Oct. 31, 1933. R. F. STEHLIK 1,932,647

TELEPHONE INSTRUMENT

Original Filed Oct. 17, 1929 4 Sheets-Sheet 1

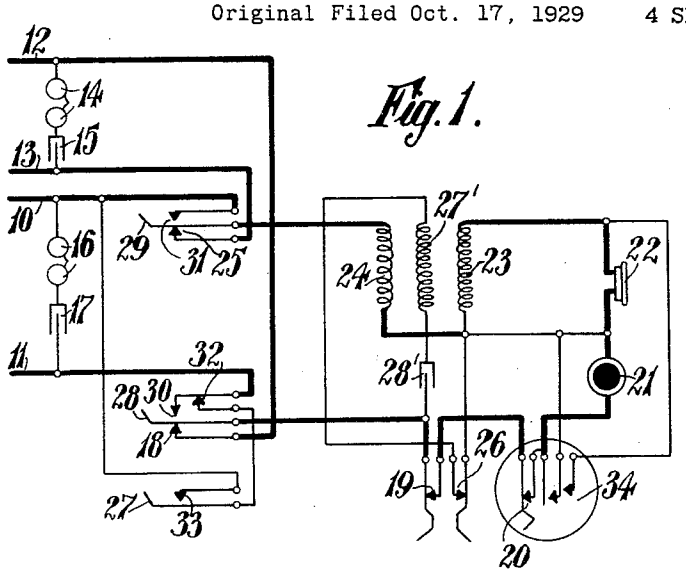


Fig. 1.

Fig. 6.

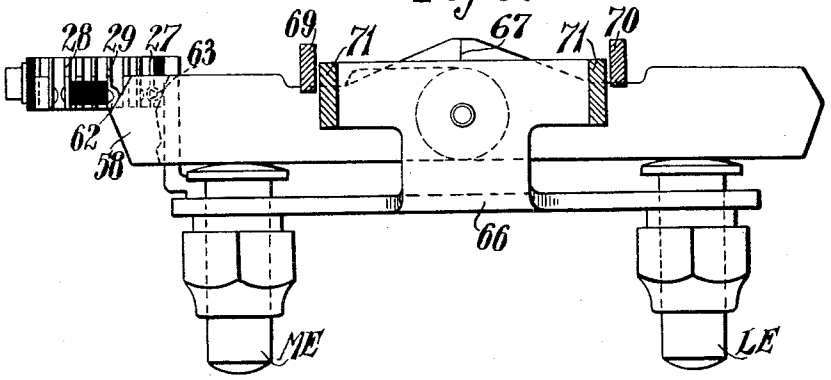
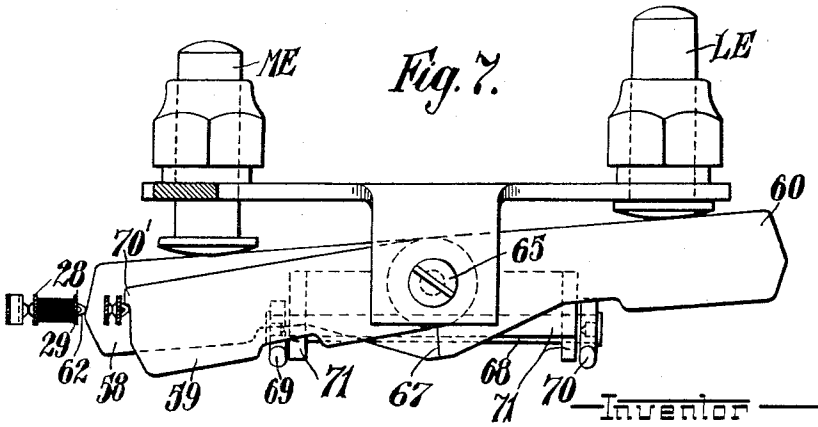


Fig. 7.



Inventor

Rudolph Frank Stehlik

Wm. Watts Cross Atty.

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TELEPHONE INSTRUMENT

Original Filed Oct. 17, 1929 4 Sheets-Sheet 2

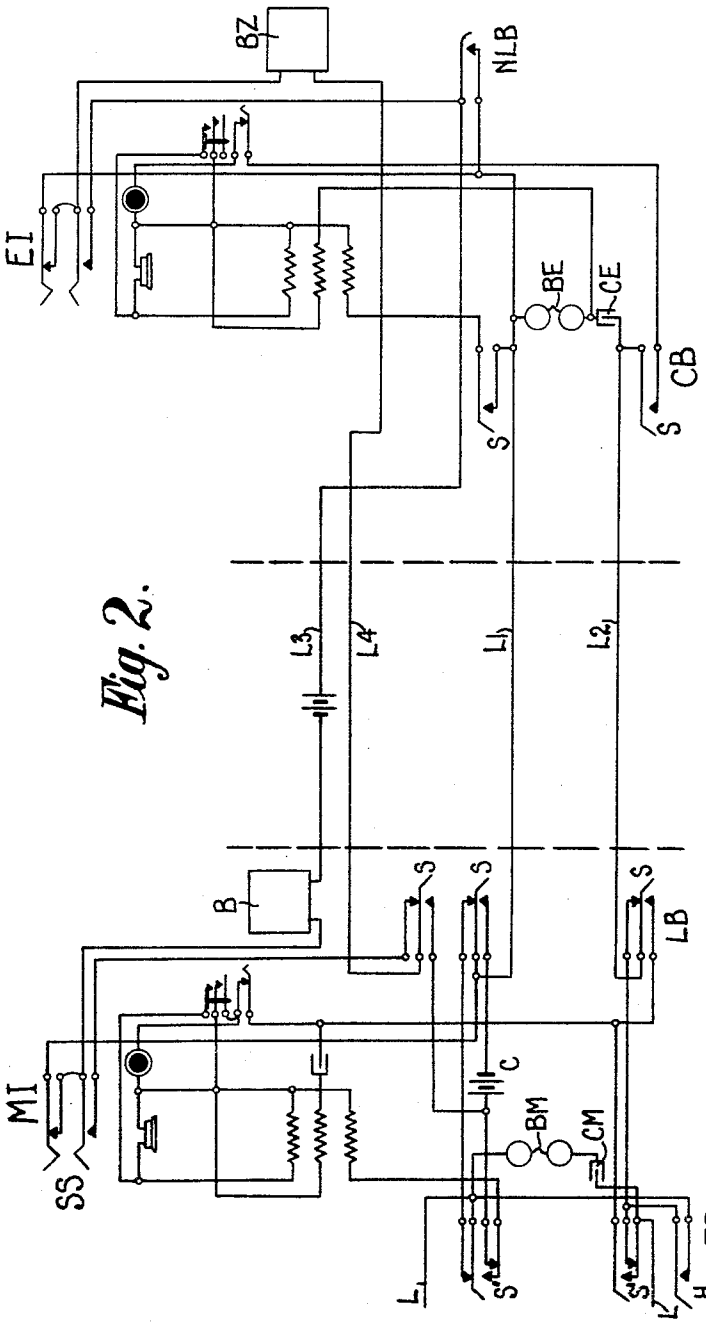

Fig. 2.

Inventor
Rudolph Frank Stehlik
Atty

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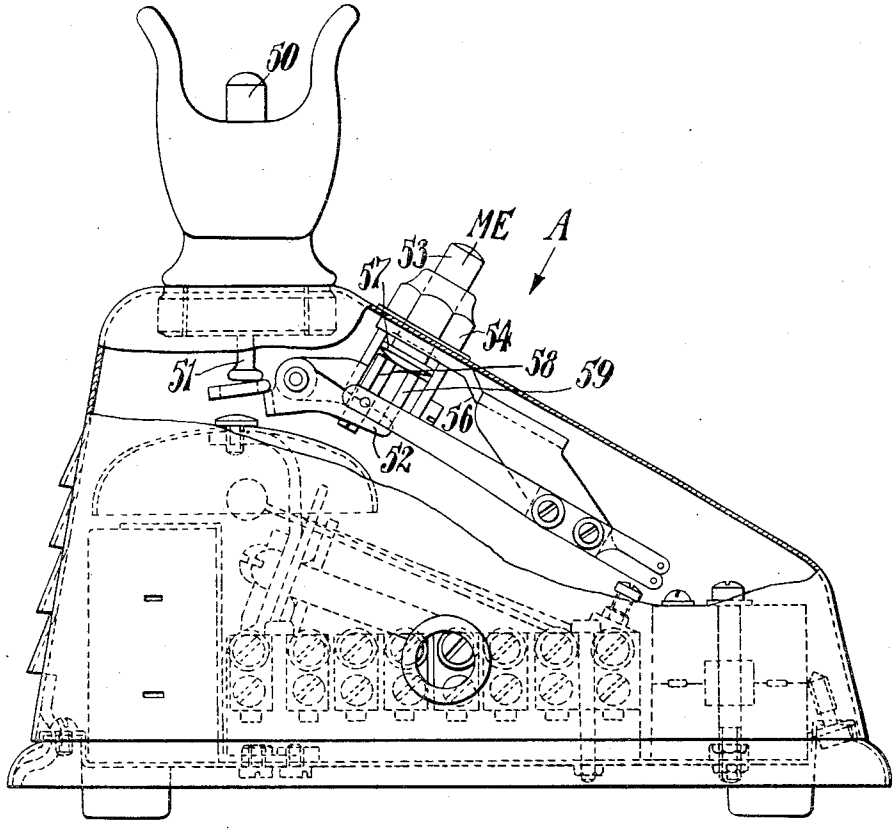
Fig. 3.



Inventor
Rudolph Frank Stehlik
Wm. Walter Owen Atty.

Oct. 31, 1933. R. F. STEHLIK 1,932,647

TELEPHONE INSTRUMENT

Original Filed Oct. 17, 1929 4 Sheets-Sheet 4

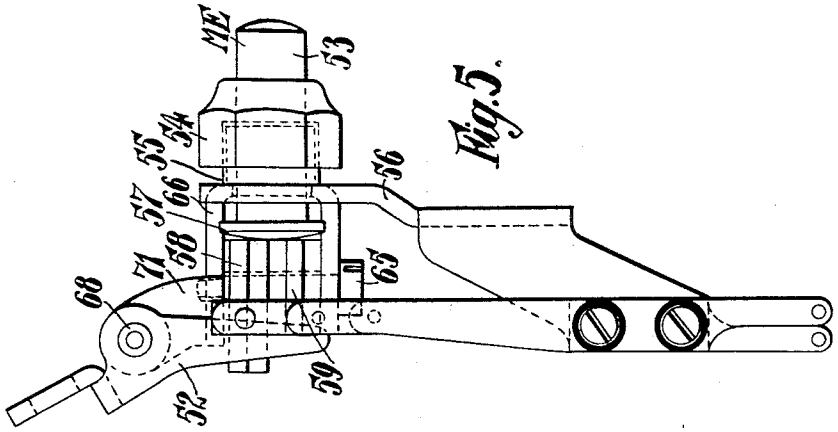


Fig. 5.

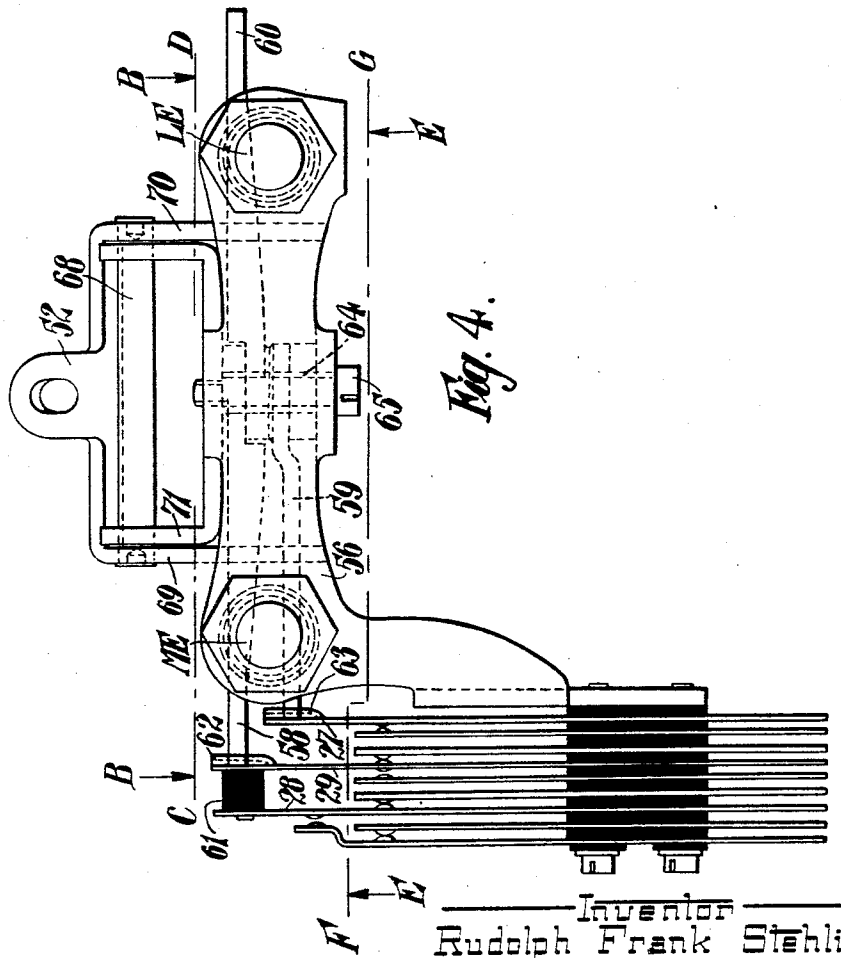


Fig. 4.

Inventor
Rudolph Frank Stehlik
Wm. Watts Dunn Atty.

Patented Oct. 31, 1933 1,932,647

UNITED STATES PATENT OFFICE

1,932,647

TELEPHONE INSTRUMENT

Rudolph Frank Stehlik, Chicago, Ill., assignor to Associated Telephone and Telegraph Company, Chicago, Ill., a corporation of Delaware

Application October 17, 1929, Serial No. 400,402, and in Great Britain November 7, 1928. Renewed April 22, 1932

17 Claims. (Cl. 179—81)

The present invention relates to improvements in or relating to telephone substation instruments and circuits associated therewith and while it more particularly is concerned with a special instrument for use in connection with different kinds of systems such as systems in which it is possible to talk on two or three different systems from the same instrument or systems in which interworking is provided between a main instrument, an extension instrument and an exchange; it also covers the circuits which become possible due to the employment thereon of the instrument referred to.

Usually it has been necessary to make one switching operation when talking with a subscriber on one network and another switching operation when talking to a subscriber on another network or to an extension instrument, and furthermore, it has been necessary to make yet a third switching operation when connection is desired with said second subscriber or said extension instrument while holding the first subscriber so that a conversation may be resumed after the desired information is obtained from the first subscriber. Such instruments are particularly useful for use in connection with both office telephone systems and the public telephone system and the present invention is particularly concerned in improvements by which it is possible to obtain all the above results by simply providing two keys, one of which is depressed when an outside call is required, and the other of which is depressed when a local call is required and it is desired to keep the exchange subscriber on the line. In case of a local call in the first instance in systems in which it is possible to talk on two or three different systems from the same instrument, it is a feature of the present invention that no operation other than lifting the hand-telephone from the cradle is required.

The drawings illustrate one way of carrying out the invention by way of example although it will be understood that considerable modifications may be made without departing from the spirit of the invention.

Referring to the drawings, Fig. 1 represents diagrammatically the circuit arrangements by which the subscriber's instrument, which is an automatic instrument, that is an instrument provided with an impulse sender, may be used for calls in an office system or for calls to the main exchange; while Fig. 2 represents diagrammatically the circuit arrangements of a main instrument and an extension instrument both of the automatic type, Fig. 3 shows the instrument in side elevation with part of the cover open so as to show a side view of the button and springs for connecting with main exchange lines. This apparatus is shown in greater detail in Figs. 4, 5, 6 and 7, Fig. 4 showing a view looking in the direction of the arrow A in Fig. 3 with the cover removed. Fig. 5 shows a side elevation of Fig. 4; Fig 6 shows a view of the buttons in normal position looking in the direction of the arrows B from the line C—D of Fig. 4; Fig. 7 shows a view of the buttons with the main exchange button operated looking in the direction of the arrows E from the line F—G of Fig. 4.

Before describing the mechanical construction the various circuit conditions will be described.

Reference should accordingly be had in the first place to Fig. 1. In this figure, 10, 11 represent the exchange line and 12, 13 the local line. It should be understood of course that while reference is made to exchange and local lines, two different exchange lines or two different local lines could be employed instead of one of each. 14 represents the bell for the local line and 15 the condenser in series therewith. 16 represents the bell for the main exchange line and 17 the condenser in series therewith so that by ringing separate bells or operating other suitable signalling apparatus a subscriber can be informed as to which line he is being called on. Normally the local line 12, 13 is connected up to the instrument set and connection can be traced as follows: line 12, contact 18, cradle springs 19, dial springs 20, transmitter 21, first winding of induction coil 24, contact 25 to line 13. It will be noted that the cradle springs 19 and 26 are shown closed, although normally they are of course open.

Considering the case of an incoming call, it will be assumed that a call is received over leads 12, 13 and the subscriber lifts his hand-telephone to close contacts 19 and 25, whereupon a circuit for his transmitter can be traced as just described, the remainder of the speaking circuit including the receiver 22 and the third winding of the induction coil 23 and the second winding of the induction coil 27', and condenser 28' being arranged in known manner with a view to producing an anti-side tone effect, that is an effect whereby local noises in the transmitter cannot be heard in the receiver. It will thus be appreciated that in order to speak on a local call all that is necessary for the called subscriber using this instrument to lift his hand-

telephone and speak. In the case of a call coming over the line 10, 11 it will be necessary for him to operate the springs 27, 28 and 29. By operating the springs 28 and 29 he opens 18 and 25 and closes contacts 30 and 31, thereby disconnecting the line 12, 13 from his instrument and connecting up the line 10, 11. Spring 28 by being operated, also causes contact 32 to be opened which prevents the closure of contact 33 by spring 27 from being of any effect. If, now, as a result of the call over 10, 11 the subscriber should wish to obtain information over the line 12, 13 without interference, he must restore the springs 28 and 29, while leaving 27 operated. He will thereby place a circuit across the line 10, 11 as follows: line 10, contact 33, contact 32 to line 11, thereby substituting a short circuit in place of his instrument circuit and avoiding opening the line wires, contact 32 being closed before contacts 30 and 31 are opened. The closure of contacts 25 and 18 again connects up the line 12, 13 to the instrument and the subscriber can operate his dial switch 34 to call up the man from whom he requires information and having done so he can again operate the springs 28 and 29 to connect up the line 10, 11 and resume his first conversation.

The means whereby the springs 27, 28 and 29 are all operated initially and whereby only the springs 28 and 29 are restored and are subsequently again operated, is one of the features of the invention and will be described when the construction of the instrument is considered. On initiating a call to a local subscriber the subscriber will simply remove his hand-telephone from the cradle, operate his dial switch and carry on the conversation in the usual way. If he requires a main exchange subscriber he will lift has hand-telephone from the cradle, operate the springs 27, 28 and 29 and operate his dial switch as before and he can then carry on the conversation. If it should then be desired to obtain information over the line 12, 13 he can proceed as before to restore the springs 28 and 29 leaving the spring 27 operated and thereby connect up the local line and establish a local call, keeping the main exchange line held by a short-circuit extending over contacts 33 and 32. Having obtained the desired information he can then reoperate the springs 28 and 29 and complete his conversation.

Figure 2 shows an arrangement according to the invention whereby calls incoming from a public exchange can be dealt with either from a main instrument or an extension instrument and in which facilities are provided to enable the main and extension instrument subscribers to communicate independently of the exchange line. Referring to this drawing L, L represent the main exchange lines and EB and LB represent the exchange button and the local button which control the springs shown immediately above the references. The instrument circuits shown are antiside-tone circuits provided with dial switches for establishing connections in an automatic telephone exchange but it will be understood that these circuits can be varied as they do not form any part of the present invention.

As regards the main instrument MI, this is provided with the two buttons EB and LB previously mentioned and also with switchhook springs SS, a buzzer B and a battery C. As will be described in detail subsequently there are interlocking levers controlled by the exchange button and the local button which operate in such a way that if either of the buttons is depressed when the other button is depressed the switching springs marked S are restored. The spring marked H remains operated, however, when once depressed and can only be restored when the receiver is replaced on the switchhook. This also replaces whichever of the two buttons is depressed and restores conditions to normal.

On the extension instrument the only buttons provided are a call button CB and a non-locking button NLB. The call button CB is operated when the extension subscriber either receives or initiates a call and remains operated as long as the receiver is kept off the switchhook. To understand the operation of the device it will be assumed first of all that a call is received over the lines L, L when it will be noted that current can flow over the bell and condenser BM and CM at the main instrument and also over the contact springs S of the buttons EB and LB respectively to the bell BE and condenser CE of the extension instrument. It is not necessary that both instruments should be provided with bells. It will be sufficient for the operation of the system if only one instrument was provided with a bell but this will really be determined by the wishes of the subscribers. In this case it will be assumed that a subscriber at the main instrument answers, and to do this he lifts the receiver and presses the exchange button EB. It will then be noted that the instrument circuit is connected up and the subscriber can talk as required, and restore everything to normal by simply restoring the receiver to the switchhook. If, however, it should be found that the call is really intended for the extension subscriber the subscriber at the main instrument will press the button LB, thereby operating the springs S associated with this button and restoring the springs S' associated with the exchange button EB. The spring H, however, remains operated and completes a short circuit across the lines L, L to hold the exchange line. The depression of the upper spring S of the button LB completes a circuit for the extension buzzer BZ over the lines L4 and L1 and through the upper normally closed contact of the switchhook springs at the extension instrument. The buzzer thereupon operates and signals the extension subscriber who answers by lifting the receiver thereby operating his switchhook springs and by depressing the call button key CB. On hearing the extension subscriber lift his receiver the main exchange subscriber can either converse with him informing him who wants him and restoring his receiver or else he can immediately restore his receiver. In either case the effect of restoring the receiver will be to establish the circuits at the main instrument to the condition shown in the drawings and the extension subscriber can talk over the exchange line direct. Of course if it should have been that the main instrument subscriber only wishes to obtain some information from the extension instrument subscriber he could resume his conversation by again depressing the exchange button EB and not restoring his receiver.

If the extension instrument subscriber had first answered he would simply have lifted his receiver and depressed the button CB, when he could have carried on conversation. If the extension subscriber should have found that the call was for the main instrument subscriber, then he would press the non-locking button NLB

thereby completing a circuit over the lines L1 and L3 in series with the battery in line L3 and the upper switchhook springs SS of the main instrument. The buzzer B would therefore operate and call the main instrument subscriber who would thereupon lift his receiver and depress the main exchange button and thereby take up the call from the exchange. As the buzzer B would be operated both in the case where the extension instrument requires to call the main instrument for an exchange call and in the case where the extension instrument requires to call the main instrument for a purely local call, a distinction would require to be made by operating the buzzer according to a pre-arranged code, as in the case of a local call the main instrument subscriber would then press the local button which if done in the case of an exchange call would break down the connection as the trunk button would not have previously been pressed. Of course, if it was desired to hold an exchange line while a discussion was proceeding between the main subscriber and the extension subscriber this could be done by the main exchange subscriber in response to a suitable code on the buzzer first operating his exchange button EB and then operating his local button LB so that he would insure the exchange call being held. For outgoing calls the arrangement is simply that either subscriber on lifting his receiver would depress a button, in the case of the main instrument subscriber the button EB and in the case of the extension instrument subscriber the button CB and then set up a call in the usual way by operating the dial switch for the number of the called party. If either instrument subscriber wishes to make a call when the other is calling due to the fact that both switchhook springs are operated, a circuit is completed over lines L3, L4 in series with the buzzers B2 and B and the lower switchhook springs of each instrument to cause both buzzers to operate, this circuit passing through the normal contacts controlled by the local button LB of the main instrument so that in the case of a local call between the two instruments the buzzer circuit is open. Seeing that there are two buzzers in series in the circuit for signalling engaged conditions and only one buzzer for calling conditions it will be noted that the notes produced by the two buzzers in the circumstances would be quite distinct. It will also be clear that the main instrument subscriber can call the extension subscriber independently of an exchange call by lifting his receiver and depressing the button LB. The circuits are generally similar to those which occur when he transfers an exchange call to an extension subscriber except that the springs H are not operated.

A description will now be given of the instrument and more particularly the arrangements by which the desired operations of springs 27, 28 and 29 of Fig. 1 and of the left-hand springs of the main extension instrument illustrated in Fig. 2 are effected in the manner described. It should be mentioned that every time a hand-telephone is restored to the cradle the said springs are restored to the positions shown in the drawings and only when the receiver is off the hook can the springs take up any of the other positions mentioned in the foregoing description.

Referring to Fig. 3 it will be noted that this shows an instrument of known type modified by the provision of the buttons ME and LE of which only ME is visible in Fig. 3. These buttons are arranged on the cover in which the dial switch may also be fitted. However in the drawings the dial switch has been omitted for the purpose of clearness. Extending through the cradle containing the contact springs is a stem 51, which rises when the hand-telephone is removed from the cradle to release the button 50 and so permits the restoring lever 52 to be operated freely and allow the buttons ME and LE to be operated. The operation of these buttons and the parts they control will be better understood by referring to Figs. 4, 5, 6 and 7. It will be noted that each button consists of a rod 53 passing through a nut 54, a boss 55 externally threaded and a hole in a frame 56 and terminates in a flange portion 57 for engaging with the spring operating plates 58 and 59. It should be mentioned that the main exchange button is effective to operate the plates 58 and 59, while the local exchange button is adapted to operate the plate 60 as will be described later. The nut 54 screws on the boss 55 and serves to secure the frame 56 and the parts secured thereto to the cover.

In Fig. 5 the cover is omitted for the sake of clearness. The frame 56 is better seen in Figs. 4 and 5 and it will be noted that it serves to support a number of contact springs which correspond to the springs shown in Fig. 1 and for that purpose the moving springs 27, 28 and 29 are shown with the same reference characters. As the springs 28 and 29 operate in all cases together, they are shown linked by a single insulation 61 and the spring 29 is provided with a curved portion 62 at its upper end for engaging with the cam surface of the spring engaging member 58. The spring 27 is similarly provided with a cam surface 63 for the purpose of engaging with the cam surface of the spring engaging member 59. The spring engaging members 58 and 59 are mounted together with the spring engaging member 60 so as to rotate about the tube 64 secured in position by a screw 65 extending between the upper and lower arm of the U-shaped member 66 which is secured to the bracket 56. The shape of these contact engaging members will be best understood by referring to Figs. 6 and 7. In Figs. 6 and 7 it will be noted that the members 58 and 60 abut against one another at their surfaces 67. They are both pivoted on the same pivot, so that when the button ME is pressed, as shown in Fig. 7, and the contact operating plate 58 moved into the position shown, the contact operating plate 60 will have been moved into a new position with button LE forced further out. Similarly when the button LE is pressed forward so as to take up the position shown in Fig. 6, the contact operating plate 58 will be restored. It will be noted that both the plates 58 and 60, as shown in Fig. 4 are tapered gradually extending towards the centre where they have half their thickness cut away on opposite sides so that they can fit the one over the other in the manner shown. The abutting parts are not cut away so that the abutting surface extends for the full thickness of the plates. The contact operating plate 59, as previously mentioned, is also pivoted on the tube 64 but only extends on one side of the pivot and is free to move relatively to either of the plates 58 and 60. The cam surface on the plate 59 is similar to the cam surface on the plate 58,

except that a stop 70' is provided to prevent the plate from moving too far and so allowing the contact springs to restore. There is no necessity for providing a similar stop in the case of the plate 58, as this plate by engaging with the plate 60 is limited in its movement by the button LE, as shown in Fig. 7.

The lever 52, operated by the rod 51 extending from the button 50 and operated by the hand-telephone, is pivoted on a bar 68. As will be seen from Fig. 4 lever 52 has two arms 69 and 70 extending one on each side of the bracket 71 which forms an integral part of the frame 56. The arm 69 extends, as will be seen from Figs. 4 and 7, so as to engage both the contact operating plate 58 and the contact operating plate 59, this engagement being effective to restore the plates to the position shown in Fig. 6, when the hand-telephone is placed on the cradle. Similarly the plate 60 is restored to normal by the extension 70 if it should be that this plate is in an off normal position that is, if the button LE in Fig. 6 has been pushed too far forward. It will thus be seen that the effect of restoring the hand-telephone to the cradle is to immediately restore all the contact operating plates to the position shown in Fig. 6.

It will be understood that the invention is not limited to the particular construction shown, for instance, the plates 58 and 60 need not be in a line but could be inclined if it was desired to mount the buttons on other than a flat surface. Similarly the circuit need not be exactly that shown in Fig. 1, as not only could it be applied to any type of instrument circuit with or without an impulse sender but it could also be applied to magnets or other systems. Instead of a direct short-circuit a retard or an indicator or other electromagnetic operated device could be connected in this circuit to serve the same purpose and possibly an additional purpose.

In order to make the instrument suitable for the main instrument illustrated in Fig. 2 suitable modifications of the contact springs and the provision of an additional holding lever will be necessary. Other applications of the invention could be used in a system where connection could be set up to either of two trunk lines or over an intercommunication line. In this case the trunk lines would be provided with "engaged" indicators at the instruments. It will be understood that the various applications of the instrument described, which may include the use of a plurality of contact spring sets at each end with appropriate operating and holding lines, are only given by way of example.

I claim:—

1. In a telephone instrument, a pair of manually operable devices, contacts controlled by said devices, means responsive to the operation of one of said devices for operating said contacts and responsive to the operation the other of said devices for restoring only certain of said contacts, and an independently operable device for restoring the remaining contacts.

2. In a telephone instrument, a pair of keys, contacts controlled by said keys, means responsive to the operation of one of said keys for operating said contacts, means responsive to the operation of the other of said keys for restoring only certain of said contacts, and independent means for restoring the remaining contacts.

3. In a telephone instrument, a pair of manually operable keys, contact springs controlled by said keys, means responsive to the operation of one of said keys for operating all of said contact springs, means responsive to the operation of the other of said keys after said first key has been operated for restoring only certain of said contact springs, a switchhook in said telephone, and means responsive to the operation of said switchhook for restoring the remaining contact springs.

4. In a telephone instrument, a pair of manually operable keys, a set of contact springs controlled by said keys, means responsive to the operation of one of said keys for operating said set of contact springs, means responsive to the subsequent operation of the other of said keys for restoring only certain of said set of contact springs, a switchhook in said telephone also controlling said contact springs, and means controlled by said switchook responsive to the replacement of the receiver thereon for restoring the remaining or all of said contact springs.

5. In a telephone instrument, a first and a second manually operable key, an operating member individual to each key and engaging each other so that the movement of one is dependent on the movement of the other, another operating member individual to said first key movable independently of said other operating members, contact springs controlled by said operating members, and means responsive to the operation of said keys for moving their individual operating members to variably operate said contact springs.

6. In a telephone instrument, a first and a second manually operable key, an operating member individual to each key and engaging each other so that the movement of one is dependent on the movement of the other, another operating member individual to said first key movable independently of said other operating members, contact springs controlled by said operating members, means responsive to the operation of said first key for moving the operating members engaging each other and the other operating member to operate said contact springs, means responsive to the operation of said second key for moving only the operating members engaging each other to restore only certain of said contact springs, and independent means for moving said other operating member to restore the remaining contact springs.

7. In a telephone instrument, a first and a second manually operable key, a pair of operating members individual to said first key, a single operating member individual to said second key, said single and one of said pair of operating members engaging each other, contact springs controlled by said operating members, means responsive to the operation of said first key for moving its pair of operating members to operate said contact springs, means responsive to the operation of said second key for moving its single operating member to restore the member it is in engagement with and release certain of said contact springs, a switchhook also controlling said operating members, and means responsive to the operation of said switchhook for restoring said single operating member to release the remaining contact springs.

8. In a telephone instrument, a pair of manually operable keys, an operating member controlled by one of said keys, a second operating member controlled by the same key, a third operating member controlled by the other of said keys to effect the restoration of said first operating member without effecting the restoration

of said second operating member, a set of contact springs controlled by said operating members, and means responsive to the operation of said keys for controlling said operating members to variably operate said set of contact springs.

9. In a telephone instrument, a pair of manually operable keys, an operating member controlled by one of said keys, a second operating member controlled by the same key, a third operating member controlled by the other of said keys to effect the restoration of said first operating member without effecting the restoration of said second operating member, contact springs controlled by said operating members, means responsive to the operation of said keys for controlling said operating members to variably operate said contact springs, a switchhook controlling said operating members, and means responsive to the restoration of the telephone on the switchhook for restoring the operated members to normal.

10. In a telephone system, two subscribers' lines, a substation telephone set terminating said lines, a pair of keys associated with said set, an operating member individual to each key and engaging each other so the movement of one is dependent on the movement of the other, a single operating member individual to only one of the keys and movable independently of said other operating members, a set of contact springs controlled by said operating members, means responsive to the operation of one of said keys for moving the operating members engaging each other and the single member to operate said contact springs and connect one of said subscriber's lines to said set, means responsive to the operation of the other of said keys for moving only the operating members engaging each other to restore only certain of said contacts for connecting a holding bridge across said line, for disconnecting said line from the set, and for connecting the other of said lines to the set.

11. In a telephone instrument, a pair of keys, a pair of operating members controlled by said keys, one of said operating members controlled by both of said keys and the other operating member controlled by only one of said keys, and contact springs controlled by said operating members.

12. In a telephone instrument, a pair of keys, a pair of operating members controlled by said keys, one of said operating members controlled by each of said keys, the other operating member controlled solely by one of said keys, and sets of contact springs controlled by said operating members.

13. In a telephone instrument, keys, operating members controlled by said keys, one of said operating members controlled by all of said keys and another operating member controlled by only a single key, and contact springs operated by said operating members.

14. In a telephone instrument, a pair of keys, a pair of operating members, sets of contact springs controlled by said operating members, one of said operating members controlled by both of said keys separately to operate said contact springs in a certain manner and the other of said operating members controlled by only one of said keys to control said contact springs in another manner.

15. In a telephone instrument, a pair of keys, a pair of operating members controlled by said keys, one of said operating members controlled by either of said keys and the other of said operating members controlled by only one of said keys, and a plurality of sets of contact springs variably operated by said operating members.

16. In a telephone instrument, a pair of keys, a pair of operating members controlled by said keys, one of said operating members controlled by either of said keys and the other operating member controlled by only one of said keys, a switchhook in said telephone instrument, and means responsive to the operation of said switchhook for restoring any of said operating members to normal.

17. In a telephone instrument, a pair of keys, an operating member controlled by both of said keys, a second operating member controlled by only one of said keys, contact springs variably operated by said operating members, and a switchhook for restoring said operating members to normal.

RUDOLPH FRANK STEHLIK.