enabling a switching over to a different tariff to be effected at particular times, for example, so that at night calls are charged at a cheaper rate. The first seven rows of holes are selected by the pin 63 while the second seven rows of holes are selected by the pin 64. The switching over to the alternative tariff is effected by putting the pin 63 into action and the pin 64 out of action or vice-versa through energization or de-energization of the unillustrated electromagnet controlling the armature 68.

The series of holes in the storing wheel 69 are fixed once and for all when the tariff is fixed.

In order to make an alteration of the tariff device easy when the tariff is altered, these rows of holes are preferably stamped out of a disc of sheet steel fixed to the storing wheel 69 and which is changed when the tariff is altered.

A time disc 79 having a spring housing 80 is rotatably mounted on the shaft 212. The spring in this housing 80 urges the time disc 79 into its normal position in which a pin 81 (Figure 12) on this disc bears against a projection 119 connected to the stationary shaft. The time disc 79 has teeth round its circumference in which a check pawl 82 can engage. An electromagnet ZM is also provided, the stepping pawl 83 of which allows the disc 79 to be stepped against the action of the spring in the housing 80. The stepping pawl 83 has a pin 84 which bears on a projection from the storing wheel check pawl 72 so that at each attraction of the electromagnet ZM, this check pawl is lifted out of the teeth 71 of the storing wheel 69. The time disc 79 is also provided with switch cams 85 at particular intervals on one side which act on a cam 86 on a member 89 arranged for movement along a stationary shaft 87 against the action of a spring 88. When one of the cams 85 moves past the cam 86, the member 89 is displaced towards the base plate for a short time. This member 89 has a slotted part 90 which engages over a fixed pin 91 (Figure 16) and which lies in front of the pins 63, 64 of the carrier 37 and limits the movement of these pins under the action of their springs 65. When the member 89 returns into the position shown in Figure 12, the effective pin 63 is drawn away from the storing wheel 69. However, before the pin 63 leaves the slot 77 in the storing wheel, a check pawl 93, which is visible in Figures 13 and 16, is released by a projection 92 (Figure 16) of the member 89 and engages in the teeth 71 of the storing wheel 69. This check pawl 93 is so arranged that its edge is displaced relatively to the forward edge of the slot 77 by half a pitch of the teeth 71. When the member 89 makes its return movement, the pawl 93 will thus first of all engage in the teeth so that the pin 63 is removed from the slot 77. As the return movement of the member 89 under the action of a cam 95 on the cam 86 always takes place at the instant of energization of the magnet AM which steps the disc 79, the storing wheel check pawl 72 is lifted at this instant. Thus, when the pin 63 comes out of the slot 77, the storing wheel 69 is released and, under the action of the spring in the housing 70, moves in the direction of the arrow through half a pitch of the teeth 71 whereupon the movement is stopped by the check pawl 73.

The movement of the member 89 only takes place for a short time. As soon as the cam 86 is again free, the member 89 is moved forward under the action of the spring 88. In this way, the pin 63 is first of all released and bears against the storing wheel under the action of its spring 65 and thus can no longer engage in the slot 77 because the latter is displaced by half a tooth pitch. On the occurrence of the further forward movement of the member 89, the projection 92 is removed from beneath the check pawl 93 and lifts the latter. The storing wheel 69 is now again released and rotates until the pin 63 engages in the next hole of the series of holes selected by the height of the pin 63 in accordance with the ascertained value. The storing wheel 69 remains in this position until the next cam 85 of the time disc 79 abuts against the cam 86 on the member 89. The time disc 79 is stepped at equal intervals of time, 5 seconds for example, by means of the electromagnet ZM. The arrangement of the cam 85 on the periphery of the wheel 79 thus determines the instant at which a storing of the charge that is to be made according to the existing tariff is to be effected by means of a rotation of the storing wheel. This occurs, for example, after the first 15 seconds after the setting into operation of the wheel 79, again after the expiration of the first three minutes and then again after the expiration of every subsequent minute up to a maximum of 12 minutes.

At each of these instants, the storing wheel 69 is released and is then rotated through the angular distance between the holes of the selected row. It can quite clearly be seen that in this way any desired graduation of a tariff can be obtained in that, for example, by means of the release after the first 15 seconds, a stepping takes place to a particular extent and by means of the release after each following minute, a stepping takes place through a smaller amount which can constantly increase.

In order to indicate to the subscriber the instant of time at which the charge storing operation for the call is undertaken, cams 94 are provided on the time disc 79 at the same intervals as the cams 85 which can actuate contacts through which, for example, the circuit for a buzzing signal is closed. These cams 94 are set at a small angular distance in advance of the cams 85 so that on the periodical stepping of the time disc 79 by means of the electromagnet ZM, a cam 94 actuates a stationary contact about 10 seconds earlier than the next cam 85 comes into engagement with the cam 86 on the member 89 for the purpose of releasing the storing wheel 69.

A further cam 95 is provided on the time disc 79 which has a somewhat greater length than the cam 94. After a complete rotation of the time disc 79 which takes 12 minutes, this cam actuates a special contact not illustrated in the drawings through which, for example, the connection can be positively broken.

An indicator 97 is also fixed on the shaft 212 by means of a screw 96 and a scale is arranged on the time disc 79 in suitable fashion so that the duration of the call can be read directly at any time by the degree of displacement of the time disc 79.

It is clear that the zone in which the called subscriber's exchange is situated is first of all ascertained by displacement of the feeler 32 along the carrier 37 and by rotation of the criterion carrier in large and small steps, and that the value of this zone is then obtained by lowering the feeler. This value is represented by the height of the pins 63, 64 connected to the carrier 37 and can be read off the scale 62. It is also clear that a storing of values will be carried out by rotation of the storing wheels 69 in accordance with the various intervals of time. This rotation takes place through an angular amount which is determined by the distance between the holes of the series of holes selected by the height of the effective pin. At the end of the connection, metering current impulses, the number of which is dependent upon the charge amount that has been stored, have to be sent to the calling subscriber's meter. For this purpose, pins 98 are arranged on the storing wheel 69 at equal distances from each other which can work a contact *g* (Figure 13). The number of pins in this ring is a multiple of the number of teeth 71 on the storing wheel

69. This is essential in order that various charges may be rounded off. For example, if the night charge is only two-thirds of the day charge, then the angular distance between the holes of the innermost seven rows of holes wiped over by the pin 64 must be exactly two-thirds of the outer seven rows of holes wiped over by the pin 63. In this way, it can be obtained that although from instant to instant a further rotation of the storing wheel 69 takes place, no raising of the charge takes place. If the number of pins is a multiple of the number of teeth 71, then the storing wheel can be stepped through one or more teeth without causing a new pin 98 to come under the contact *g*.

The production of the metering current impulses by wiping of the pins 98 over the rollers 99 (Figure 13) controlling the contact *g* has the advantage that the emission of current impulses is effected with absolute accuracy and exactness, no distortion in the transmission occurring as may occur when the transmission is effected by means of relays. Also, in this way, the sending of the meter current impulses is concluded by the time the wheel 69 has returned into its normal position whereas, if the meter current impulse circuit were controlled by a contact itself controlled by the electromagnet which effects the step by step return movement of the storing wheel 69, it might easily happen that this electromagnet is not de-energized on reaching the normal position of the storing wheel 69, and, therefore, sends out further current impulses.

The electromagnet TM, the check pawl 76 of which engages the teeth 71, is, as already mentioned, provided for returning the storing wheel 69. In order that the storing wheel 69 may be rotated, the pin 63 or 64 which has been operative until then has to be lifted out of the selected series of holes. For this purpose, when the supervision of the connection is ended, an electromagnet AM (Figure 16) is energized, the armature of which has a projection 100 by means of which the actuation of a contact *am* and various mechanical controlling steps are effected. The device necessary for this purpose is illustrated in detail in Figure 16. It consists essentially of a shaft 101 rotatably mounted in the base plate 211 and on which the various switching cams are fixed. A spring 103 engages with the switching cam 102 and tends to hold the shaft 101 always in a particular normal position. A pin 105 is fixed on the switch cam 104 and lies between two pins 106 of the armature 100 so that on energization of the electromagnet AM, the shaft 101 is rotated against the action of the spring 103. On the occurrence of this rotary movement, a check pawl 108 is first of all released by a projection 107 of the cam 104 and engages in the storing wheel teeth 71. This check pawl 108 is so arranged that its position of engagement registers with the holes in the rows of holes and thus is not displaced through half a tooth pitch relatively to the running edge of these holes as was the above mentioned check pawl 93. By the engagement of the check pawl 108, the position taken up by the storing wheel 69 is maintained independently of the pins 63, 64.

On further rotation of the shaft 101, the oblique projection of a cam 109 abuts against the member 89 and presses this member towards the base plate so that the pin 63 or 64 is, in the already described manner, brought out of engagement with the selected series of holes in the storing wheel 69.

After this return movement of the pins 63, 64, a projection 110 of the cam 102 removes the check pawl 59 out of the rack 58 so that the carrier 37 is lifted under the action of the spring 34 and separates the feeler 32 from the criterion carrier.

On further rotation of the shaft 101, a cam 111 removes the check pawl 47 out of the rack 46 so that the feeler 32 returns into the normal position under the action of the spring 42 in which position the contact *nw* is actuated by the projection 49. When this movement occurs, the lower end of a pin 112 fixed to the rack 46 engages under the check pawl on the criterion carrier which has already been mentioned and which is not shown in the drawings and which is in engagement with the toothed wheel 217. The check pawl is thus displaced and the criterion carrier is consequently released and rotates under the influence of the clock spring fixed to the plate 220 until its projection 225 abuts against the movable stop 226, that is to say, until the normal position is reached. In this position the contacts *vw* and *ow* are again reversed.

By means of the return of the carrier member 37 into its normal position, a rod 113 connected to the check pawl 82 and the free end of which lies on the upper edge of the rack 58, is lifted so that the check pawl 82 is brought out of engagement with the time disc 79 and this disc, also under the influence of the clock spring arranged in the spring housing 80, is returned into its normal position determined by the stop 81.

The energization of the electromagnet AM also has the result that the whole of the hitherto displaced parts are returned with the storing wheel 69 into their normal positions. It is only this storing wheel which is held in the displaced position by the check pawl 108 and the check pawl 72. The electromagnet AM remains energized for the whole duration of the return movement. Thus, by means of the contact *g*, current impulses are sent out until the projection 73 of the storing wheel abuts against the movable stop 74 whereby the contact *go* is opened which causes the energization circuit of the electromagnets AM and TM to be broken.

As already described, in this example of construction, the value of the call is determined by means of a downward movement of the carrier 37. It may, however, be necessary that no multiple metering should take place in the first evalution so that on the determination of only a small value, the storing wheel 69 and the time wheel 79 remain in their normal position. In order to obtain a positive dependence for this purpose, contacts *em0*, *em1*, *em2* (Figure 12) are closed by the member 60 which is connected to the carrier member 37. The contact *em0* is closed when the carrier member is lowered through one step, the contact *em1* when the carrier member is lowered through two steps, while the contact *em2* is only closed when the carrier member is lowered through at least three steps. For example, the circuit for the stepping magnet ZM of the time disc 79 is first of all closed by this contact *em2* so that thus a multiple metering can only take place in dependence upon the time and the established value when the product is at least 3. The contact *em1* can, for example, effect a metering by one step which is appropriate for local calls while other switching functions can be carried out through the contact *em0*.

If special contacts are to be closed in depend-

ence upon the rotation of the discs of the criterion carrier through large and small steps, then fixed contacts 114 are arranged on the circumference of the criterion carrier (Figure 15) which can be actuated by cams of the criterion carrier. In their simplest form, these cams are formed by stampings out of a sheet 115 which is inserted in one of the slits in the discs 213 and is connected in suitable fashion, by bending for example, to the last of these discs. In this way, it is possible to close circuits in particular positions of the criterion carrier.

By connecting the contacts 51 which, on displacement of the feeler 32, are wiped over by the arm 50, to the contacts 114, it is possible, for each of the 1000 possible settings, to actuate the circuits corresponding to the setting of three selectors of the trunking scheme. This may be necessary in order, for example, to re-route the connection made by a subscriber over a simpler and shorter path.

The arrangement of the whole of the moving parts of the described time-zone meter on one side of a stationary base plate 211 has the advantage that these parts are easily accessible and that the degree of displacement of the individual parts is visible.

The supply of current to the various electromagnets and mechanically controlled contacts is effected through a contact strip 116 (Figure 12) which is arranged at the base 117 of the base plate 211. The contacts 118 of this strip 116 are made, in known fashion, as pins so that if the arrangement 117 is fixed to a frame, an electrical connection can be made without difficulty with the contact springs of a corresponding opposite strip. In this way, easy interchangeability of the described device is obtained.

We claim:—

1. A device for time and zone metering in telephone systems, comprising means for ascertaining the zone value of a connection, a time switch device and a movable meter stepping device, said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to start a movement of said meter stepping device, and said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time.

2. A device for time and zone metering in telephone systems, comprising means for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said time switch device being adapted to produce energizations at intervals of time for stepping said meter stepping device, and said meter stepping device being constructed as a rotary disc, said disc being provided with means arranged in several concentric rows corresponding to the number of zone values and adapted to limit the rotation of said disc to an angle determined by the ascertained zone value.

3. A device for time and zone metering in telephone installations, comprising means for ascertaining the zone value of a connection, a time switch device and a movable meter stepping device, said time switch device being provided with means for at intervals of time corresponding to the unit periods of conversation starting a movement of said meter stepping device and said meter stepping device being provided with means for limiting its such movement to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time.

4. A device for time and zone metering in telephone installations, comprising means for ascertaining the zone value of a connection, a time switch device constructed as a rotary disc and a meter stepping device, the disc of said time switch device being provided with cams arranged at particular angular distances for the production of energizations for stepping the meter stepping mechanism at intervals of time and said meter stepping mechanism being provided with several groups of means, each group corresponding to a zone value and each means within one of said groups corresponding to a different interval of time, said means being adapted to limit the stepping of said meter stepping device to an extent determined by the ascertained zone value and by the actual interval of time.

5. A device for time and zone metering in telephone installations with calling and called subscribers, comprising means for ascertaining the zone value of a connection, a time switch device, a movable meter stepping device, means associated with said time switch device for closing energizing circuits for starting a movement of said meter stepping device at intervals of time corresponding to the unit periods of conversation, means associated with said time switch device for signalling the calling subscriber, said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time.

6. A device for time and zone metering in telephone installations, comprising means for ascertaining the zone value of a connection, a time switch device, a movable meter stepping device, means associated with said time switch device for starting a movement of said meter stepping device and means associated with said time switch device for signaling the calling subscriber and means for limiting the movement of said meter stepping device to an extent determined by the ascertained zone value, said signaling means being arranged so as to be actuated before actuation of said means for starting a movement of said meter stepping device.

7. A device for time and zone metering in telephone installations with calling and called subscribers, comprising means for ascertaining the zone value of a connection between a calling and a called subscriber, a movable meter stepping device and a time switch device, said time switch device being provided with means for starting a movement of said meter stepping device, with means for signaling the calling subscriber and with means for cutting off the connection at the expiration of a particular period of time when the called subscriber fails to reply, and said meter stepping device being provided with means for limiting its movement to an extent determined by the ascertained zone value and by the actual interval of time.

8. A device for time and zone metering in telephone installations with calling and called subscribers, comprising means for ascertaining the zone value of a connection between a calling and a called subscriber, a time switch device, a movable meter stepping device, means asociated with said time switch and adapted to start a movement of said meter stepping device, means controlled by the called subscriber adapted to make said means of said time switch effective after the expiration of a minimum length of time after the called subscriber has answered and means associated with said meter stepping device for limiting the distance through which it is moved in accordance with the ascertained zone value and the actual interval of time.

9. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a movable meter stepping device, circuits for moving said meter stepping device step by step, and means associated with said time switch device for controlling said stepping circuits for starting a step by step movement of said meter stepping device at intervals of time corresponding to the unit periods of conversation, said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time.

10. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a meter stepping device and means for locking said meter stepping device against movement, means associated with said time switch device for mechanically controlling said locking means and means associated with said meter stepping device for limiting the distance through which it is stepped in accordance with the ascertained zone value.

11. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a movable meter stepping device; said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to produce energizations for starting a movement of said meter stepping device; and said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment, the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time; the meter stepping device being further provided with means for transmitting a number of metering current impulses corresponding to the extent to which it is moved or stepped.

12. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a movable time switch device, a movable meter stepping device mounted for rotation, means for moving said meter stepping device, and means for switching said meter stepping device back into its normal position; said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to produce energizations for starting a movement of said meter stepping device; and said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment, the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time; said meter stepping device being also provided with means for transmitting a number of metering current impulses corresponding to the extent to which it is moved, and said means for transmitting the metering current impulses being effective only upon the switching back of said meter stepping device into normal position.

13. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a meter stepping device and a number of contacts corresponding to the number of zone values related to said meter stepping device, said time switch device being adapted to produce energizations at intervals of time for stepping said meter stepping device, said meter stepping device being provided with several groups of means for controlling said contacts, each group corresponding to one of said contacts and each means within one of said groups corresponding to a different interval of time, and said device for ascertaining the zone value being adapted to close a number of circuits corresponding to the number of zone values, each of said circuits including one of said contacts controlled by said means of the meter stepping device.

14. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a meter stepping device, means for mechanically locking said meter stepping device against movement, said time switch device being adapted to control mechanically said locking means for said meter stepping device at particular intervals of time and said meter stepping device being provided with mechanical means for limiting its stepping to an extent determined by the ascertained zone value.

15. A device for time and zone metering, comprising a device for ascertaining the zone value of a connection and adapted to close a number of circuits corresponding to the number of zone values, a time switch device, a driving magnet for said time switch device, an intermittently closed switch, two stepping circuits for said time switch device, one of said stepping circuits being controlled by said intermittently closed switch and being adapted to step said time switch device intermittently, a meter stepping device, a driving magnet for said meter stepping device, means associated with said switch for closing a circuit for said driving magnet of said meter stepping device, a plurality of contacts corresponding to the number of zone values, means associated with said meter stepping device for influencing said contacts, said second stepping circuit for said time switch device being adapted to wipe over the contacts of the meter stepping device and the contacts of said device for ascertaining the zone value and being adapted to step said time switch device through one step.

16. A device for time and zone metering in telephone installations, comprising a device for

ascertaining the zone value of a connection, a time switch device, a meter stepping device, two ratchet wheels provided with oppositely acting teeth connected to said meter stepping device, a check pawl and a driving pawl for each of said ratchet wheels and means actuated by said driving pawls for disengaging said check pawls, said time switch device being adapted to produce energizations at intervals of time for stepping said meter stopping device, said meter stepping device being provided with means for limiting its stepping to an extent determined by the ascertained zone value.

17. A device for time and zone metering according to claim 16, in which a driving pawl for one ratchet wheel and a check pawl for the oppositely running ratchet wheel are arranged side-by-side in pairs.

18. A time zone counter according to claim 16, in which said driving pawl for one wheel and said check pawl for the opposite running wheel are arranged as a pair side-by-side, and a driving lever associated with each of said driving pawls, and a projection on each of said driving levers adapted to act on the associated check pawl during the stepping movement.

19. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a meter stepping device, said time switch device being adapted to produce energizations at intervals of time for stepping said meter stepping device, said meter stepping device being provided with means for limiting its stepping to an extent determined by the ascertained zone value, two oppositely acting ratchet wheels connected to said meter stepping device, a check pawl and driving pawl for each of said ratchet wheels, a driving pawl for one wheel and a check pawl for the oppositely running wheel being arranged side-by-side, a driving lever connected to each driving pawl, a projection on each of said driving levers, a pivoted lever on each of said check pawls arranged with one end in the path of movement of said projection on one of said driving levers, a stop pin on each of said check pawls and a spring acting on each of said pivoted levers.

20. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a meter stepping device constructed as a rotary disc and being provided with several concentric rows of holes, a stop pin controlled by said first mentioned device and adapted to engage in said holes, a spring acting on said meter stepping device and locking means for preventing movement of said meter stepping device under the influence of its spring, said time switch device being adapted to control said locking means at particular intervals of time.

21. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device constructed as a rotary disc and provided with cams, a meter stepping device constructed as a rotary disc and provided with several concentric rows of holes, a stop pin controlled by said first mentioned device, adapted to engage in said holes, a spring acting on said meter stepping device and a bent member acting on said stop pin, said cams of said time switch device being adapted to control said member temporarily.

22. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device constructed as a rotary disc and provided with a plurality of cams, a meter stepping device constructed as a rotary disc and provided with a plurality of concentric rows of holes, a stop pin controlled by said device for ascertaining the zone value and adapted to engage in said holes, a bent member controlled by said cams and acting on said stop pin, a spring acting on said meter stepping device and check pawls acting on said meter stepping device, said check pawls being controlled by said bent member, said bent member being adapted, on being temporarily actuated, to control said stop pin and said check pawl in such a way that on disengagement of said stop pin, said meter stepping device is released for a partial rotation under the action of its spring and, on re-engagement of said stop pin, is then completely released.

23. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device, a movable meter stepping device, said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to produce energizations for starting a movement of said meter stepping device, and said meter stepping device being provided with two groups of several series of means for limiting its movement to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time; together with means for selectively making effective a group of limiting means for said meter stepping device corresponding to the tariff in force.

24. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter switching device, said time switch device being adapted to produce energizations at intervals of time for stepping said meter stepping device, said meter stepping device comprising for each zone value two series of cams and two contacts controlled by said cams and means for selectively switching in one of said two contacts according to the appropriate tariff.

25. A device for time and zone metering in telephone systems, comprising means for ascertaining the zone value of a connection, a time switch device and a movable meter stepping device, said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to start a movement of said meter stepping device, and said meter stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment; the last named means being arranged in several groups, each group corresponding to a zone value and the means within each of said groups corresponding to a different interval of time, and the said means for limiting the movement of said meter stepping device including stop pins associated therewith and holes arranged in concentric rows upon the same cooperating with said stop pins controlled by the device for ascertaining the zone value, two concentric rows of holes [illegible] providing

ed for each zone value and two pins being controlled by said device for ascertaining the zone value, and means for selectively making effective one of said pins corresponding to the tariff in force.

26. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said first mentioned device comprising two rotary selectors, one of said rotary selectors being provided with a plurality of switch arms and 100 switch contacts for each of said switch arms, said time switch device being adapted to close circuits at intervals of time for stepping said meter stepping device, and said meter stepping device being provided with means for actuating a number of contacts corresponding to the number of zone values, said contacts being electrically connected to the contacts of said device for establishing the zone value.

27. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time device and a meter stepping device, said first mentioned device comprising two movable members, one of said movable members being provided with a plurality of different means, the other of said members being adapted to evaluate one of said means, said time switching device being adapted to start a movement of said meter stepping device at intervals of time and said meter stepping device being adapted to limit its movements to an extent determined by the evaluated means.

28. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said first mentioned device comprising two movable members, one of said movable members being provided with a plurality of teeth, the other of said movable members being adapted to determine the length of each of said teeth, said time switch device being provided with means for starting a movement of said meter stepping device at intervals of time, said second mentioned movable member acting on said meter stepping device for limiting its movements.

29. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said device for ascertaining or establishing the zone value comprising a movable carrier member, a plurality of pins on said carrier member, a movable feeler member for determining the length of said pins and means for stepping said carrier member in large and small switching steps; said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to start a movement of said meter stepping device, and said stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment, the last named means being arranged in several groups, each group corresponding to a zone value and being selected by said feeler member, the means within each of said groups corresponding to a different interval of time.

30. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said device for establishing the zone value comprising a shaft, a movable member rotatably arranged on said shaft, a plurality of discs on said movable member, a plurality of teeth on each of said discs, a feeler member, a guide for the movement of said feeler member along said shaft, means for moving said feeler member radially to said shaft for determining the length of said teeth; said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to start a movement of said meter stepping device, and said stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment, the last named means being arranged in several groups, each group corresponding to a zone value and being selected by said feeler member and the means within each of said groups corresponding to a different interval of time; and means for stepping the said carrier member in large and small switching steps.

31. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a time switch device and a meter stepping device, said device for establishing the zone value comprising a movable carrier member, means for stepping said carrier member in large and small switching steps, said means including a plurality of teeth on said carrier member, means for actuating contacts on said carrier member and a movable feeler member for determining the length of the teeth of said carrier member; said time switch device being adapted at intervals of time corresponding to the unit periods of conversation to start a movement of said meter stepping device, and said stepping device being provided with means adapted to limit the movement thereof to an extent determined by the ascertained zone value and by the time interval at that moment, the last named means being arranged in several groups, each group corresponding to a zone value and being selected by said feeler member and the means within each of said groups corresponding to a different interval of time.

32. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a rotary time switch device, a rotary meter stepping device, said time switch device being adapted to produce energization at intervals of time for stepping said meter stepping device, said meter stepping device being provided with several groups of means, each group corresponding to a zone value and each means within one of said groups corresponding to a different interval of time, said means being adapted to limit the stepping of said meter stepping device to an extent determined by the ascertained zone value and by the time interval at that moment, a base plate and a stationary shaft fixed in said base plate, said time switch device and said meter stepping device being arranged on said stationary shaft.

33. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection, a rotary time switch, a rotary meter stepping device, said time switch device being adapted to produce energization at intervals of time for stepping said meter stepping device, said meter stepping device being provided with several groups of means, each group corresponding to a zone value and each means within one of said groups

corresponding to a different interval of time, said means being adapted to limit the stepping of said meter stepping device to an extent determined by the ascertained zone value and by the time interval at that moment, a base plate and a stationary shaft fixed in said base plate, said time switch device and said meter stepping device being arranged on said stationary shaft, said base plate being provided with openings for the passage of individual parts of said time switch device and said meter stepping device.

34. A device for time and zone metering in telephone installations, comprising a device for ascertaining the zone value of a connection consisting of a rotary carrier member and a feeler member, a rotary time switch device, a rotary meter stepping device, said time switch device being adapted to produce energization at intervals of time for stepping said meter stepping device, said meter stepping device being provided with several groups of means, each group corresponding to a zone value and each means within one of said groups corresponding to a different interval of time, said means being adapted to limit the stepping of said meter stepping device to an extent determined by the ascertained zone value and by the time interval at that moment, a base plate and a stationary shaft passing through said base plate, said movable carrier member being arranged on said stationary shaft on one side of said base plate and said time switch device and said meter stepping device being arranged on said shaft on the other side of said base plate.

OTTO MUCK.
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PAUL ZIER.