ABSTRACT OF THE DISCLOSURE

The disclosure relates to a wiring chain for connecting electric contacts including a length of wire with disconnect terminals cramped thereto at regular intervals along the wire. Each terminal is insulated in a tight-fitting sheath of dielectric material with the disconnect portion thereof in alignment with the contact portion of the insulated terminal to be positioned on a contact pin. Because each terminal is fully insulated by a sheath the chain may be used to connect contact pins at any spacing and it is not necessary that each terminal in the chain be mounted on a pin.

BACKGROUND OF THE INVENTION

Conventional wiring chains are formed from a length of wire which is secured to contacts by a wire wrap connection or by a terminal as shown in U.S. Pat. No. 3,186,077. These conventional chains are expensive due to relatively high labor costs and due to the requirement that individual connections must be machine formed. Because the contacts are not insulated there is a possibility that short circuits may occur with adjacent circuitry. The conventional wiring chain is difficult to remove once secured to contacts if it is desired to alter the circuitry formed by the chain and is not suitable for general use because the spacing of the connections along the chain is intended for a specific geometry of contacts.

SUMMARY OF THE INVENTION

The invention relates to a mass produced wiring chain of indefinite length in which insulated contact terminals are secured to a wire at regular intervals along the length thereof to permit given terminals to be secured to contact pins where desired. If the spacing between contact pins to be joined together electrically by the wiring chain is greater than the spacing between adjacent terminals on the chain, the contacts may be joined together by attaching spaced wiring chain terminals to them without using the intermediate terminals. Because all of the terminals are fully insulated to avoid short circuiting, it is not necessary that they all be secured to contacts. Since the wiring chain can be used to establish an electrical connection between randomly spaced contacts, a given chain may be used for a number of applications, thus avoiding the necessity of providing a separate wiring chain for each application.

The insulation sheath provided around each terminal on the wiring chain serves to both insulate the terminal and to keep it clean of dirt, dust or other foreign matter which might impair the contact properties of the terminal.

In the drawings:

FIG. 1 illustrates a length of a wiring chain according to the invention;
FIG. 2 is a perspective view of a circuit board with two wiring chains secured to contact pins therein;
FIG. 3 is an enlarged sectional view of a terminal on one of the contact chains of FIG. 2, taken along section line 3--3;
FIG. 4 is a sectional view taken along line 4--4 of FIG. 5;
FIG. 5 is a sectional view of a terminal in a modified wiring chain similar to FIG. 3, taken along section line 5--5 of FIG. 2;
FIG. 6 illustrates a circuit board with a further modified wiring chain secured thereto; and
FIG. 7 is a sectional view of a contact pin with terminals as in FIG. 6 mounted thereon.

FIG. 1 illustrates a wiring chain 10 of indefinite length comprising a length of insulated wire 12 to which insulated terminals 14 have been attached at regular intervals.

The insulation of wire 12 surrounds a continuous metal conductor 13. As shown in FIG. 2, the chain 10 may be used to establish electrical connection between selected pin contacts 16 mounted on a circuit board or suitable support 18. Each insulated terminal 14 includes a metal connector 20 surrounded by a tightly fitting dielectric insulting sheath 22 which completely surrounds and insulates the connector 20. The sheath may be made of plastic or other suitable material. The connector 20 includes an insulation grip ferrule 24 adjacent one end of the sheath, a wire grip ferrule 26, and a connector socket 28 adjacent the other end of the sheath. The socket 28 is aligned in the sheath 22 so as to make a positive electrical connection with pin 30 when it is inserted through opening 32 at end 34 of the sheath.

A reverse bend portion 36 of wire 12 extends through opening 38 at end 40 of sheath 22, into the sheath, and is held to the connector 20 by insulation crimp ferrule 24. The nose 42 of the reverse bend portion 36 is stripped of insulation adjacent ferrule 26 and is secured to the connector 20 by the wire crimp ferrule so as to establish an electrical connection between the connector 20 and the conductor 13 in the wire 12.

The insulation is stripped from the nose portion 42 of the reverse bend 36 in each terminal 14 so that a continuous length of conductor 13 extends along the length of chain 12. Thus each connector 20 is secured to the conductor 13 and is in electrical connection with every other connector 20 in the chain. By crimping the connector 20 to the conductor 13 without severing the conductor, a direct electrical connection is established between any two of the connectors 20 in the chain. This feature is important since the resistance between the two connectors is minimized. If individual lengths of wire were used to connect adjacent connectors in the chain objectionable contact resistance between non-adjacent connectors might be encountered. By forming the chain from a single length of conductor with connectors 20 crimped to median portions thereof without severing the wire contact resistance along the wire due to the cramped connections is minimized. The insulation crimp ferrule 24 and the wire crimp ferrule 26 secure the wire 12 to the connector 20 so that the terminal 14 may be pulled from pin 16 by gripping the wire 12 without pulling the reverse bend portion of the wire from the connector 20.

The wiring chain 10 is manufactured by crimping connectors 20 to wire 12 at regular intervals therealong after the nose portions 42 have been bared of insulation. The connectors 20 are then fitted into cylindrical sleeves of heat shrink plastic material such as irradiated polyvinyl chloride or polyethylene. The plastic sleeves are then heated and shrink about the connectors 20 as shown in FIGS. 3 and 4, thus forming a tight fitting insulation for the connectors. Ends 34 and 40 of the sleeves 22 extend past the end of the connectors 20 thereby affording a more effective insulation for the connectors.

When a terminal 14 is inserted on a pin 30, sleeve end 34 forms a seal with the top surface of board 18 to prevent dirt or other impurities from entering the contact socket 28 and affecting the electrical connection between the connector 20 and pin 30. Socket end 40 at the other
end of the terminal 14 forms an effective seal around the ends of the reverse bend wire portion 36 to prevent impurities from entering the socket through opening 38. Thus the sleeve 22 serves not only as an electrical insulation for the connector 20, but also as a physical barrier for contaminating materials from reaching the contact area of socket 28.

As shown in FIG. 2, a chain 10 may be used to provide an electrical connection between selected pins on board 18. Where it is desirable to connect together two pins which are spaced further apart than the spacing of terminals 14 along the chain, the intermediate terminals 44 are not connected to any pin and lie adjacent board 18. By providing a wiring chain 10 with terminals 14 attached thereto at regular intervals along the length of the chain, it is possible to secure an electrical connection between pins or contact members at any given geometry or spacing. The sheaths 22 surrounding the connectors 20 of the intermediate terminals 44 prevent a short circuit between these terminals and nearby pins 16.

When a wiring of board 18 with a portion of chain 10 has been completed, the end 46 of the wire 12 running from the end or last terminal 47 is secured from the remainder of the chain by cutting wire 12. The chain 10 may be formed from relatively long lengths of wire and may have up to 250 or more terminals attached thereto. It is convenient to store the completed chain on a reel from which appropriate length segments may be unwound as needed for a given wiring application.

Wiring chain 50 shown in FIG. 2 is a modification of wiring chain 10 wherein lead wire 52 has terminals 56 attached thereto at regular intervals along its length. The difference between the chains 10 and 50 is that in chain 50, the wire 52 is led from the insulating sheath 54 of terminals 56 through the opening 58 at the sheath end 60 adjacent board 18. Connector 62 of terminal 56 is identical to the connector 20 used in terminal 14 and includes an insulation crimp ferrule 64, wire crimp ferrule 66, and socket 68 which is adaptable to receive and form an electrical connection with contact pin 70 mounted on the board 18. A reverse bend portion 71 of wire 52 is secured to the connector 62 by insulation crimp ferrule 64 and wire crimp ferrule 66 which is secured to the bare nose portion 72.

Portions 74 of wire 52 run from the insulation crimp ferrule 64 along the length of the connector 62 inside the sheath 54 to opening 58 so that the wire 52 between terminals may be led flat along the surface of the board 18. Thus the wiring chain 50 is somewhat more compact than the wiring chain 10 and has the advantage that there is less likelihood of snagging the wire 52. Sheath 54, like sheath 22, is shrunk around the connector 62 and wire portions 74 to form an insulating cover for the terminal.

FIG. 6 illustrates wiring chains 80 each comprising a length of wire 82 with terminals 84 secured at regular intervals along the wire. Each terminal includes a socket 86 and insulation crimp and wire crimp ferrules 88 and 90 which are secured to the insulation and conductor of reverse bend portion 92 of wire 82. Insulation and crimp ferrules 88 and 90 are located to one side of socket 86 and are connected to the socket by 180° bend portion 94. The socket 86 communicates with the openings 96 and 98 at both ends of the sheath shrink insulating sheath 100 to permit two terminals 84 to be mounted on a single pin 102. Thus by utilizing wiring chains of the type shown in FIGS. 6 and 7, an added degree of wiring flexibility is attained and it is possible to cross connect two or more chains.

As in wiring chains 10 and 50 shown in FIG. 2, chain 80 may be used to connect contact pins having a spacing greater than the spacing of the terminals 84 along the chain. All of the terminals 84 are surrounded by a heat shrink plastic sheath 100 so that the intermediate or unused terminals do not cause short-circuiting problems. Since the sockets 86 in terminals 84 of the chain 80 are in communication with both ends of sleeves 100, the terminals may be mounted on contact pins 102 either in the position shown in FIG. 7 wherein the lead wire 82 is led from the end of the sheath or sleeve 100 adjacent the circuit board 104, or the terminal 84 may be mounted on the pin in the opposite orientation with the wire 82 leading out of the end of the sheath away from the circuit board as in the case of terminal 106. The terminals may be mounted on the pin in either position depending upon pin spacing, the desired location of the wire on the circuit board, and other factors.

While in describing the terminals 14, 56 and 58 of chains 10, 50 and 80, female pin sockets have been described, the invention is not limited to the use of a socket for receiving a pin member and includes wiring chains of the type described with a suitable socket for mating with a contact element which is inserted into the surrounding insulating sheath through an opening in the sheath. In the described embodiments the terminals are connected to the contact pins by movement of the terminals generally along the axis of the sheath so that the pin projects through one end of the sheath and into the socket.

When the insulating sheaths are formed from an integral cylinder of dielectric or plastic material with the connected terminals crimped to medial portions of the lead wire, both ends of the wire extend away from the terminal through one end of the sheath. This feature of the invention is not limited to the embodiment of the wiring chain, improves the insulating and protective properties of the sheath, and results in a neater wiring chain.

While I have illustrated and described preferred embodiments of my invention, it is understood that these are capable of modification, and I therefore do not wish to be limited to the precise details set forth.

What I claim as my invention is:

1. A wiring chain of indefinite length comprising a continuous length of insulated wire conductor, a plurality of connectors spaced along the length of said conductor, each connector including socket contact means and wire contact means, and a generally cylindrical sheath of dielectric material surrounding each connector, each sheath being tightly fitted around a connector and extending axially past both ends of the connector to insulate the same and having an open end, said conductor having looped portions extending into said opened ends of said sheaths, said wire contact means being secured in an electrical connection with said looped portions of said conductor, and said socket contact means being disposed within said sheath to make an electrical connection with a contact element extending into the sheath.

2. A wiring chain as in claim 1 wherein said sheaths are open at both ends and said looped portions extend into one end thereof and said socket contact means is disposed to receive a contact element extending through the other end thereof.

3. A wiring chain as in claim 1 wherein said sheaths are open at both ends and said socket means are disposed therein for receiving a contact element extending into the sheath through either end thereof.

4. A wiring chain as in claim 1 wherein the nose of each looped portion is bare of insulation and said wire contact means comprises a ferrule secured thereto by a crimp type connection.

5. A wiring chain as in claim 2 wherein said socket contact means and said wire contact means are aligned axially within said sheaths with said wire contact means located adjacent said one end of said sheath, and said wire contact means comprises a ferrule crimped to said looped portions of the wire conductor and said socket contact means comprises a pin receiving socket.

6. A wiring chain as in claim 1 wherein said socket contact means are disposed to receive contact elements extending through said open ends.
7. A wiring chain as in claim 6 wherein said socket contact means and said wire contact means are positioned within the sheaths in side-by-side relation. 

8. A wiring chain of indefinite length comprising a continuous length of insulated wire conductor, a plurality of connectors spaced along the length of said conductor, each connector including socket contact means and wire contact means, said wire contact means being secured to said conductor to establish an electrical connection therewith, and a generally cylindrical sheath of dielectric material surrounding each connector, each sheath being tightly fitted around a connector and extending past both ends of the connector to insulate the same, each sheath having an open end with said wire conductor extending into said sheaths through the open ends thereof, said socket contact means being disposed within said sheath to make an electrical connection with a contact element extending into the sheath. 

9. A wiring chain as in claim 8 wherein portions of said wire conductor in said sheaths extend past said socket contact means. 

10. A wiring chain of indefinite length for establishing low resistance electrical connections between spaced contact elements comprising a continuous length of insulated wire, a plurality of terminals secured to said wire at spaced intervals therealong to form said chain, each terminal including a wire contact portion secured to said wire to make an electrical connection therewith and a disconnect portion, a sleeve of irradiated plastic material shrink fitted around each terminal and open at each end thereof and extending axially at each end thereof past the terminal to insulate the same, the disconnect portions of said terminals being positioned adjacent ends of the sleeves and in alignment with such ends for establishing electrical connections with contact elements inserted through such ends and into the sleeves, said wire extending into said sleeves through open ends thereof. 

11. A wiring chain as in claim 10 wherein the said wire extends from said wire contact portions through the openings at the other ends of said sleeves. 

12. A wiring chain comprising a continuous length of insulated wire, a plurality of terminals secured to said wire at spaced intervals therealong to form a chain of indefinite length, each terminal including a wire contact portion and a disconnect portion, a sleeve formed of irradiated plastic material shrink-fitted around each terminal and open at each end thereof and extending axially at each end thereof past the terminal to insulate the same, the wire contact portion of each terminal being secured to a bared looped portion of said wire, said looped portions of said wire extending into said sleeves through one end thereof, the disconnect portion of said terminal being positioned adjacent one end of the sleeve and in alignment with such end for establishing an electrical connection with a contact inserted through said end and into the sleeve. 

13. A wiring chain as in claim 12 wherein said looped portion of said wire extends into said sleeve through the opposite end thereof. 

14. A wiring chain as in claim 12 wherein said disconnect portion of said terminal is disposed in alignment with both ends of said sleeve whereby the contact may be inserted in either end of said sleeve for establishing an electrical connection with said disconnect portion. 

15. A wiring chain as in claim 12 wherein said looped portion extends into said sleeve through said one end and past said disconnect portion. 

16. A wiring chain as in claim 12 wherein said wire contact portion is crimped to said bared loop portion to form an electrical connection therewith.

References Cited

UNITED STATES PATENTS
1,818,884 8/1931 Eekstein. 
2,800,635 7/1957 Christenberg. 
2,974,400 3/1961 Sowa 339—213 XR 
3,035,113 5/1962 Danchuk 174—74 
3,171,091 2/1965 Goldsmith 336—83 
3,294,941 12/1966 Mullen 200—143 
3,335,389 8/1967 Reichard 359—28 
3,363,309 1/1968 Logan et al. 29—628 

FOREIGN PATENTS
218,542 1/1957 Australia.

RICHARD E. MOORE, Primary Examiner
P. A. CLIFFORD, Assistant Examiner
U.S. Cl. X.R.
29—628; 339—18, 149, 276