March 15, 1960 E. J. GUTTRIDGE ET AL 2,929,042

CONNECTION BOX WITH SLIDABLE PLUGBOARD

Filed May 8, 1956

2 Sheets-Sheet 1

Fig. 1.

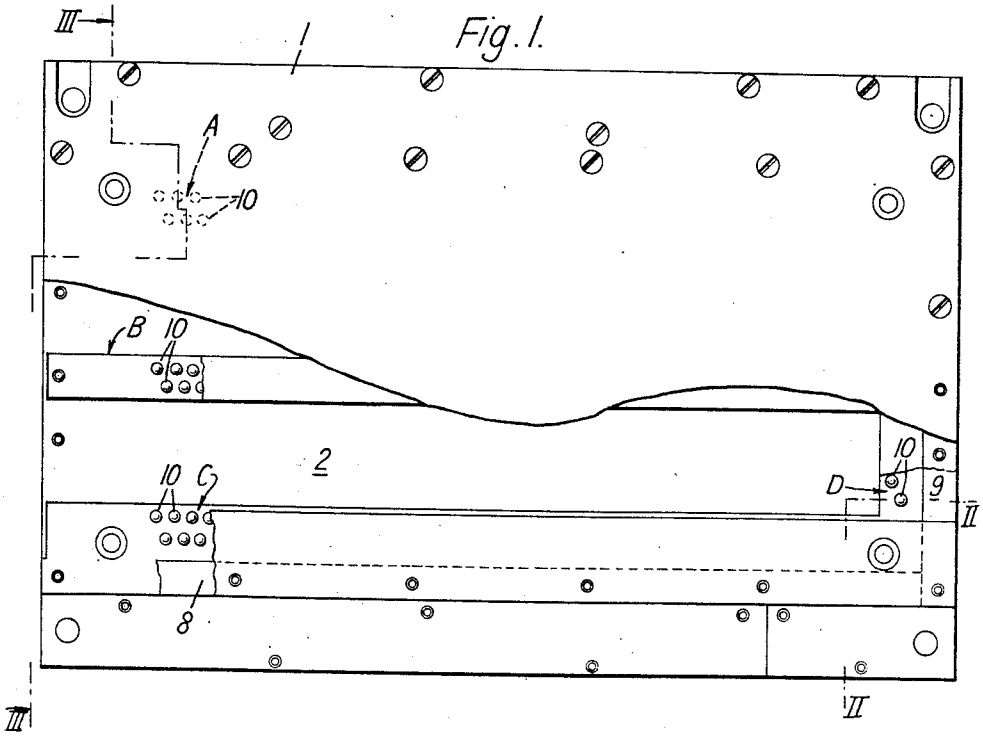


Fig. 2.

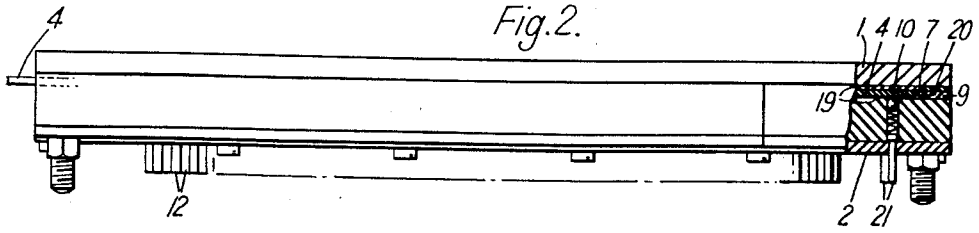
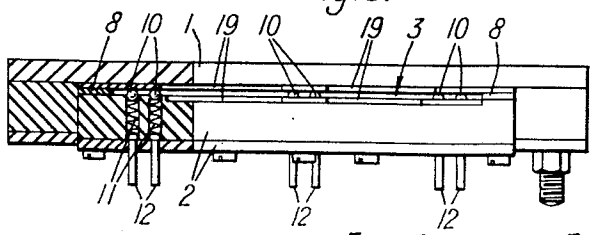


Fig. 3.



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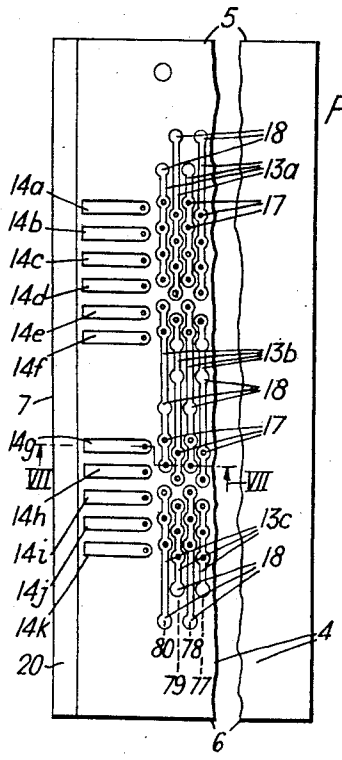

Fig.5.

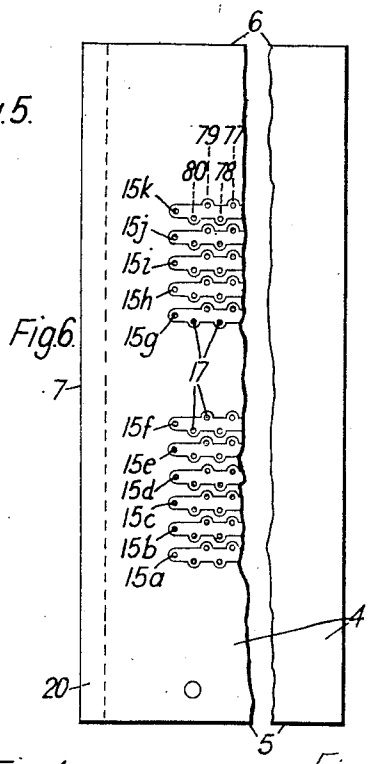

Fig.6.

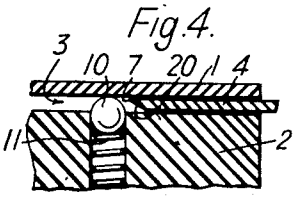

Fig.4.

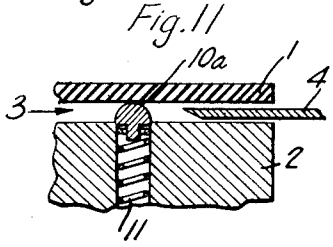

Fig.11

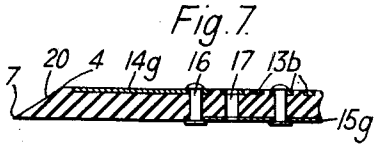

Fig.7.

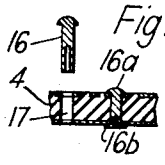

Fig.8.

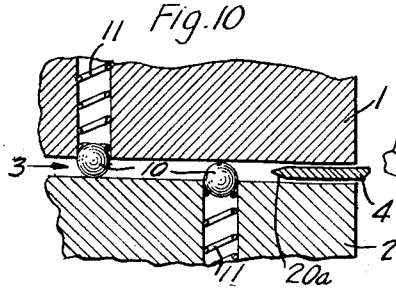

Fig.10

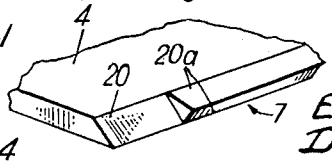

Fig.9.

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CONNECTION BOX WITH SLIDABLE PLUGBOARD

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Application May 8, 1956, Serial No. 583,499
Claims priority, application Great Britain June 3, 1955
1 Claim. (Cl. 339—18)

This invention relates to connection boxes such, for example, as are used with computing or other statistical machines.

As is well understood it is, in statistical machines, often required to route an input to the machine to an output position having a significance different from that of the source of derivation of input. In mechanically controlled machines this function is effected by a connection box including cross- or Y-wiring and in electrically controlled machines it is usually effected by a plugboard.

With the kind of plugboard usually employed to effect cross-connections in electrically controlled machines there is usually entailed a certain amount of rewiring and adjustment in order to modify the cross-connections and this, according to the amount of modification required, results in a fairly long stoppage of the machine during the changeover operations since the plugboard is not an interchangeable part of the machine. It is a main object of the present invention to provide an electrical connection box which includes fixed electrical contacts to cover all connections it may be desired to effect and to use therewith a connection element, hereinafter referred to as a plugboard, which can be set-up for use at any convenient time and inserted into the box to effect therewith all the desired cross-connections by the mere insertion of the plugboard into the box thereby, since a changeover from one set-up to another consists only in the removal of a plugboard from the machine and the replacement thereof by another pre-set-up plugboard, reducing the standstill time of the machine when effecting a change of cross-connections.

It is also an object of the invention so to arrange the plugboard that the cross-connections thereof can readily be modified or altered before insertion of the plugboard into the connection box.

In order that the invention may be clearly understood, one embodiment thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a top plan, with parts broken away, of a connection box according to the invention,

Fig. 2 is a side elevation, partly in section on line II—II, Fig. 1,

Fig. 3 is a view taken on the line III—III, Fig. 1,

Fig. 4 is a section of a part of the connection box and illustrates the manner in which a plugboard is inserted into the connection box,

Fig. 5 is a broken view of the obverse side of a plugboard,

Fig. 6 is a broken view of the reverse side of the plugboard,

Fig. 7 is a section on line VII—VII, Fig. 5,

Fig. 8 is an exploded view illustrating the use of semi-tubular rivets with the plugboard,

Fig. 9 is a diagrammatic pictorial view illustrating an alternative form for the leading edge of a plugboard,

Fig. 10 is a section of a part of the connection box and illustrates a manner of connection to both sides of a plugboard, and

Fig. 11 is a section of a part of a connection box and illustrates an alternative form of connection to a plugboard.

Referring to Figs. 1 to 4 of the drawings, the connection box comprises a box-like structure open at one end and having its two opposed wider sides 1, 2, secured in fixed spaced relation to provide a chamber 3 into which a flat plugboard 4 can be slid and located by the edges 5, 6 and 7, Figs. 5 and 6, thereof relative to resilient contacts to be described below and supported by the side 2 of the connection box.

The sides of the connection box are made of electrically insulating material and the chamber 3 is defined not only by the inner surfaces of the wider upper and lower connection box sides 1 and 2, as viewed in Figs. 2, 3 and 4, but by spacer elements 8 clamped therebetween to be engaged respectively by the side edges 5 and 6 of the plugboard when the latter is pushed into the chamber 3. A stop member 9, Figs. 1 and 2, is provided to be abutted by the leading edge 7 of the plugboard when the plugboard is inserted into the chamber 3, the stop 9 and spacer elements 8 accordingly coacting to locate the plugboard accurately within the chamber 3.

The resilient contacts each comprise an electrically conductive ball 10 located in an aperture extending through the side 2 of the connection box. The diameter of the ball is such that it cannot fully enter the chamber 3 and is therefore at all times partially located in the aperture formed in the side 2. An electrically conductive spring 11 is housed in the aperture and tends to force the ball into the chamber 3 and also effects electrical connection between the ball and a contact tag 12 to which an electrical lead can be soldered or otherwise secured and by which input impulses are applied to the connection box. In the embodiment of the invention illustrated in the drawings, the resilient contacts are arranged in three columns A, B and C, Fig. 1, extending lengthwise of the chamber 3, and a further column D, Fig. 1, which extends transversely of the length of the chamber 3 to be adjacent to the stop 9. It will be understood that the disposition of the resilient contacts within the connection box can be other than that illustrated in the drawings but will in all instances be such as to ensure that there are sufficient resilient contacts to effect the desired co-operation with the different forms of alternative plugboards which it is desired to insert into the chamber 3 from time to time.

The plugboard illustrated in Figs. 5 and 6 is one form of plugboard which can be used with the arrangement of resilient contacts shown in Figs. 1 and 3, and the plugboard 4 consists of a flat piece of electrically insulated material to the opposite sides of which there are applied what are known in the art as printed wiring. On the obverse side, Fig. 5 the printed wiring comprises a pattern of electrically conductive strips 13*a*, 13*b*, 13*c*, there being one set of strips 13*a*, 13*b*, 13*c*, for each column of a record card. In Figs. 5 and 6 it is assumed that the plugboard is for use with a record card containing 80 columns and in these figures are illustrated the electrically conductive strips corresponding to columns 77 to 80. Further strips 14*a* to 14*k*, Fig. 5, are provided to receive outputs from a plurality of electrically conductive lines 15*a* to 15*k* which lines are provided on the reverse side of the plugboard and extend lengthwise of the plugboard, that is in a direction transverse to the length of the strips 13*a*, 13*b*, 13*c*. In order to provide the desired connections, electrically conductive contact elements shown as rivets 16, Figs. 7 and 8, are inserted through aligned holes 17 extending through the electrically conductive strips, the plugboard, and the electrically conductive lines. As shown in Fig. 8, the rivets are of the kind known as semi-tubular rivets, the hollow ends of which can be readily opened out after insertion of the rivet through the plugboard thereby to effect electrical connection between a strip 13*a*, 13*b*, 13*c* as ap-

propriate, and the electrically conductive line appropriated thereto.

The use of semi-tubular rivets **16** facilitates the removal of misplaced rivets, or of rivets to change or modify the plugboard connections and the recess left after riveting serves for centering a tool for knocking out the rivet. Further, since a rivet is retained in position only by an overturned rim, instead of by a solid head, there is little likelihood of damage to the plugboard when a rivet is knocked out.

It will be readily understood that by the arrangement herein described with reference to Figs. 5 and 6, an electrically conductive strip **13***a* can be connected, as appropriate to an electrically conductive line **15***a*, **15***b*, **15***c* or **15***d*; an electrically conductive strip **13***b* can be connected to an electrically conductive line **15***e*, **15***f*, **15***g*, or **15***h*; and an electrically conductive strip **13***c* can be connected to an electrically conductive line **15***i*, **15***j*, **15***k*. The lines **15***a* to **15***k* are connected by rivets **16** to the corresponding strips **14***a* to **14***k* on the obverse side of the plugboard so that pulses can pass out from the lines **15***a* to **15***k* and hence to resilient contacts D, Fig. 1. The electrically conductive strips are also provided with enlarged electrically conductive areas **18** which are engaged by the balls **10** when the plugboard is inserted into the connection box, and to which pass the input impulses to the plugboard.

It will be understood that the ends **16***a*, **16***b*, Fig. 8, of the ends of the rivets will extend beyond the faces of the plugboard and, to permit the plugboard to pass freely into the chamber **3**, the sides **1** and **2** thereof are provided with grooves **19**, Figs. 2 and 3, which permit the free passage of the ends **16***a* and **16***b*.

The plugboard is of rectangular cross-section and if the leading end of the board, that is the end **7** first inserted into the chamber **3**, is left square, that is substantially at right-angles to the length of the board, it would be impossible for the plugboard to be inserted into the chamber **3**. To facilitate the insertion of the plugboard into the chamber **3**, the leading end of the plugboard is provided with a chamfer or bevel **20**, Figs. 2, 4, 5 and 6, which forms an acute angle with the reverse side of the plugboard and extends substantially to that side thereof. Thus, from Fig. 4 it will be seen that as the plugboard is inserted into the chamber **3**, the chamfer **20** will engage the balls **10** so that they are depressed into their apertures as the plugboard is inserted into the chamber **3**. The chamfer **20** also ensures that the plugboard is not inserted into the chamber in an upside-down condition thereof, that is a condition in which the balls **10** cannot contact the areas **18**, and strips **14***a* to **14***k*, Fig. 5, when the plugboard is in position in the chamber because, if the plugboard should be inserted into the chamber in the upside-down condition thereof, the chamfer or bevel **20** will be reversed from the position illustrated in Fig. 4 and the leading edge **7** of the plugboard will engage the balls but will not effect depression thereof.

In some instances, as shown in Fig. 10, balls **10** may be provided to co-operate with both sides of the plugboard and the plugboard will, in such cases, be provided with a double bevel **20***a*, as illustrated in Fig. 9 to effect depression of the balls as the plugboard is inserted into the connection box. If this double bevel extends along the whole of the leading edge of the plugboard, the balls will be depressed by the plugboard if it is inserted into the chamber the right-way-up or upside-down. To ensure that the plugboard with a double bevel can only be inserted into the chamber **3** when it is correctly oriented, the double bevel **20***a*, Fig. 9, extends along only that part of the leading edge **7** which is to be passed through areas in the chamber in which resilient contacts are located, and a part of the leading edge **7**, on one or both sides of the double bevel **20***a* has only a single bevel portion **20**. The single bevel portion **20** co-operates with resilient members, similar to balls **10** and springs **11**, which are provided solely for the purpose of ensuring orientation of the plugboard, and it will be impossible to insert the plugboard into the chamber in the upside-down condition thereof because the single bevel portion **20** will engage with the resilient members but will not effect depression thereof. Only when the plugboard is correctly oriented will the single bevel portion **20** depress the resilient members co-operating therewith, so that the plugboard can only be inserted into the chamber when it is correctly oriented.

As has been described above the inputs to the connection box are applied through the contact tags **12** and the outputs from the box are made through the column D of balls **10** and contact tags **21**, Fig. 2, appropriated thereto, the balls **10** of column D being arranged to make electrical contact, as appropriate, with the conductive strips **14***a* to **14***k*.

In the foregoing description the resilient contacts in the connection box have been described as balls, but it will be understood that, if desired, the resilient contacts may be other than balls, for example as shown in Fig. 11, the contacts may consist of mushroomlike elements **10***a* provided only with a semi-circular portion to make engagement with the areas **18** of the plugboard.

We claim:

A connection box for effecting electrical connections comprising a housing forming a slot opening through one end of said housing, said housing having a plurality of bores therein in communication with said slot, electrically conductive contact elements in said bores, terminals closing the outer ends of said bores and projecting from said housing, electrically conductive springs in said bores and compressed between said contact elements and said terminals and biasing said contact elements to enter said slot with the inner ends thereof abutting the wall of said slot opposite the wall from which the elements project, the inner ends of said elements having camlike surfaces thereon facing the entrance to the slot, the surfaces of said elements immediately above the slot wall from which the elements project and facing the entrance to the slot being disposed substantially perpendicular to said slot, a plugboard slidable into said slot, said plugboard having circuit completing means thereon for completing preselected circuits between certain of said terminals and arranged so that the circuits are completed only when the board is inserted with a given surface facing a given direction, and means in said slot for accurately positioning said plugboard, said circuit completing means including contacts on said plugboard connected in a predetermined arrangement for engaging certain contact elements when the plugboard is in place for electrically connecting certain terminals, said plugboard having at least a portion of one transverse corner of the leading edge which is aligned with at least some of said contact elements beveled to be complementary to said camlike surfaces, so that when the plugboard is inserted into the slot in correct position the beveled edge cooperates with the cam surfaces of the contact elements to cam the contact elements into the bores to permit passage of the plugboard, but if inserted incorrectly the leading edge will abut the sides of said contact elements and prevent entry of said plugboard.

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