

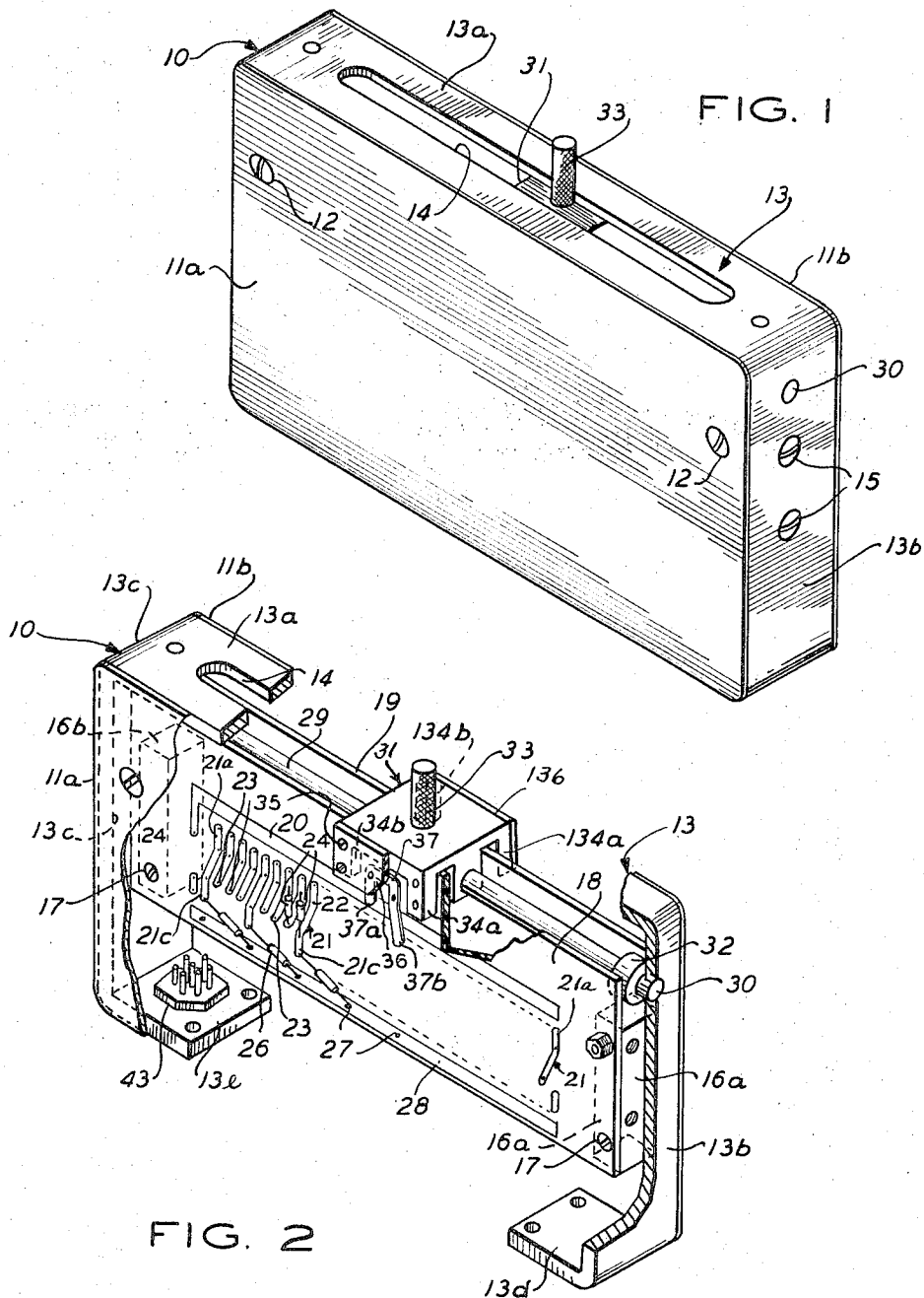
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C. F. SCOTT
SLIDE ATTENUATOR

3,337,831

Filed June 1, 1965

3 Sheets-Sheet 1



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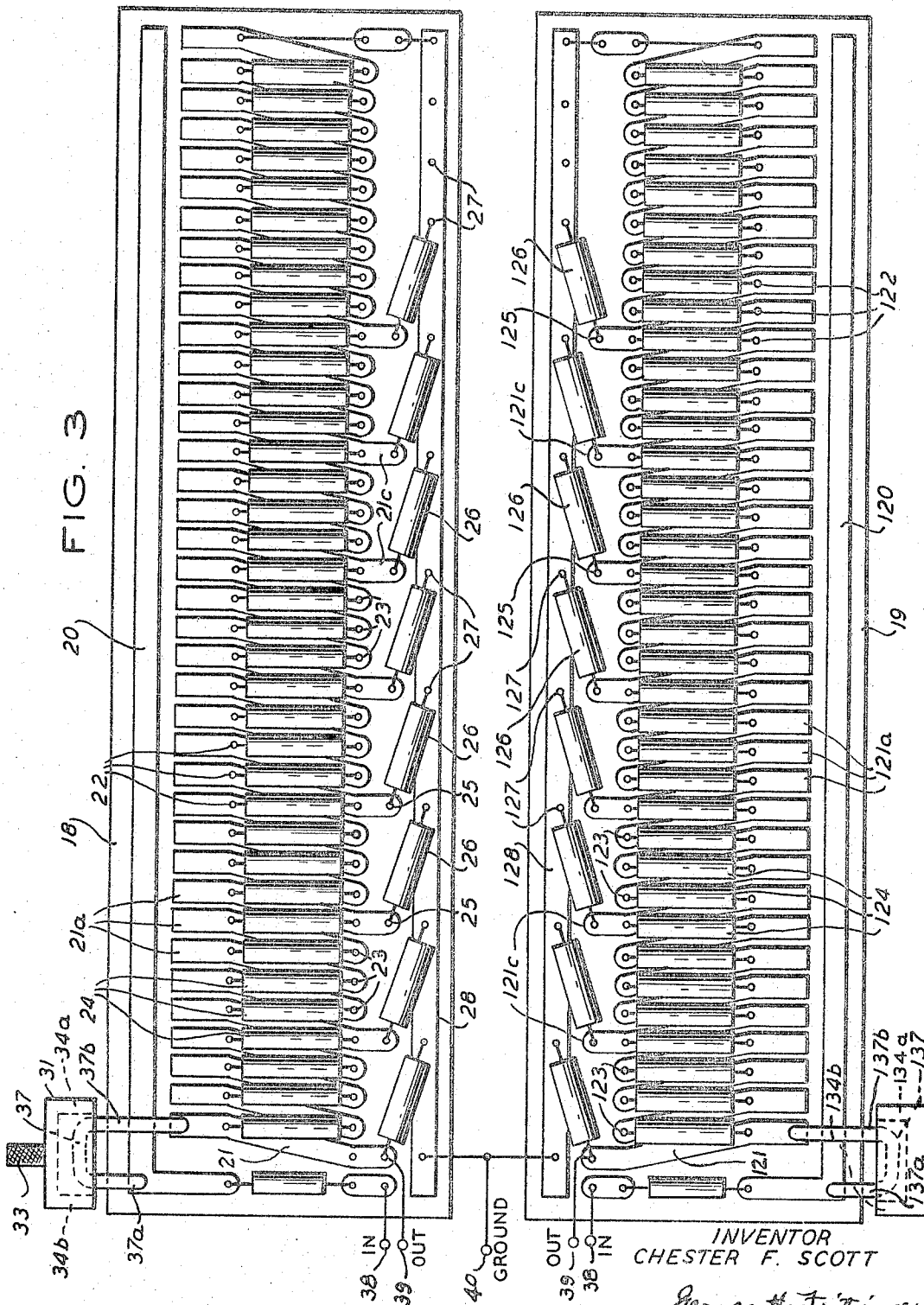
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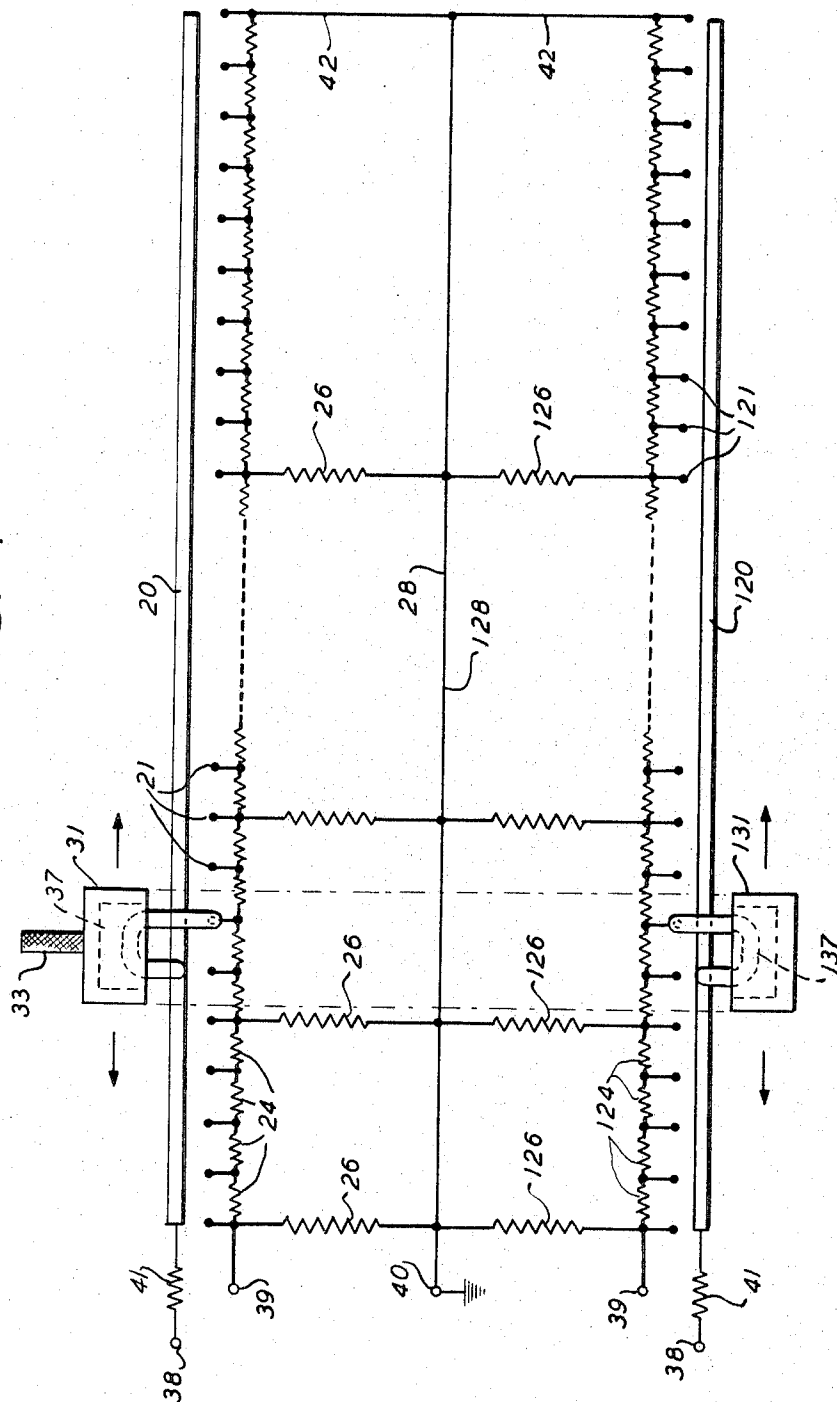
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FIG. 4



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SLIDE ATTENUATOR

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ABSTRACT OF THE DISCLOSURE

The invention relates to a variable attenuator of a ladder type housed in a rectangular case having a central slot-like space running therethrough from top to bottom. The attenuator is in two sections comprising two printed circuit boards in a spaced relationship forming sidewalls of the slot-like space through the case. The circuit boards have slide contacts and resistor elements only on their oppositely facing surfaces confronting the sidewalls of the case. A switch control member which bridges the circuit boards at the top has wipers which engage the slide contacts and a central handle which extends outwardly of the case through the central slot. Each printed side of the circuit boards comprise a series of transverse bars mounted side-by-side having upper end portions in a row constituting switch contact terminals and lower apertured portions to receive the end wires or resistors connected between the bars. Also, the printed side of each circuit board has a slip bar lengthwise thereof along the row of slide contact terminals along which the respective switch wiper is movable by the handle to connect it selectively to the switch contact terminals. Some of the transverse bars have an extended length to enable easy connection of parallel resistors of the attenuator to a common ground bar at the lower end of the circuit board.

This invention relates to a novel construction of a slide attenuator wherein the contact means are protected from dust and dirt which may fall on the attenuator when it is mounted on a horizontal panel.

The invention relates especially to a so-called ladder form of attenuator comprising a series of pi-type resistor networks with means for making input connections selectively at taps along the series arms of the networks. Further, the invention relates to such attenuators which have a rectilinearly movable switch armature. However, no unnecessary limitation of the invention to this specific form of attenuator herein disclosed is intended.

In communication systems the attenuators are often mounted on horizontal panels with the result that dust and dirt, especially cigarette ashes, may fall on and collect on or in the attenuator. If such dirt is permitted to reach the switch contacts it will ultimately cause a breakdown in the proper functioning of the attenuator.

An object of the invention is to provide a novel attenuator having a through space from top to bottom through which falling dirt may pass without reaching the switch contacts of the attenuator.

Another object is to provide an attenuator of a novel and durable construction which is highly dependable in operation and economical to produce.

Other objects and features of the invention will be apparent from the following description and the appended claims.

In the description of my invention, reference is had to the accompanying drawings of which:

FIGURE 1 is an isometric view of the present slide attenuator.

FIGURE 2 is an isometric view similar to FIGURE 1 but with the case mostly broken away to show the in-

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ternal construction, and wherein only part of the resistors forming the attenuator are shown so as not to becloud the circuit arrangement on the printed circuit boards;

FIGURE 3 is a diagrammatic layout of the printed boards and of the resistors connected thereto forming the two attenuator sections, the lower of the two sections being the rear section in FIGURE 2 shown aligned with the front section but in an inverted position relative thereto; and

FIGURE 4 is a fractional schematic circuit diagram of the present attenuator.

The present slide attenuator shown in the accompanying drawings is housed in a rectangular case 10 comprising two rectangular side covers 11a and 11b secured by screws 12 to a central rectangular frame 13 formed by bending a relatively heavy metal strap into a U-shape having a flat top wall 13a with depending end walls 13b and 13c and foot portions 13d and 13e bent inwardly from the respective end walls. In the top wall 13a there is a central slot 14 running lengthwise thereof. Secured by screws 15 to the inner sides of the end walls are vertical bars 16a and 16b. Secured to the opposite sides of these bars by screws 17 are rectangular printed circuit boards 18 and 19. These boards have printed circuit bars on their outer sides confronting the sidewalls 11a and 11b of which the bar arrangement on the rear board 19 is a virtual image of the arrangement appearing on the front board in FIGURE 2.

In describing the printed circuit boards 18 and 19 the components on the rear board 19 corresponding to those on the front board 18 in FIGURE 2 are given the same reference characters increased by 100 as appears particularly in the diagrammatic showing in FIGURE 3. A description of the printed board 18 will therefore suffice as a description for both boards.

The printed board 18 has a slip bar 20 near the top extending lengthwise of the case throughout the length of the slot 14. Below the slip bar is a series of separate elongate transverse contact bars 21 having upward terminal portions 21a in a row along and directly below the slip bar. The contact bars have terminal wire holes 22 directly below the terminal portions 21a and have also terminal wire holes 23 in their lower or far end portions. Connected between successive contact bars 21 are series resistors 24 each having one terminal wire in a hole 22 of one contact bar and the other terminal wire in a hole 23 of the next succeeding contact bar. In order that these series resistors may stand vertically within the case the body portions of the transverse contact bars are obliquely disposed so that the holes 23 and 24 of successive contact bars are vertically arranged.

Certain selected ones of the contact bars 21 have depending terminals 21c each provided also with a terminal wire hole 25. In the illustrative example herein shown, the first contact bar and every fourth contact bar thereafter through seven intervals, are so provided with the depending terminals 21c. These depending terminals serve as connector tabs for a set of parallel resistors 26 the other ends of which are received in terminal wire holes 27 in a common connector bar 28 located below and extending along the row of connector bars 21. Thus, a series of pi-type resistance networks is formed on each printed board. The networks on both printed boards have a common ground connection forming a ladder type attenuator as shown in FIGURE 4.

Located between the printed circuit boards is a rod 29 extending lengthwise of the case and supported at its ends in holes 30 provided in the end walls 13b and 13c. Mounted on this rod is a slide 31. Also, on end portions of the rod are rubber grommets 32 serving as bumpers for

the slide. The slide is manually movable by a finger piece 33 extending upwardly through the slot 14. The slide has a pair of L-shaped side fingers 34a and 34b extending across and downwardly alongside the top portion of the printed board 18 and has a similar pair of L-shaped side fingers 134a and 134b extending across and downwardly alongside the top portion of the board 19. Secured by screws 35 to the fingers 34a and 34b is a plate 36 of insulating material to a central portion of which is riveted a bridging contact 37 having one depending contact finger 37a slidably engaging the slip bar 20 and another depending contact finger 37b slidably engageable with the terminal portions 21a of the contact bars 21. As the slide is moved by the finger piece 33 the slip bar is connected selectively to the terminal portions 21a to make selective connection to the junctions between the series resistors 24.

At the back side of the attenuator as it appears in FIGURE 2 the slide has a bridging contact 137 engaging the printed board 19 in the same manner as the bridging contact 37 engages the printed board 18. Thus, selective connections are made in an identical manner to the two symmetrical attenuators on the printed boards 18 and 19.

Further, as is shown in FIGURE 4, input circuit connections 38 are made to the slip bars 20 and 120 and output circuit connections 39 are made to the first contact bars 21 and 121 at the left or start position of the slide. Also, a ground connection 40 is made to the common connector bars 28 and 128. When the slide is at its start position a direct connection is made from the slip bars to the output leads, but resistors 41 are serially connected to the slip bars so that there will be an initial insertion loss of several db.

The attenuator may for example have 37 steps designed to provide an insertion loss of 1.5 db per step throughout the 28 steps running through the seven pi networks and to provide a db loss per step throughout the remaining portion of the attenuator according to the desired taper for mixing controls which is 2, 3, 4, 4, 4, 4, 7, 10 and "off." To this end the first parallel resistors 26 and 126 (at the left end of the attenuator as shown in FIGURE 4) may have 903 ohms, the subsequent parallel resistors of the seven identical pi sections may have 451.5 ohms; the series resistors 24 and 124 in each of the seven identical pi sections may have values proceeding from left to right of 60 ohms, 60 ohms, 57 ohms and 49 ohms; and the series resistors following the seven identical pi sections may have in sequence from left to right 82 ohms, 111 ohms, 106 ohms, 62.5 ohms, 35.2 ohms, 21 ohms, 17.75 ohms, 9.85 ohms and 4 ohms respectively. At their far or right ends the 4 ohm resistors are connected by leads 42 to the ground connector bar 28. All lead connections (input, output and ground) to and from the attenuators are made via a connector plug 43 in a foot portion 13d of the frame as shown in FIGURE 2.

As is apparent from the foregoing description the present attenuator has a through slot from top to bottom from which the finger piece 33 projects for adjusting the slide. This slot is determined within the case by sidewalls which are constituted by the inoperative sides of the printed circuit boards 18 and 19. All operative components of the attenuators are in the side spaces between the printed boards and the sidewalls wherein they are fully shielded from dirt by the walls of the case and the printed boards. Also, any dirt which may fall into the slot can pass out through the bottom without accumulation in the case and without interfering with the operation of the attenuator. This design makes the attenuator especially suitable for mounting on horizontal panels.

The embodiment of my invention herein particularly shown and described is intended to be illustrative and not necessarily limitative of my invention since the same is subject to changes and modifications without departure from the scope of my invention, which I endeavor to express according to the following claims.

I claim:

1. A slide attenuator comprising two rectangular printed circuit boards mounted in spaced parallel relationship, each of said printed circuit boards having on its outer side a series of transverse elongate contact bars mounted side-by-side with terminal portions in a row lengthwise of the board and with resistor-wire holes in rows also lengthwise of the printed board of which a first row of holes is intermediate of the lengths of the contact bars at the inner ends of said terminal portions and a second row of holes is at the far ends of the contact bars opposite said terminal portions, each of said printed circuit boards having also a slip bar lengthwise of the board and adjacent said row of terminal portions, series electrical resistors connected between successive contact bars with one terminal wire of each resistor engaging an intermediate hole in a respective contact bar and the other terminal wire of the resistor engaging a far end hole of a next adjacent contact bar, a supporting rectangular frame for said printed circuit boards surrounding said boards edgewise thereof, a rod between said printed circuit boards supported at its ends by the end walls of said frame, a slide mounted on said rod having side portions extending beyond the outer sides of said printed circuit boards, a top wall of said frame having a slot of a width less than the width of the space between said printed circuit boards and of a length equal approximately to the length of said slip bar, a handle on said slide extending outwardly through said slot, and a bridging contact mounted insulatedly on each side portion of said slide beyond the edge of said slot for connecting the respective slip bar to said terminal portions selectively as said slide is moved manually along the printed boards.

2. The slide connector set forth in claim 1 wherein selected ones of said contact bars separated by predetermined numbers of intervening contact bars are provided with extending connector tabs at their far ends, including parallel resistors connected between said selected bars and a common ground, and including input circuits connected to said slip bars whereby each printed board is connected as a series of pi-type resistor networks having a plurality of taps along the series arm of each network selectively connectable to the respective input circuit by said slides.

3. The slide connector set forth in claim 2 including a connector bar extending lengthwise of each printed board adjacent said far ends of said contact bars, said extending terminal portions and said connector bar being provided with terminal wire holes receiving the terminal wires of said parallel resistors, and a lead wire connection to said connector bar for connecting the connector bar to ground.

4. A slide attenuator comprising a rectangular protective case having a narrow width dimension relative to its length and height dimensions, two spaced printed circuit boards mounted in said box in spaced parallel relation to each other and in spaced parallel relation to the side walls of the case, each of said printed circuit boards having a series of separate contact bars spaced in a row lengthwise of the box and having a continuous slip bar at one side of said row and a continuous ground connector bar at the other side of said row extending throughout the length of said row, said bars of each printed circuit board being on the outer side of the printed board confronting the respective side wall of said case, series resistors connected between successive contact bars, parallel resistors connected between selected contact bars and said connector bar, said resistors being located in the spaces between said printed boards and said side walls of the case, the top wall of said case having a slot midway between said printed boards and extending lengthwise of the case throughout the length of said row of contact bars, said printed boards being offset from the sides of said slot in the side spaces of said case and said case

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having a bottom opening to provide a through space between the printed circuit boards via said slot for dirt falling onto the box, a slide between said printed boards mounted for movement lengthwise thereof, a handle on said slide extending outwardly through said slot, and contact bridging members on opposite sides of said slide each having one terminal slidably engaging said slip bar and another terminal selectively engageable with said contact bars as said slide is moved by said handle.

5. The slide attenuator set forth in claim 4 wherein the contact bar arrangement on one of said printed circuit boards is a virtual image of the other whereby to provide two symmetrical pi-type resistor networks with a common ground along which identical connections are made selectively by said slide from said slip bars to junctions between the respective series resistors as said slide is moved.

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tions between the respective series resistors as said slide is moved.

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