June 1, 1937. F. APPELIUS 2,082,561

PAYSTATION TELEPHONE SYSTEM

Filed Feb. 13, 1936

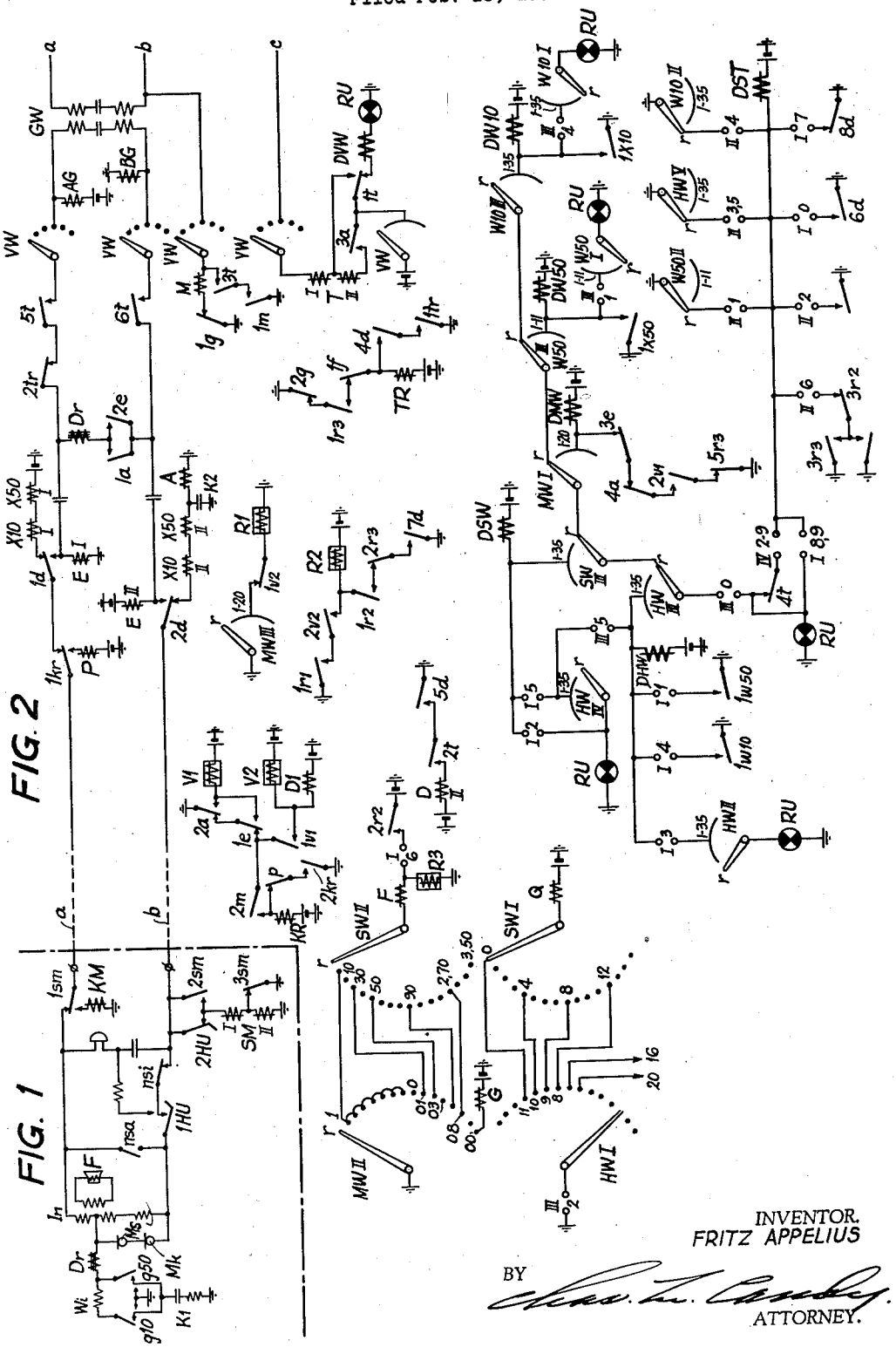

FIG. 1

FIG. 2

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Patented June 1, 1937

2,082,561

UNITED STATES PATENT OFFICE

2,082,561

PAYSTATION TELEPHONE SYSTEM

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Application February 13, 1936, Serial No. 63,707
In Germany February 21, 1935

9 Claims. (Cl. 179—6.3)

The invention relates to a circuit arrangement for pay stations adapted for short distance working. As is known in such pay stations the fee according to the call number which is to be dialled must be inserted before beginning to dial. The control as to whether the fee inserted corresponds to the value of the call set up, can be effected either in the paystation or by switching devices in the exchange.

The present invention relates to a circuit arrangement in which fee control takes place in the exchange. The control device in the exchange consists fundamentally of a discriminating switch to be set up by the dialled impulses, and a switch which is set by fee impulses whose setting must correspond with the setting of the discriminating switch if the call is to be switched through. The setting of the switch which is set by the fee impulses involves no difficulties if the setting is to be effected by fee impulses of one kind. In order to make the pay station more convenient to use it must be able to be operated by coins of various values. A relatively simple construction of the pay station apparatus is possible if for each type of coin a particular fee impulse contact is closed in the pay station. Moreover, the switching arrangements may be such that it can be left to the subscriber to decide when to insert the coins, i. e. either before or after removing the receiver.

Since not only short distance and local calls with automatic payment control may be set up from the pay station, but also long distance calls in which the supervising operator is informed of the amount of the sum inserted by means of audible signals produced in the pay station, the switching arrangements must be such that the impulses produced by the operation of the fee impulse contacts on the insertion of coins, and also the audible signals produced by the insertion of coins, are not distorted in their transmission to the exchange. Crackling noises produced by the opening and closing of the fee impulse contacts must also be kept at a minimum. These various demands are met by the invention in that the fee impulse contacts which are constructed as successively closing contacts connect earth potential transitorily to the point of symmetry at the pay station over various resistances corresponding to the value of the inserted coins. In order to make the contact closing, which is produced by the fee impulse contacts, effective for setting the fee indicating switches in the exchange, according to the invention relays are connected to the line in series, which possess two differential windings of which one winding is connected to one branch of the line and the other winding to the other branch of the line. The constants of these fee impulse relays are so chosen that one of the relays only energizes when subjected to strong current. Moreover, a further relay is connected in series with one winding of the fee impulse relays and is energized over the exchange loop when the receiver is removed, no influencing of the fee impulse relays taking place on account of the differential arrangement of the winding of these relays. By means of the fee impulse contacts in the pay station which connect earth potential to the line over various resistances according to the value of the inserted fee one or both of the fee impulse relays are caused to energize. Each of the two fee impulse relays controls a fee selector in the exchange. In order to transmit the correct value corresponding to the sum of the inserted fee in coin units to the switch associated with the discriminator, special switching means are necessary. For this purpose the invention makes use of an auxiliary selector which first takes up the complementary steps of the one feed selector and transmits its complementary steps to the totalling switch and at the same time converts the fee value taken up from the fee selector into units while simultaneously subtracting the setting of the other fee selector which is produced by the simultaneous energization of both fee impulse relays, by means of a corresponding wiring of the contacts of the auxiliary selector to those of the totalling switch. The transmission of the setting of the other fee selector takes place similarly by means of the auxiliary selector in that the auxiliary selector again takes up the complementary steps in this second fee selector and then transmits its complementary steps to the totalling switch.

The manner in which the individual switching operations take place is indicated by the embodiment described below.

Fig. 1 represents switching arrangements in the pay station and Fig. 2 those in the exchange. The references in Fig. 1 have the following significance:

1HU and 2HU are the contacts which are operated by the switch hook. *nsa* is the dial offnormal contact. *nsi* is the dial impulse contact. The collecting magnet is indicated by KM and on energizing it directs the coins which are in an intermediate container into the collecting box. SM is a locking magnet which effects the return of the coins present in the intermediate

container on hanging up the receiver in dependence upon the switching operation in the exchange. On the insertion of 10 pfg. pieces the contact *g*10 is transitorily closed, and on inserting a 50 pfg. piece the contact *g*50 is transitorily closed. W*i* is a resistance. D*r* is a choke coil. The speech microphone is indicated by M*s* and the gong microphone by M*k*. F is the receiver and I*n* an induction coil. In Fig. 2 the contacts of the relays are indicated by corresponding small letters and are differentiated by prefixed arabic numerals. The wipers of the selectors are differentiated by roman numerals. The rotary magnets of the selectors are given references consisting of several letters of which the first is D and the remaining letters corresponding to the switch wipers controlled by the magnets.

It will be assumed that the short distance calls are defined by a two digit characterizing number. The fee which is to be paid will be assumed to lie between 10 pfgs. and 3.50 marks. This fee can be paid as desired in 10 pfg. and 50 pfg. pieces. It is, of course, also possible for a further kind of coin to be used if corresponding devices are provided in the pay station whereby on the insertion of a coin of high value the fee impulse contact is operated a number of times. Such devices are known. It will be assumed that a connection whose call number has the characterizing number 08 in the first two digits of the call number can only be set up by the insertion of a fee amounting to 2.70 marks by the calling party. In the example to be considered the calling party inserts 22 10 pfg. pieces and one 50 pfg. piece. The switching operations which are then brought about are as follows:

When the calling party inserts a 10 pfg. piece into the pay station the contact *g*10 is transitorily closed. Relay X10 energized over its winding X10I.

(1) Earth—*g*10—W*i*—D*r*—1*sm*—1*kr*—1*d*—X10I—X50I—battery.

Relay X50 does not receive sufficient current to energize. Rotary magnet DW10 is energized over the contact 1*x*10.

(2) Earth—1*x*10—DW10—battery.

The rotary magnet DW10 drives the wipers of the fee selector W10 forward by one step. This selector W10 has three wipers W10I, W10II, W10III and possesses 35 steps 1–35 and one resting step *r*. During the insertion of the 22 10 pfg. pieces the fee selector W10 is set to step 22. On the insertion of the 50 pfg. piece relays X10 and X50 are energized.

(3) Earth—*g*50—D*r*—1*sm*—1*kr*—1*d*—X10I—X50I—battery.

The rotary magnet DW50 is energized over contact 1*x*50.

(4) Earth—1*x*50—DW50—battery.

The fee selector W50 possesses three wipers W50I—W50III. The number of steps amount to 11 and one resting step *r*. On the insertion of the 50 pfg. pieces the fee selector W10 is also displaced by one step through the energizing of relay X10. After the insertion of the amount of 2.70 marks the fee selector W10 is thus standing on step 23 according to the present example and the fee selector W50 on step 1. On taking up the receiver contact 1HU is closed so that relay A pulls up in the following circuit:

(5) Earth—A—X50II—X10II—2*d*—*nsi*—1HU—M*k*—M*s*—I*n*—1*sm*—1*kr*—1*d*—X10I—X50I—battery.

Relays X10 and X50 do not energize in this circuit since their windings I and II are arranged differentially. By means of the energizing of relay A a free group selector is seized. Over contact 3*a* rotary magnet DVW of the preselector is started up in the known manner. As soon as the preselector VW has seized the group selector, relay T energizes and by means of contact 1*t* disconnects the rotary magnet DVW from the relay interrupter RU. The feeding relays AG and BG in the group selector GW remain energized over contact 1*a*. By means of contact 2*a* the slow-to-release relay V is energized.

(6) Earth—2*a*—V1—battery.

On transmitting the first selecting impulse relay A deenergizes during the opening of impulse contact *nsi*. Since relay V1 is slow-to-release relay D energizes over its winding DI in the following circuit:

(7) Earth—2*a*—1*e*—1*v*1—DI—battery.

Relay D locks up over its winding DII over circuit.

(8) Earth—5*d*—2*t*—DII—battery.

By means of contacts 1*d* and 2*d* the lines are connected to the impulse relay E and, at the same time, the fee impulse relays X10 and X50 are disconnected. Relay E serves as feeding relay for the microphone M*s* and possesses two windings EI and EII. Microphone feeding over relays X10 and X50 would be unpractical since on account of the necessary high resistance of these relays the microphone feeding current would be too small. As soon as the impulse contact *nsi* again closes relay E energizes.

(9) Earth—EI—1*d*—1*kr*—1*sm*—I*n*—1HU—*nsi* 2*d*—EII—battery.

Over contact 1*e* relay V1 is maintained energized. The rotary magnet DMW of the discriminating switch MW energizes over contact 3*e*. The discriminating switch MW has three wipers MWI–III and possesses 20 contacts and one resting contact *r*. On dialling the characterizing digit 0 the discriminating switch MW is set on contact 0. On commencing to dial, an operation which is conveniently characterized by the energizing of relay D, the control switch is displaced from position 0 to position 1. The wipers of the control switch are represented in the usual way by roman numerals in combination with arabic numerals. The arabic numerals indicate the position of the control switch. The rotary magnet of the control switch is indicated by DST. On the first setting impulse the rotary magnet DST is energized in the following circuit:

(10) Earth—6*d*—I0 of the control switch—DST—battery.

As soon as the control switch has reached position 1 the auxiliary selector HW is caused to take up the complementary steps of the fee selector W50. The rotary magnets DHW and DW50 runs synchronously until the wiper W50I has reached the rest position *r*.

(11) Earth—RU—W50I on contacts 1–11—control switch III—DH50—battery. Earth—contacts of the fee selector 1W50—control switch I—DHW—battery.

When the fee selector W50 has reached the rest position *r* the auxiliary selector HW is standing on contact 10 i. e. 11—1. The contacts which are brushed by wiper HW1 are wired to the contacts of the totalling switch SW which are brushed by wiper SWI, in such a manner that contact 11 of HW is connected to contact 0 of SWI, contact 10 of HW is connected to contact 4 of SWI, contact 9 of HW is connected to contact 8 of SWI and so on. In this manner

the fee recorded in selector W50 is converted into 10 pfg. units, while at the same time the value transmitted to the fee selector W10, produced by the simultaneous energizing of X10 and X50 when contact *g*50 is closed, is subtracted.

As soon as the auxiliary selector HW has taken up the complementary steps of W50 the control switch is advanced to position 2. The rotary magnet DST of the control switch energizes in the following circuit:

(12) Earth—W50II—contact *r*—control switch II1—DST—battery.

The totalling switch SW must now be displaced to the contact which is connected to that contact on which the auxiliary selector HW is set. The rotary magnet DSW receives current from the interrupter over wiper I of the control switch in position II, in the following circuit:

(13) Earth—relay interrupter RU—I2—DSW—battery.

As soon as wiper SWI has reached contact 4 relay Q energizes:

(14) Earth—contact III2 of the control switch—contact 10 of HWI—contact 4 of SWI—Q—battery.

The rotary magnet DST of the control switch is again energized over wiper 2*a* and wiper II of the control switch in position 2 so that the control switch proceeds to position 3. The advancing circuit for DSW is accordingly interrupted. In order to take over the setting of fee selector W10 the auxiliary selector HW must now be advanced to the rest position. This is effected over the following circuit:

(15) Earth—RU—HWII on contact 10—control switch I3—DHW—battery.

As soon as the auxiliary selector HW has reached its rest position the rotary magnet DST energizes over wiper HWV and wiper II in position 3.

(16) Earth—HWV in position *r*—II3—DST—battery.

The rotary magnet DHW is now driven synchronously with the rotary magnet DW10 until the selector W10 reaches its rest position.

(17) Earth—RU—contacts 1–35 of W10I—III4—DW10—battery, and earth—contacts of the fee selector 1W10—I4—DHW—battery.

The auxiliary selector HW has now taken over the complementary steps from W10. It is now on contact 13, i. e. 36—23. As soon as W10 has reached the rest position the magnet DST of the control switch is again energized over the circuit:

(18) Earth—W10II on contact *r*—II4—DST—battery.

The control switch is now in position 5. In this position the totalling switch is again set in motion and takes over the complementary steps from the auxiliary selector HW. The rotary magnets DHW and DSW are operated synchronously in the following circuit:

(19) Earth—RU—HWIV on contacts 1–35—I5—DSW—battery, and earth—RU—HWIV on contacts 1–35—III5—DHW—battery.

The complementary steps of HW amount to 36—13 i. e. 23. The totalling switch SW is thus advanced from its position 4 by a further 23 steps and thus reaches contact 27. This corresponds to the inserted fee of 2.70 marks in 10 pfg. units.

The setting of the totalling switch SW is effected independently of the further operation of the selecting devices. As soon, therefore, as the number of impulse trains corresponding to the call number of the connection has been sent out, testing can take place as to whether the setting of the discriminating switch MW corresponds with the setting of the totalling switch SW. On transmitting the first dialled impulse the discriminating switch MW was displaced. During the impulse transmission relay V2 energizes in the following circuit:

(20) Earth—2*a*—1*e*—1*v*1—V2—battery.

Relay V2 is slow-to-release. Accordingly at the end of the first impulse train relay R1 pulls up.

(21) Earth—MWIII on contacts 1–20—1*v*2—R1—battery.

On transmitting the second impulse train relay R2 energizes on account of the slow-to-release feature of relay R1.

(22) 1*r*1—2*v*2—R2—battery.

Relay R2 locks up over its contact 1*r*2 and the contact 2*r*3 and 7*d*. After the totalling switch SW had been set on the contact corresponding to the total fee paid in, the control switch was advanced to position 6. The rotary magnet DST was energized in the following circuit:

(23) Earth—HWV on contact *r*—II5—DST—battery. In position 6 of the control switch relay F energizes if the position of the discriminating switch MW corresponds with the position of the totalling switch SW. In the present example the number 08 was characteristic of the call for which the sum of 2.70 marks had to be paid. The following circuit is accordingly established:

(24) Earth—MWII on contact 08—SWII on contact 27—F—I6—2*r*2—battery.

In position 6 of the control switch the slow-acting relay R3 draws up.

(25) Earth R3—I6—2*r*2—battery.

If the setting of switches MW and SW do not correspond relay TR becomes energized.

(26) Earth—2*g*—1*r*3—1*f*—TR—battery. Relay TR locks up over contact 1*tr* and 4*d*. The connection set up is cut off by means of contact 2*tr* since the control relays AG and BG of the group selector deenergize. If the correct fee has been introduced the energizing of relay TR is prevented by contact 1*f*. The rotary magnet DST of the control switch is again energized through contact 3*r*3 as soon as relay R2 has deenergized, the locking circuit of this relay being broken by contact 2*r*3.

(27) Earth—3*r*3—3*r*2—II6—DST—battery.

The rotary magnet of the control switch is energized over wiper I in position 7 as soon as relay D releases. Relay D is deenergized by means of contact 2*t* when the connection is released. On replacing the receiver the exchange loop is broken by contact 1HU and relay E releases. The control relays AG and BG are deenergized by means of contact 2*e* and the first group selector releases. Relay T in the preselector deenergizes. The locking circuit for relay D is broken by contact 2*t*. The preselector is returned to its rest position over contact 1*t* in the known manner. Rotary magnet DST draws up over the circuit.

(28) Earth—8*d*—I7—DST—battery.

When the called subscriber replies relay M receives an impulse over the fourth wiper of the pre-selector VM and locks up over contact 3*t* and its own contact 1*m*. On replacing the receiver the locking magnet SM is caused to energize over contact 2HU in the pay station in the following circuit:

(29) Earth—SM2HU—2*d*—EII—battery.

By means of contact 1*sm* the collecting magnet KM is connected to the *a*-lead and by means of contact 3*sm* the high resistance winding SMII of magnet SM is connected up so that relay E can no longer remain energized. As soon as relay E has released relay KR is energized provided that the called subscriber has replied.

(30) Earth—2*a*—1*e*—2*m*—KR—battery.

Relay KR locks up over its own contact 2*kr* and contact *p*. The collecting magnet KM and relay P energize over contact 1*kr*. Contact *p* breaks the locking circuit for relay KR. Relay KM causes the inserted fee to be collected. If the subscriber has not replied the energizing of relay KR is delayed. When the connection is released the control switch is advanced from position 7 to position 8 as already explained. The control switch is advanced into its rest position over wiper I and contacts 8 and 9.

(31) Earth—RU—I—8, 9—DST—battery. If the auxiliary selector HW is not yet in the rest position it is advanced to the zero position over IIIo and HWIII. In the same way the totalling switch SW, the discriminating switch MW and the fee selectors W10 and W50 are advanced to the rest contact *r*.

If the calling party takes up his receiver before inserting the fee relay A energizes. This has the same effect as that already described. If the contacts *g*10 and *g*50 are closed when the receiver has already been removed this has no influence on the energizing of relay A because the ratio of the resistances in the branch circuits thus established is so chosen that relay A receives sufficient energizing current.

It may be mentioned that by the use of a corresponding call finder circuit it is possible to use the discriminating switch HM, the totaling switch SW, the auxiliary selector HW and the control switch SW in common for a larger number of pay stations, since these switching devices are only transitorily operative during the setting up of a call. It is also possible to use the setting of the totalizing selector to set control meters associated with the paystation.

Local calls, for which a fee of 10 pfg. is paid, are characterized by having no 0 in the first digit of the call number. Contacts 1—9 of the discriminating switch are therefore connected with the 10 pfg. contact of the totalling selector. It is also possible to provide for free calls. In this case the contact of the discriminating switch MW corresponding to the characterizing number of the free call must be connected to the zero contact of the totalling switch so that in this case the release relay F can energize.

As already explained long distance calls can also be set up from the pay station and in this case the supervision of the fee which is to be paid is effected by audible signals which are transmitted by way of the microphone M*k*. In order that these signals should not be distorted by the closing of contacts *g*10 and *g*50 various measures must be taken to reduce the crackling sounds. This is effected according to the invention in that the earth potential for fee impulse signalling is connected up over a choke coil DR of high inductance which in turn is connected to a point approximating to the point of symmetry of the induction coil I*n*. The fee impulse contacts *g*10 and *g*50 are constructed as successively closing contacts of which one contact spring which is arranged next to the operating spring is connected to an earth condenser K1. The asymmetry in the line produced by the operation of relay A in series with windings II of the fee impulse relays K10 and X50 is equalized by the condenser K2.

In the case of free calls on dialling, for example, the digits 00 relay G is energized over MWII and by opening its contact 1*g* prevents the energizing of relay M when the called party replies. In this case the energizing of the collecting relay KR is also prevented when the receiver is replaced. Contact 2*g* prevents the energizing of relay TR so that no disconnection is brought about by the fee testing.

What is claimed is:

1. In an automatic telephone system, a paystation telephone connected by a line to the exchange, a calling device for transmitting impulses to the exchange to extend a connection to a desired subscriber, a discriminating switch also responsive to said calling device impulses, coin operated contacts at said paystation, a different resistance connected to said line by each of said contacts responsive to the passage of corresponding coins in said paystation, coin relays in said line each responsive to the connection of a particular resistance to said line, coin switches at said exchange each operated by an associated coin relay, and means for permitting the extension of the call only in the event that the positions to which said discriminating switch and said coin switches are operated correspond to the value and destination of the call.

2. In a paystation telephone system as claimed in claim 1 in which the coin contacts operate the coin relays by connecting ground impulses over the different resistances to one side of the line, while the calling device impulses are transmitted over the line in series.

3. In a paystation telephone system as claimed in claim 1 in which the coin relays are differentially arranged in series with each other and connected to opposite sides of the line and in which the coin contacts operate the corresponding coin relay by connecting ground impulses to one side of the line through the corresponding resistance to operate only the associated coin relays, and in which an impulse relay is connected in series with said coin relays and is only responsive to dial impulses transmitted over both sides of said line in series.

4. In an automatic telephone system, a paystation telephone connected over a line to the exchange, a calling device at said paystation for transmitting impulses over the line in series to the exchange in order to establish a connection with another subscriber, coin contacts at said paystation operated by the passage of coins thereat, a different resistance connected to ground potential through each of said coin contacts by the passage of the coins in order to transmit coin impulses over one side of the line, a differential coin relay for each of said coin contacts and each relay having a different energizing characteristic, an impulse relay responsive only to dial impulses transmitted in series over the line, a discriminiating switch operated by said impulse relay, a coin switch operated by each of said differential coin relays, and means whereby a connection is extended to a desired subscriber only in case the discriminating switch and the coin switches are set to positions corresponding to the particular fee required and the impulse series associated with the location of the wanted subscriber.

5. In a paystation telephone system as claimed in claim 4 in which a totalling switch is pro-

vided to add the fee sum of the settings of the coin switches in order to determine whether the connection to the wanted subscriber is to be extended.

6. In a paystation telephone system as claimed in claim 4, an auxiliary switch and a totalling switch at said exchange, said auxiliary switch automatically operated to a position corresponding to the position of one of said coin switches and then the other, said totalling switch thereby operated to the position assumed by said auxiliary switch, said totalling switch converting the coin values into unit coin values from the first of said coin switches and subtracting the values of the setting of the other of said coin switches therefrom, the bank contacts of said auxiliary switch and said totalling switch being correspondingly wired together to effect the conversion value.

7. In a paystation telephone system as claimed in claim 4, an auxiliary switch and a totalling switch, said auxiliary switch first operated to transmit the setting of one of said coin switches to said totalling switch and then releasing, then operated to the position of the other coin switch and transmitting the setting of said coin switch to said totalling switch during the release of the auxiliary switch.

8. In a paystation telephone system as claimed in claim 1 in which the coin relays are disconnected from the line circuit after the connection has been extended.

9. In a paystation telephone system as claimed in claim 1 in which crackling noises and disturbances to a listening operator caused by the insertion of coins are reduced by connecting ground potential through the resistances and the coin contacts to the approximate center point of the paystation induction coil through a choke coil, and by a condenser in circuit with the coin contacts and another condenser in circuit with the dial impulse relay of the line circuit.

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