Feb. 15, 1944. R. F. MALLINA 2,341,933

IMPULSE TRANSMITTING DEVICE

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FIG. 1.

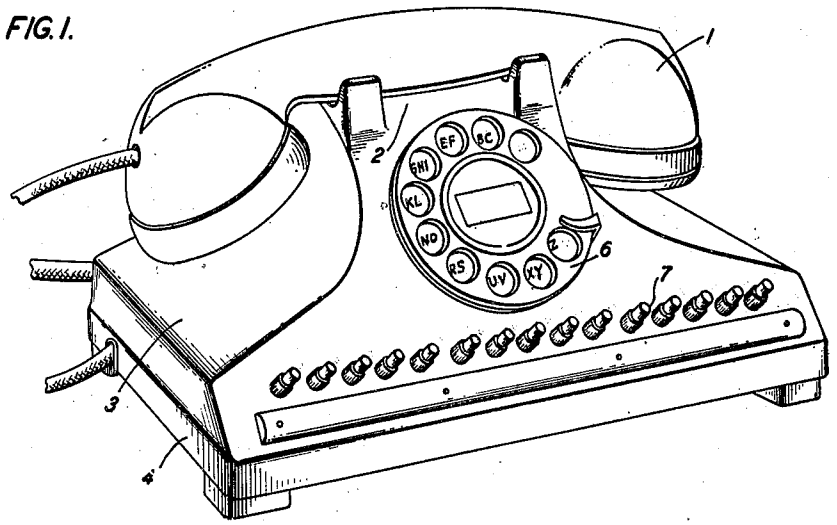
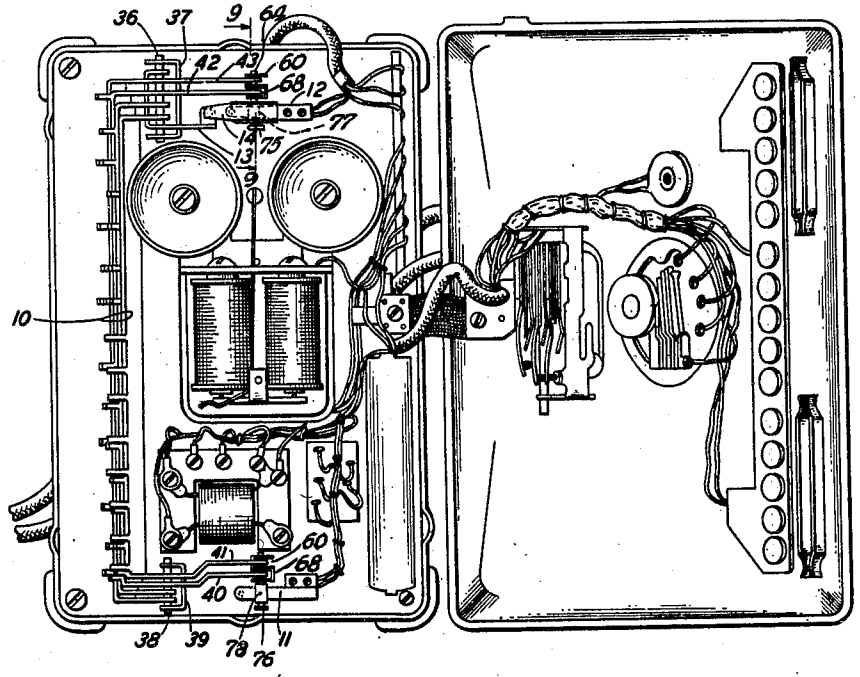


FIG. 2.



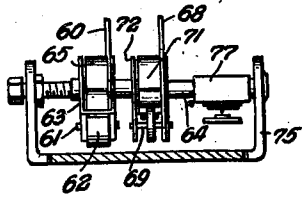


FIG. 9.

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FIG. 3

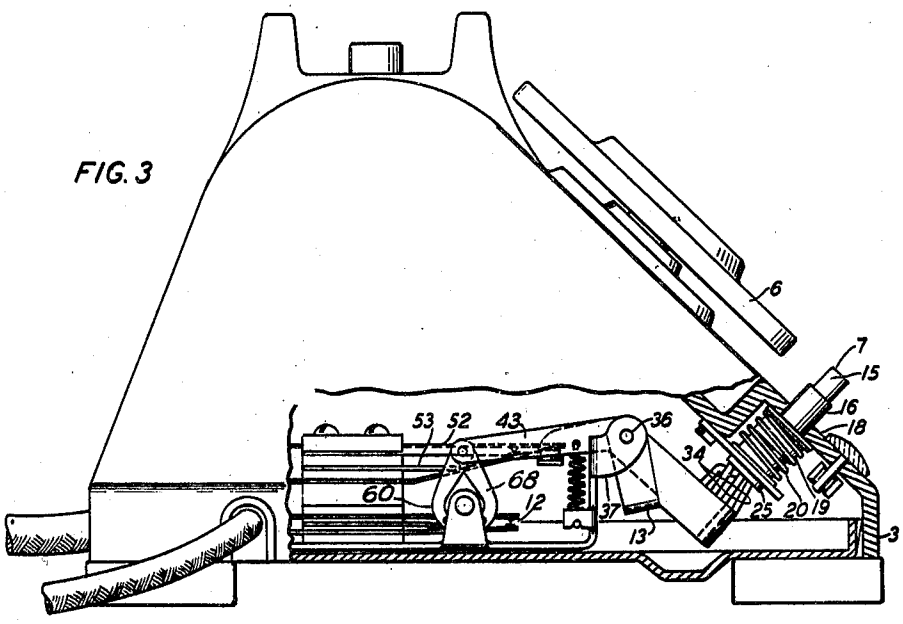


FIG. 4

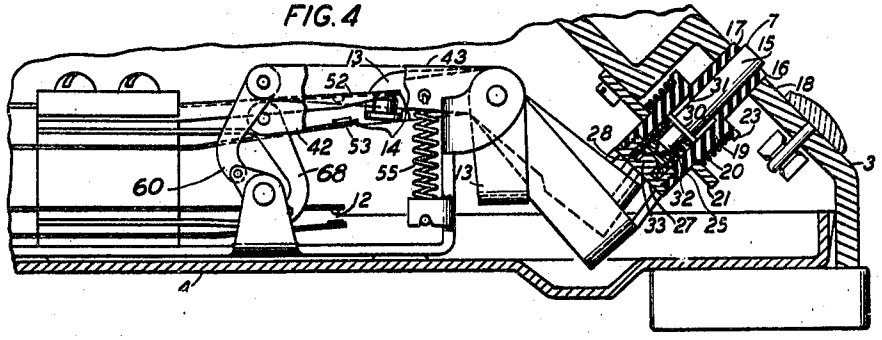


FIG. 5

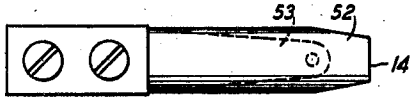


FIG. 6

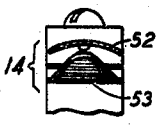


FIG. 7.

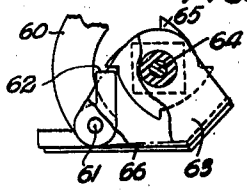
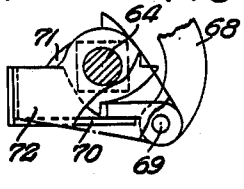


FIG. 8.



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Patented Feb. 15, 1944

2,341,933

UNITED STATES PATENT OFFICE

2,341,933

IMPULSE TRANSMITTING DEVICE

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Application May 28, 1942, Serial No. 444,837

6 Claims. (Cl. 179—90)

This invention relates to impulse transmitting devices and particularly to improvements in such devices for use in controlling the operations of switches in automatic telephone systems.

An object is to improve the operating characteristics of such devices and particularly the timing of the operations.

Heretofore impulse transmitting devices have been provided in which push-buttons operate on levers to control them in combinations. The levers may operate on contacts to close corresponding combinations of connections to establish code signals for transmission over a line to control switches at a central office. It is usual in devices of this kind to also provide a special common lever arranged to operate each time any of the others are operated to control a set of common contacts. It has also been proposed, as shown in the copending application by H. M. Bascom and F. A. Hubbard, filed May 28, 1942, Ser. No. 444,772, to control the levers in combination by push-buttons to actuate contacts both on the downward stroke and on the upward stroke of the levers and push-buttons.

It is in connection with impulse transmitting devices of this character that the present invention is concerned, and a feature thereof is a specially constructed push-button assembly which consists of an inside plunger, an outside sleeve and an intermediate spring in combination with an arrangement in which so-called break-through springs are employed in place of the contacts operated by the common lever. By this means a minimum time requirement for each operative stroke of the button is obtained, that is, the push-buttons, levers and break-through springs will cooperate to permit the actuation of the contacts to prevail for a minimum time interval for each operative stroke initiated by the operator so that the transmission of code numbers may not exceed a required speed. The invention has been illustrated in the accompanying drawings, in which:

Fig. 1 shows a perspective view of a telephone stand with operating buttons arranged in accordance with the applicant's invention;

Fig. 2 shows a general arrangement of the various apparatus inside of the telephone stand shown in Fig. 1 and embodying the mechanisms controlled by the buttons in accordance with the applicant's invention;

Fig. 3 is a side view of the telephone stand shown in Fig. 1 with a part of the housing broken away to show details of the applicant's invention;

Fig. 4 is a view similar to Fig. 3 but somewhat enlarged and partially broken away, and showing one of the buttons and associated parts in operated position;

Fig. 5 shows a top view and Fig. 6 a front view of the break-through spring arrangement in accordance with the applicant's invention;

Figs. 7 and 8 show the two types of pawl and ratchet mechanism employed in connection with this invention, and

Fig. 9 is a cross-section of these mechanisms taken on line 9—9 of Fig. 2.

Referring now to the drawings, in general the desk stand consists of a handset 1 mounted in a cradle 2 forming a part of a housing 3 of the desk stand, the housing being mounted on a base plate 4. On the front surface of the housing 3 is shown the usual dial mechanism 6 and a single row of buttons 7, the latter designed in accordance with the applicant's invention for the control over the transmission of code impulses.

In Fig. 2 is shown the general arrangement of apparatus inside the desk stand and particularly the ordinary operating levers 10, groups of contacts 11 and 12 controlled by these levers, a common lever 13 and contacts 14 controlled thereby.

Referring now to the applicant's invention as applied to this telephone stand, each button in the row 7 consists of an inside plunger 15 and an outside sleeve 16 both of which may be made from some material other than metal such as a plastic or a rubber composition. The outside sleeve consists of a reduced cylindrical section 17 protruding partly through an opening in the slanting front portion 18 of the housing 3 and an enlarged section 19. Surrounding this section 19 is a spring 20 which abuts at the lower end against a holding plate 21 and at the upper end against a flange 23 on the enlarged portion 19 to restore the sleeve 16 to its normal position as shown in Fig. 3. The portion 19 terminates in a somewhat reduced portion 25 which extends through the holding plate 21 and being smaller in diameter than the portion 19 a shoulder is formed between these portions which prevents the sleeve 16 from being pushed down beyond the position as shown in Fig. 4. The bottom end of the portion 25 is enclosed by a metal cap 27 screwed into this portion and inside of the sleeve 16 is another helical spring 28 placed at one end against this cap 27 and at the upper end against the enlarged flange 30 on the push-button 15. Normally the spring 28, therefore, pushes the push-button 15 up into the sleeve 16 until the flange 30 engages the shoulder 31 in the sleeve

16. The button 15 also extends at 32 inside the helical spring 28 and the cap 27 is provided with a similar projection 33 projecting partly inside the helical spring 28 to guide the spring 28 during its operative movements.

These push-button assemblies control the group of four levers 10 which are U-shaped and located side by side with their bottom portions parallel to each other and with one group of left-hand side members mounted on the pin 36 secured in a U-shaped bracket 37, and a similar group of right-hand side members mounted on the pin 38 secured in bracket 39. Mounted on bracket 37 is the common lever 13 which rotates each time one or more of the four levers 10 are operated. Combinations of these levers 10 may be operated by the various buttons by having the lower surface of the caps 27 engage fingers 34 extending from the levers 10 in different combinations opposite the different caps so that on the operation of any one of the plungers 15 and associated sleeve 16, a corresponding combination of these levers 10 is rotated. Each of the levers in group 10 is provided with an extension such as 40, 41, 42 and 43 on the opposite sides of their supporting pivotal points to which a pawl and ratchet mechanisms are attached. These mechanisms may be arranged so that two of the extensions, for example 41 and 43, will act to rotate the associated mechanism on the downstroke of the corresponding connected levers and the other two extensions 40 and 42 will act to rotate the associated mechanism on the upstroke of the corresponding connected levers. The pawl and ratchet mechanisms for extension 41 or 43 are arranged as shown in Figs. 7 and 9 and the mechanism for extension 40 or 42 is as shown in Figs. 8 and 9. In regard to the mechanism for extension 41 or 43 each of these extensions is connected to a link such as 60 which in turn is connected at 61 to a pawl 62 and a bracket 63, the other end of this bracket being rotatably mounted on shaft 64 on which is also mounted a ratchet wheel 65. The pawl 62 is held against the ratchet wheel 65 by a spring 66. On the upstroke of the link 60 and extension 41 or 43 pawl 62 rotates the ratchet wheel 65 one quarter turn. In regard to the mechanism for extension 40 or 42 each of these extensions is connected to a link 68 controlling pawl 69, bracket 70 and associated ratchet wheel 71 on the shaft 64 with a spring 72 for pawl 69 as in the mechanism for extension 41 or 43. In this case, however, the downward stroke of the link 68 and extension 40 or 42 causes the pawl 69 to rotate the ratchet wheel 71 one quarter turn in the same direction as was the ratchet wheel 65 on the operation of its associated extension. The mechanisms for extensions 42 and 43 are mounted on a common shaft 64 and the ratchet mechanism for extensions 40 and 42 are mounted on another common shaft 74. The shafts 64 and 74 are mounted on brackets such as 75 and 76, respectively, and each shaft is provided with a cam such as 77 and 78, respectively, and having a square cross section. These cams are so arranged that for each rotation of a corresponding ratchet wheel one step, contacts such as 11 or 12 controlled by these cams will be closed momentarily. Thus it will be seen that when combinations of levers 10 are depressed and are released, connections may be closed momentarily in sequence during the forward and the backward strokes of these levers or during either movement, that is, for each operation of a button these contacts may be operated during the downward stroke of the button or during the upward stroke or both during the downward and the upward stroke, depending on what levers are operated by a button. The common lever 13 is also provided with an extension 50 which operates through an insulation stud 51 on the springs 14. As shown in Figs. 5 and 6, one of thes esprings 52 is of a curved cross section so that when the stud 51 operates on this spring it will require an increasing pressure to bend the spring until it arrives at the so-called break-through point when decreasing pressure is required. This spring 52 opens a connection with the spring 53 located underneath the spring 52. The levers may be restored to normal position by such springs, as for example 55.

It should now be observed that if the operator puts his finger on a plunger 15 with a comparatively slow movement of the finger, the pressure on plunger 15 may be transmitted through springs 28 to the sleeve 16 and from thereon to the fingers 34 to operate the corresponding levers 10 and the common lever 13 which will act on spring 52 to cause it to separate from spring 53. In this case, of course, it will take an appreciable time before the connection between the springs 52 and 53 is opened and before the pawl and ratchet mechanisms controlled by the actuated levers 10 will operate on the contacts 11 and 12 to momentarily establish connections. This will allow sufficient time for circuit functions to be performed as controlled by the momentary opening and closing of these contacts in combinations in accordance with the code devised. On the other hand, if the operator applies his finger on plunger 15 with considerable speed and pressure, the inertia of the sleeve 16, the levers 10 and 13, the tension in springs 28 and 20 and the pressure exerted by spring 52 against movement by the lever 13 due to its curved cross section, will be such that the plunger 15 will depress spring 28, perhaps as far as it will go, before the energy accumulated in spring 28 extends itself by acting on the sleeve 16 to make it move and function on the levers and springs as hereinbefore described. The operator may even after having depressed plunger 15 as far as it will go, touch the sleeve 16 and depress it to perform its functions. However, under any of these circumstances there will be sufficient time for the springs 11 and 12 to open and close their connections in accordance with a minimum time limit required. The spring 20, of course, to some extent also prevents sleeve 16 from moving too soon in case plunger 15 is depressed quickly. In a similar manner, the return movements of the levers 10 and 13 are delayed due to the inertia of the levers and due to the fact that when the finger is removed from the plunger 15, the spring 28 will permit it to be restored and prior to the restoring of the sleeve 16 to normal, due to the energy accumulated in spring 28 when both the sleeve 16 and plunger 15 were depressed further in unison. The operations of a pawl and ratchet mechanism to actuate springs as controlled by the levers on their return stroke to normal will therefore be delayed. Thus, regardless of how slow or fast the plunger 15 is depressed by the operator or how slow or fast it is released when the operator removes his finger, the levers will operate on the springs 11 and 12 and 52 and 53 to open and close connections within a minimum time limit and this is due, as stated, to the construction of the push-button assemblies, the inertia of the levers and the break-through spring characteristics of

spring 52 and these values may, of course, be controlled to provide this minimum time limit requirement by adjusting the tension in the springs 28 and 20 and the construction of the break-through spring 52 and the inertia of the levels. It has been found in practice that these values are easily adjusted to accomplish the desired result in accordance with the applicant's invention.

What is claimed is:

1. In a telephone stand, a set of levers, a set of push-buttons, means for moving said levers in different combinations from a normal to an actuating position in response to the movement of a corresponding push-button, means for returning the levers to normal, electrical circuit closing contacts, means for closing said contacts in different combinations and sequences in response to the movements of said levers from normal position or from actuated position or from both positions as controlled by said push-buttons and by the means for returning the levers to normal, said push-buttons, said levers, and said means for returning the levers to normal having energy absorbing and inertia characters so distributed as to cooperate to permit the actuations of the electrical circuit closing contacts to prevail for a minimum time interval for each operation of said elements.

2. In a telephone stand, a set of levers, a set of push-buttons, means for moving said levers in different combinations from normal to actuated positions in response to the operation of a corresponding push-button, means for returning the actuated levers and push-buttons to normal, electrical circuit-closing means, means for actuating said circuit closing means in combinations during the movement of said levers from normal position or during the return movement of said levers from actuated positions or during both movements depending on the combination of levers moved, said elements being so constructed and cooperating in such manner that the electrical circuit-closing means will not being to function until a certain minimum interval of time after a push-button has begun to be actuated or until a certain interval of time after a push-button has begun to return to normal.

3. In a telephone stand, a set of levers, a set of push-buttons each comprising two movable sections and an intermediate flexible coupling member, means for moving said levers in different combinations from normal position to an actuated position in response to the manual movement of a corresponding push-button, means for returning said levers and push-buttons to normal, said movements of said levers from normal position being delayed in starting a certain minimum interval of time after the manual movement of the corresponding push-button from normal begins and said movements of the levers from the actuated positions being delayed in starting a certain minimum interval of time after the return movement of the push-button from the actuated position begins due to the flexible coupling between the two sections of the push-buttons and the inertia of the levers, and electrical circuit-closing contacts controlled by said levers in different combinations and sequences during the movement of the levers from normal position or from actuated position or from both positions.

4. In a telephone stand, a set of levers, a set of push-buttons, fingers protruding from said levers to engage said push-buttons in different combinations so that on the operation of any one of said push-buttons a corresponding combination of levers is moved from a normal position to an actuated position, ratchet wheels, pawls on said levers associated with said ratchet wheels so that on the movement of certain levers to the actuated positions certain ratchet wheels are rotated and on the movement of certain other levers from the actuated positions certain other ratchet wheels are rotated, operating contacts controlled by the rotation of said ratchet wheels to establish electrical connections in corresponding combinations and sequences, a common lever arranged to move from a normal position to an actuated position, each time any one of the first-mentioned levers is moved from its normal position, operating contacts controlled by the movement of said common lever, said last-mentioned contacts being in the form of springs having a curved cross section to delay the operative movements of the levers and the closing of the operating contacts, each of said push-buttons consisting of an inner plunger for actuation by an operator and an outer sleeve for the actuation of the levers, and an intermediate flexible connection between said plunger and sleeve for delaying the operative movements of the levers a certain minimum interval after the operator has started the actuation of the inner plunger and for delaying of the restoring movements of the levers a certain minimum interval after the starting of the actuated inner plunger back to normal.

5. In telephone stand, two pairs of levers, a plurality of push-button assemblies, each assembly comprising a plunger, a sleeve surrounding a lower portion of said plunger, a cap enclosing the lower end of said sleeve and a spring inserted between said cap and the lower end of said plunger, means for moving said levers in different combinations in a downward direction on the depression of a corresponding plunger through the medium of the associated spring, sleeve and cap, a spring for returning each lever from the downward position in an upward direction to the normal position when the plunger of the associated push-button assembly is released, a pair of ratchet wheels associated with each pair of levers, a pawl for each lever, the pawl for one lever of each pair arranged to rotate one of the associated ratchet wheels one-quarter turn on the downward movement of said lever and the pawl for the other lever of each pair arranged to rotate the other associated ratchet wheel one-quarter turn in the same direction during the upward movement of the lever, a shaft connected to each pair of ratchet wheels having a square cross section portion, a normally separate pair of contact springs associated with each square cross section portion so arranged as to close for an interval during each quarter rotary movement of the associated ratchet wheels, a common lever arranged to move in a downward direction each time any one of the two pairs of levers is moved in a downward direction, a pair of spring contacts of which at least one has a curved cross section and associated with said common lever to release said common lever in an upward direction to its normal condition when said common lever is released by said two pairs of levers, said contact spring or springs having curved cross sections acting on said common lever to resist the downward movement of the common lever at an increase in pressure while they are bent to pass through the break-through position, when the resistance against the depression of the common lever is rapidly decreased, the tension in said

spring in the push-button assemblies, the inertia of the levers and the resistance exerted on the common lever by the springs having curved cross sections being such as to delay the closing and opening of the spring contacts a certain interval of time after a push-button plunger begins to move in a downward direction or in an upward direction or in both directions.

6. In a telephone stand, a set of levers, a set of push-buttons for actuating said levers in combinations and having energy absorbing characteristics operative when said push-buttons are actuated and when they are released to delay the starting of the operative and release movements of said levers, circuit closing contacts, means for actuating said contacts by some of said levers during the operative movements thereof and for actuating others of said contacts by others of said levers during the return movements thereof, the closing of said circuit contacts being thereby delayed for a certain time interval after the operation of said push-buttons due to the energy absorbing character of said push-buttons.

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