United States Patent

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[54] **CONNECTION POINT LOCATING APPARATUS**
1 Claim, 2 Drawing Figs.

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[51] **Int. Cl.** **G09f 9/00**
[50] **Field of Search** ..... 116/114, 124, 124.1, 124.4, 135, 129; 33/1 M; 219/79

[56] **References Cited**

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ABSTRACT: A connection point locator for the panels of integrated circuits with their numerous connection sockets and/or terminal prongs, comprising a base for attachment of the panel, resilient strings moveably supported from said base in rectilinear condition and at right angles to each other to represent the ordinate and abscissa, respectively, of a Cartesian coordinate system, and means for moving each of said strings over the panel predetermined distances in a direction parallel to the other string while in rectilinear condition, to vary the location of their point of intersection which identifies a desired connection point on the panel. According to the invention, said strings are made of resiliently yieldable material, such as rubber, so that they may be moved out of the immediate environment of the discovered connection point, for the operator to establish the desired connection without hinderance and without impairment of the accuracy of the locator in subsequent connection-point-locating operations.

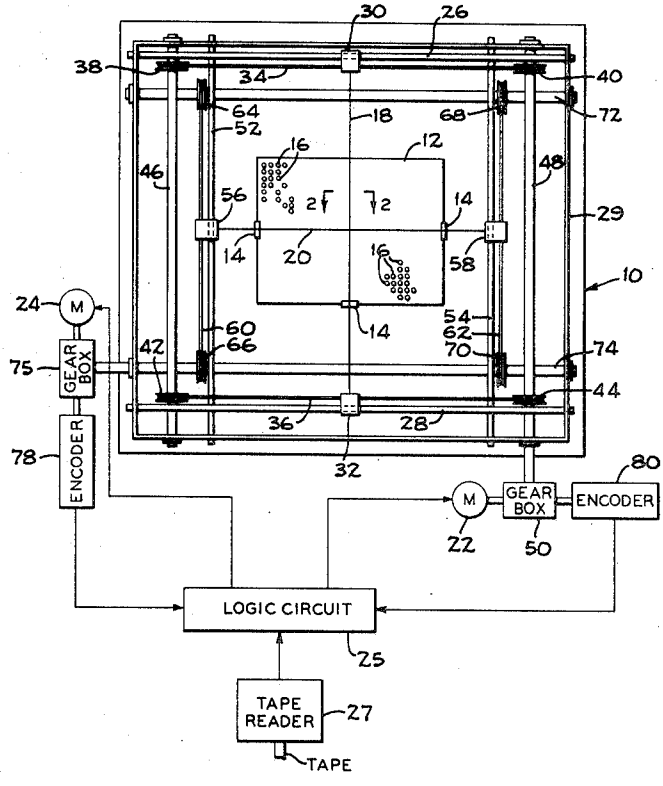


Fig. 1

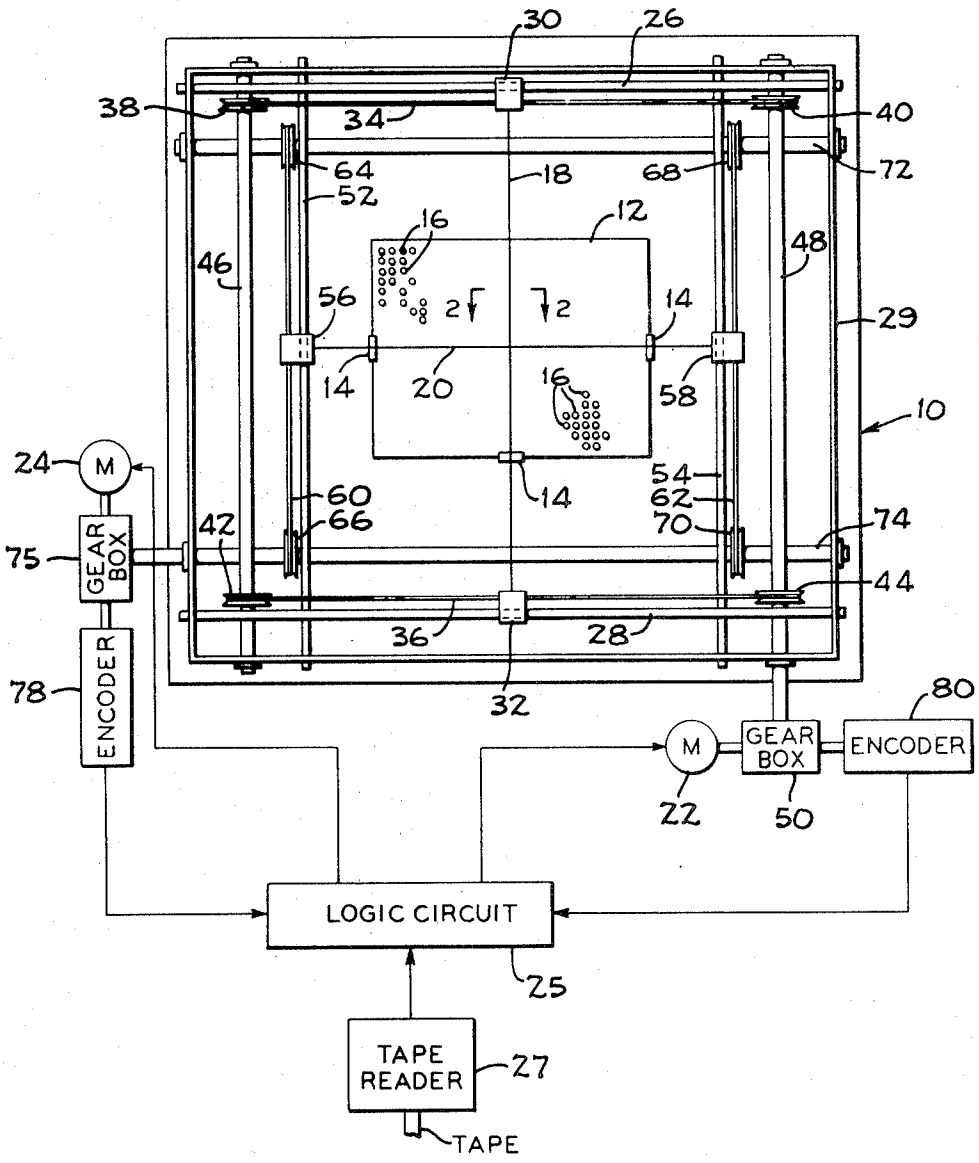




Fig. 2

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CONNECTION POINT LOCATING APPARATUS

The present invention relates to apparatus designed to find desired terminals in the task of wiring high density circuit panels, i.e. panels having numerous sockets and/or connection prongs or terminals on their opposite sides. An apparatus of this type performs automatically the time-consuming search and decision phase in the work of operators whose task it is to connect, on such panels, predetermined terminals according to a master chart. The present invention relates specifically to apparatus of this type wherein a desired connection terminal, be it a socket or prong, is found by moving over the panel, strings or wires disposed at right angles and representing the abscissa and ordinate of the Cartesian system, by means of motors operated under the control of logic circuits until their point of intersection comes to a halt and is located directly above the desired connection terminal. At present, these so called X–Y positioning mechanisms are usually constructed to place a connection-establishing tool, such as a wire-wrap tool or a soldering instrument over the desired contact point leaving it to the operator to service and trigger the tool when the X–Y positioning mechanism comes to halt over the discovered connection point, without need for the operator to search for the particular point and make the decision whether the proper terminal has been found. Some types of apparatus of this kind may even perform the connection-establishing-operations automatically. However, apparatus of this kind are complex and costly.

The invention is based upon the realization that the difficulty in wiring high density circuit panels lies in finding the proper terminals to be connected, but that once the proper terminals have been found, it is simpler, just as reliable and requires far less complex and costly equipment, to allow the operator to connect the discovered terminals with the help of tools that are independent of the connection-point-locating mechanism.

It is, therefore, an object of the present invention to provide a connection-point-locating mechanism that may be operated in the conventional manner under the control of logic circuitry to place the intersection point of a Cartesian coordinate system over a sought terminal and which is of such construction that once the sought terminal has been ascertained in this manner, the apparatus permits an operator to establish the necessary connections manually without being obstructed by the identifying strings, and without danger of misaligning or otherwise endangering the proper function of the connection-point-locating mechanism in subsequent operations.

In accordance with the invention I construct the strings which represent the abscissa and ordinate of the X–Y positioning mechanism, from resiliently yieldable material, such as rubber having elastic memory. On account of this feature, after the intersection point of the strings has come to a halt over, and has thus identified, a sought terminal, the operator merely pushes or pulls the strings aside and thus has access to the discovered terminal to work thereon with his connection establishing tool, and after the desired connection has been made, the operator merely allows the tensioned strings to bounce back into their normal rectilinear working positions at right angles to each other. Now the apparatus is again ready for renewed use without any danger that a misalignment was introduced into the apparatus, which might impair its accuracy in subsequent search operations.

The invention will best be understood by reference to the accompanying drawing which illustrates schematically a preferred embodiment thereof and wherein

FIG. 1 is a schematic front elevation of a connection-point-locating apparatus embodying the invention, with its logic circuitry shown in block form; and

FIG. 2 is an enlarged section through one of the connection-point-identifying resilient strings of the apparatus shown in FIG. 1, taken along line 2—2 of said Figure and viewed in the direction of the arrows associated with said line.

In FIG. 1 of the drawing the reference numeral 10 designates a mounting board to which a contact panel 12 may be detachably secured in a centered position in any suitable manner, such as by means of clamps 14. Panels of this type have a surface provided with numerous sockets, and into predetermined ones of these sockets the contact prongs of integrated circuit modules are to be inserted; and numerous connector prongs 16 project from the opposite surface of the panel, and predetermined ones of these prongs may have to be connected by attaching the ends of wires of varying lengths to the proper prongs thus establishing the proper connections according to wiring charts of radio, television or computer devices. As previously point out, the proper connection points, i.e. the proper prongs where the connections are to be made and/or the proper sockets into which the contact prongs of integrated circuit units are to be inserted, are found by strings or cords 18 and 20 one of which i.e. 18 extends in the direction of and represents the ordinate of a Cartesian system, and the other one 20 extends in the direction of and represents the abscissa of the Cartesian system. During the search operation the former one is moved in the direction of the abscissa, and the latter one in the direction of the ordinate by motors 22 and 24, respectively, under the control of logic circuits represented by block 25 to which the required information is fed from punched tapes, magnetic tapes and the like symbolically indicated by the block 27. These motors come to a halt when the intersection point of the two strings 18 and 20 registers with the sought contact prong or socket.

In FIG. 1 the reference numerals 26 and 28 designate horizontally disposed, vertically spaced, parallel guide rods that are suitably supported from a frame 29 secured to the base board 10, and slidably mounted upon said rods in vertical alignment with each other are carriages 30 and 32, respectively, between which is tensioned the string 18 which is of resiliently yieldable material, such as rubber or plastic (FIG. 2), and whose opposite ends are suitably anchored in said carriages 30, 32. As pointed out hereinbefore, string 18 represents the ordinate or Y-axis of a Cartesian system. To move these carriages in unison on guide rods 26 and 28, respectively, in the direction of the abscissa or X-axis, they are attached to corresponding runs of horizontally disposed endless belts or sprocket chains 34 and 36, respectively. Each of said belts or sprocket chains 34 and 36 is trained over pulleys or sprockets 38, 40 and 42, 44, respectively, that are firmly mounted upon vertically disposed, horizontally spaced drive shafts 46 and 48 which are rotatably supported in the frame 29 near the opposite side edges of base board 10. In the particular embodiment of the invention illustrated schematically in FIG. 1 the left-hand shaft 46 is an idler shaft, but the right-hand shaft 48 is driven by motor 22 through a gearbox 50.

Likewise supported in frame 29 in horizontally spaced relation are two vertically disposed guide rods 52 and 54 upon which are slidably supported in horizontal alignment with each other two carriages 56 and 58, respectively, and suitably anchored in, and tensioned between, said carriages is the string or cord 20 which is likewise of resiliently yieldable material and represents the ordinate of X-axis of the Cartesian system. Said carriages 56 and 58 are secured to corresponding runs of two endless belts or sprocket chains 60 and 62 trained about pulleys or sprockets 64, 66 and 68, 70, respectively, that are mounted upon vertically spaced, horizontally disposed drive shafts 72 and 74, which are rotatably supported in the frame 29. The upper one 72 of said shafts is an idler shaft, and the lower one 74 is driven by motor 24 through a gearbox 75.

The operation of motors 22 and 24 is controlled in a conventional manner from an electronic logic circuit unit represented by the block 25 in FIG. 1, which takes its direction from a punched or magnetic tape through a tape reader that is symbolically represented by the block 27 in FIG. 1 as pointed out hereinbefore. The exact moment when the operation of the motors 22, 24 is to come to a halt because the strings 18 and 20 have reached their proper positions, is determined by encoders represented by blocks 78 and 80 which signal back to the logic circuit unit 25 that the operation is completed. Control arrangements for the motors which move

components of a connection point locating mechanism that represent the abscissa and ordinate of a Cartesian system, are well known in the art and as such do not represent the present invention. Control circuitry of this type is disclosed, for instance, in U.S. Pat. No. 3,392,256 issued to Bradham on July 9, 1968.

When the described apparatus has located a sought connection point, be it a prong or a socket on panel **10**, it is now an easy matter for the operator to make the necessary connections, be it insertion of the prong or prongs of an integrated circuit into specific sockets or soldering wire ends to, or wrapping them around specific contact prongs, with the tools designed for such operations. After identification of the sought prong or socket in the panel, the operator merely pulls the strings **18** and **20** apart from the discovered socket or prong and holds them apart and he is now free to manipulate his tool or the integrated circuit module to make the desired connections; and after he has completed the necessary operations, he releases the strings **18** and **20** and due to their elastic character, they return to their original positions, so the apparatus of the invention may now again be used to find

another connection point, without the danger that the displacement of the strings from their contact-point-identifying position may have misaligned, and thus impaired the accuracy of the contact-point-finding apparatus of the invention in subsequent operations.

I claim:

1. A connection point locator for integrated circuit panels, comprising a base for attachment of a panel, rectilinear strings moveably supported from said base at right angles to each other and representing the ordinate and abscissa, respectively, of a Cartesian coordinate system, and means for individually moving each of said strings in its rectilinear condition in a direction parallel to the other string over a panel attached to said base, to vary the location of their point of intersection with a view to identifying a desired connection point on the panel, said strings being made of a resiliently yieldable material, so that they may be moved out of registry with the identified connection point, without impairment of the accuracy in the operation of the locator in subsequent connection-point-identifying operations.

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