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[54] **TERMINAL BLOCK**
11 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **339/198,** 339/242, 339/259
[51] **Int. Cl.** **H01r 7/12**
[50] **Field of Search** 339/14, 198, 217, 205, 259, 242

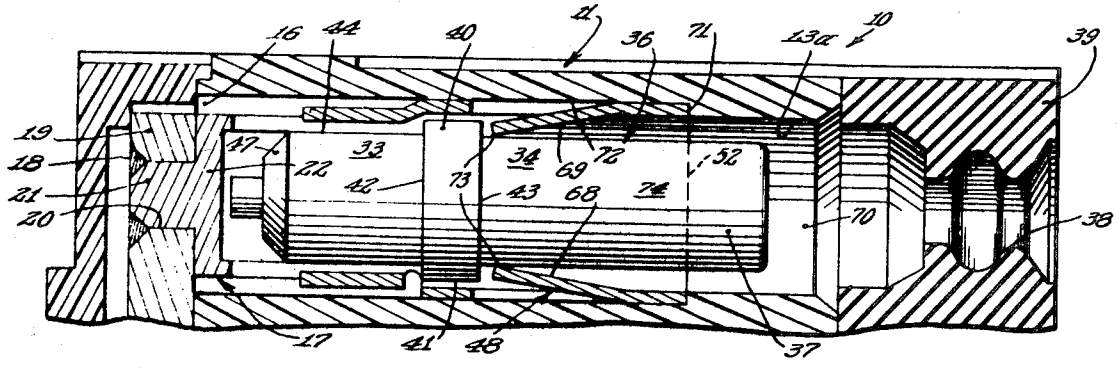
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ABSTRACT: A terminal block for receiving and electrically interconnecting a plurality of pin contacts. The pin contacts are inserted into bores formed in the body of the terminal block and the forward or nose portions thereof are telescopically received in mating socket contacts securely disposed within the bores. Also disposed within each bore is a sheet-form member rolled into a generally tubular configuration and having a collet portion which retains its respective pin contact in its corresponding bore and a clamping ring portion which provides a radial reactive force to its socket contact when the nose of the pin contact is inserted therein. A bridging portion interconnects the collet portion and the clamping ring portion and is located at the neutral axis of the sheet-form member to enable the collet portion and the clamping ring portion to radially expand and contract independently of one another.



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SHEET 1 OF 2

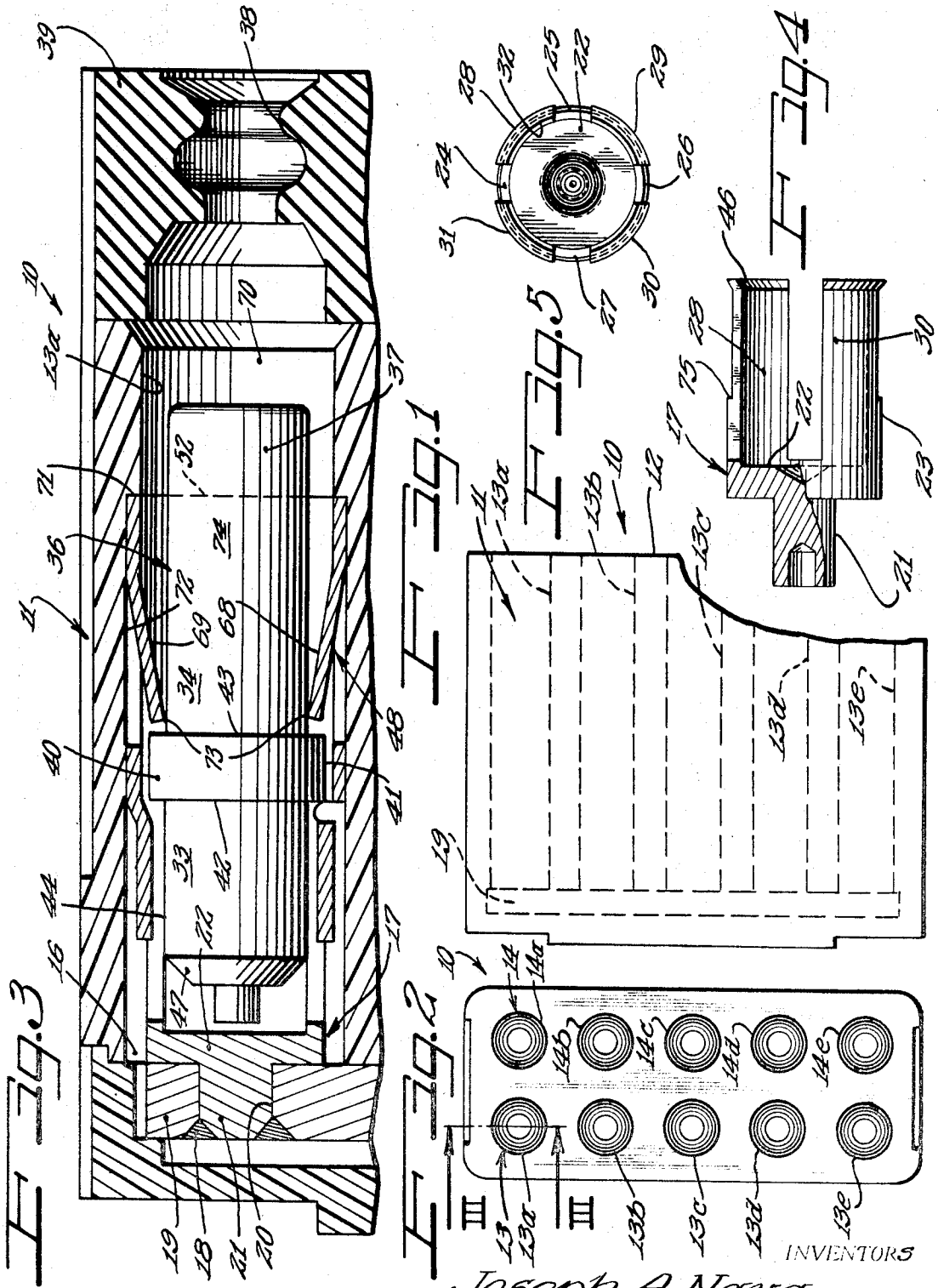


FIG. 3

FIG. 1

FIG. 5

FIG. 4

FIG. 2

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Fig. 8

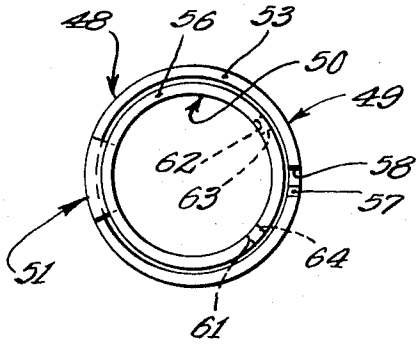


Fig. 7

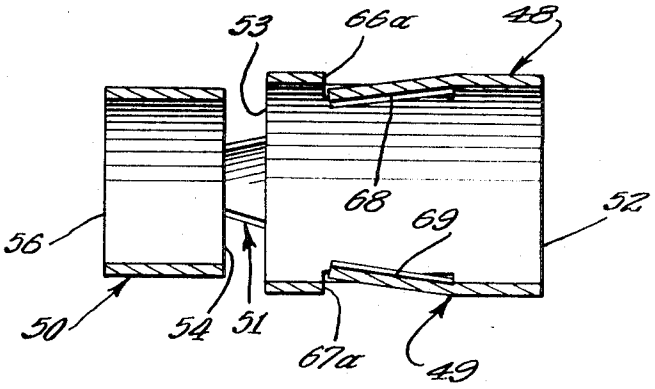
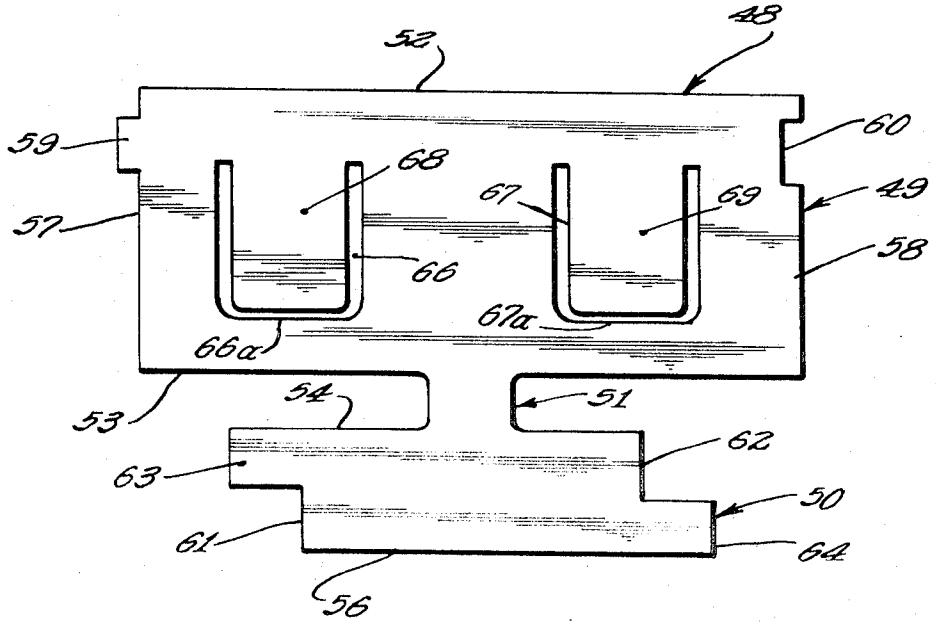


Fig. 6



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TERMINAL BLOCK

BACKGROUND OF THE INVENTION

This invention relates to the field of terminal blocks used in electrically connecting plural conductors and more particularly to the field of terminal blocks particularly adapted to receive and interconnect pin contacts connected to the conductors.

There is an increasing need for combining large quantities of wires into a common distribution bussed wire. Many prior art methods consist in pigtailing or soldering plural conductors together or fastening the same to screw-type binding posts.

As a result of increases in the cost of labor and as a further result of their dependence upon human skill, the prior art methods have been found inadequate in many high-performance systems such as aircraft.

Current technology involves the termination of a contact to a wire by crimping, and insertion of this contact into a bussing type of terminal block. Some of the known terminal blocks are described, for example, in U.S. Pat. Nos. 3,383,643 and 3,383,644, both of which are assigned to the assignee of the present application. Many known terminal blocks include spring designs which provide a contacting surface for the pin contact and further include some means of retaining the pin contact in engaged relation to the electric contacting portion of the terminal block.

The known terminal blocks have been found less than adequate in one or more respects. First of all, known terminal blocks require considerable physical space per bussed pin contact. Second, the performance and reliability of the terminal blocks in terms of electrical contact of the interconnected pin contacts, contact retention, pin removal capability and the like is less than adequate to serve the existing requirements in many areas of technology. Third, many terminal blocks require the pin contacts which are to be interconnected to be inserted into opposite sides of the terminal block so that a rearrangement of the bussing system requires the removal of pin contacts from both of the opposite sides.

SUMMARY OF THE INVENTION

In light of the foregoing, it is an object of the present invention to provide a terminal block having higher performance characteristics and greater reliability.

Another object is to provide a terminal block of reduced size on a per-pin contact basis.

Another object is to provide a terminal block in which certain areas of technology dealing with electrical contacts and contact retention means are utilized and improved upon and combined to provide an improved terminal block.

Another object of the invention is to provide a terminal block including a series of bores opening to one side thereof, a tined socket contact securely disposed within each bore, bussing means for interconnecting given ones of the socket contacts and means within each bore to retain within the bore a pin contact inserted into the socket contact and to provide a radial reactive force on the socket contact to increase the clamping force of the socket contact on the body portion of the pin contact.

To these ends, the present invention may be summarized as comprising a body in which a plurality of bores are formed opening to one side thereof. A corresponding plurality of socket contacts are disposed within the bores at the opposite ends thereof. The socket contacts are all securely fastened to one or more bus bars for electrically interconnecting various groups of the socket contacts in prearranged circuitry.

Also within each bore is disposed a flat sheet-form member rolled into a generally tubular configuration. One portion of the sheet-form member comprises an axially split clamping ring for circumferentially surrounding the socket contact to provide a radial reactive force thereto. Another portion comprises a collect for retaining in the bore a pin contact telescopically inserted into the socket contact. Interconnecting the clamping ring and the collect is a bridge section extending symmetrically along the neutral axis of the sheet-form member to enable the clamping ring and the collet to expand and contract independently of one another.

By virtue of the present invention, increase contact density per given volume is achieved within the terminal block. For example, in one size of prior art terminal blocks, no more than eight No. 20 contacts can be accommodated. The same size terminal block, however, constructed in accordance with the principles of the present invention, is able to accommodate up to sixteen No. 20 contacts, or twice the number accommodated by the prior art terminal blocks.

This "miniaturization" is due essentially to the unique combination of the collet and the clamping ring of the present invention. The two portions of the sheet-form member perform distinct and independent functions. The C-shaped clamping ring provides reactive forces on the tines of the socket contact to maintain adequate pressure between the socket contact and the pin contact to assure electrical continuity therebetween in environments of temperature, vibration and shock. The collet portion of the sheet-form member provides means for retaining the pin contact in the bore of the terminal block.

In the cylindrically shaped assembled configuration of the sheet-form member, the clamping ring and collet are independently expansible and contractable. This independence of action is obtained by locating the bridging portion of the sheet-form member which interconnects the clamping ring and the collet at the neutral axis of the clamping ring such that the inherent spring actions of the ring and the collet may occur without effecting each other.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and to the accompanying sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example only.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a terminal block constructed in accordance with the principles of the present invention.

FIG. 2 is a right end elevational view of the terminal block illustrated in FIG. 1.

FIG. 3 is an enlarged cross-sectional view of a single terminal block bore and a socket contact, pin contact and other components disposed therewithin.

FIG. 4 is a side elevational view of a socket contact of the present invention, a portion of which is shown in section.

FIG. 5 is an end elevational view of the socket contact shown in FIG. 4.

FIG. 6 is a plan view of a sheet-form member shown in its flat, disassembled state and before it is rolled into tubular configuration and inserted into a bore of the terminal block.

FIG. 7 is a cross-sectional view of the sheet-form member in its cylindrically shaped, assembled configuration.

FIG. 8 is an elevational end view of the sheet-form member shown in FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawing there is disclosed in FIGS. 1 and 2 a terminal block constructed in accordance with the principles of the present invention and indicated generally at reference numeral 10. The terminal block 10 comprises a body 11 which may be made of plastic or other insulation material and which has formed therein opening from one end 12 thereof a plurality of rows of vertically aligned bores. In the exemplary embodiment herein illustrated, there are two rows of bores indicated at 13 and 14 with the individual bores in row 13 being identified at reference numerals 13*a*—13*e* and the bores in row 14 being identified respectively at reference numerals 14*a*—14*e*.

Securely disposed at inner ends **16** of the bores in rows **13** and **14** are a corresponding number of male or socket contacts **17**. Each of the sockets **17** is connected in fixed assembly by means of a weld or the like connection as indicated at reference numeral **18** to an electrical bus bar **19** which is apertured as at **20** to receive a cylindrical protuberance **21** extending centrally axially from a backwall **22** of its respective socket contact **17**. The terminal block **10** may comprise one or more bus bars of which bar **19** is typical and in the embodiment illustrated, all of the socket contacts **17** disposed in the bores of row **13** are secured to one bus bar while all of the second contacts in row **14** are secured to a separate and distinct bus bar which is insulated from the bus bar of row **13**. Thus, in the illustrated embodiment all of the electrical contacts inserted into the various bores of row **13** are electrically interconnected with one another, whilst all of the contacts inserted into the row **14** bores are electrically interconnected with one another.

Referring to FIGS. **3—5**, each of the socket contacts **17** comprises a tubular portion **23** shaped in the form of a cylindrical sleeve which is split axially as at **24—27** to provide a plurality of tines indicated at reference numerals **28—31** extending axially from the backwall **22** of the socket contact **17**. Inner walls **32** of the tines **28—31** comprise together a circumferentially interrupted surface of revolution which telescopically receives and physically engages a forward nose **33** of a body portion **34** of a cylindrical pin contact **36** inserted into its respective bore, **13***a*, the bore which is illustrated in FIG. **3**. A rear end **37** of the pin contact **36** is, of course, adapted to receive an electrical conductor such as a wire to which it is crimped or otherwise fastened, the wire extending, in the inserted position of the pin contact **36**, through an undulated bore **38** which may be formed in a resilient body **39** bounded or otherwise securely attached to the more rigid body member **11**. The pin contact **36** further comprises a circumferentially continuous radially outwardly extending rib **40** including a peripheral wall **41** extending between a pair of radial walls **42** and **43**.

The diameter of the nose portion **33** of the pin contact **36** is only slightly larger than the free or unstressed diameter of the inner walls **32** of the socket contact tines **28—31**. Thus, when the pin contact **36** is inserted into the socket contact **17** an outer wall **44** of the nose end **33** engages and provides a slight radially outward force to the tines **28—31** whereby good electrical contact therebetween is afforded. The distal ends of the tines **28** and **31** are tapered slightly outwardly as indicated at reference numeral **46** to guide a tapered forward end **47** of the pin contact **36** into axial alignment with the socket contact **17**.

In order to retain the pin contact **36** in the bore **13***a* with the nose end **33** thereof inserted in the socket contact **17** and to maintain proper electrical continuity in environments of temperature, vibration and shock, there is also provided in the bore **13***a* (as well as in all of the other bores of the terminal block **10**) a socket clamping and retaining means which, in the embodiment illustrated herein is indicated generally at reference numeral **48**. In FIG. **1** the member **48** assumes a generally tubular configuration, the configuration which obtains after the member **48** has been inserted in assembled and locked-in elation into the bore **13***a*.

FIG. **6** illustrates the configuration of the member **48** before it is assembled into the bore **13***a*. As illustrated, the member **48**, in its preassembled configuration, may be characterized as comprising a flat sheet-form member which preferably is stamped from a single piece of sheet stock. The member **48** may, for convenience, be referred to as being axially oriented and as having an axis which extends substantially centrally therethrough, or from top to bottom as the member **48** is viewed in FIG. **6**. The sheet-form member **48** may also be characterized as comprising a collet portion **49**, a clamping ring portion **50** and a bridge portion **51** which interconnects the collet and clamping ring portions **49** and **50**. The collet portion **49** comprises a pair of spaced transverse walls **52** and **53** and the clamping ring portion **50** comprises a pair of spaced transverse walls **54** and **56**. The space between a pair of spaced transverse walls **53** and **54** of the collet and clamping rings portions **49** and **50** equals the longitudinal dimension of the bridge portion **51**.

The collet portion **49** also comprises a pair of spaced parallel axially extending sidewalls **57** and **58**, one of which comprises a radial protuberance as indicated at reference numeral **59** and the other of which comprises a notch or recess **60** shaped complementarily to and disposed in axial alignment with the protuberance **59**.

Similarly, the clamping ring portion **50** comprises a pair of spaced parallel sidewalls **61** and **62**, both of which have extending radially therefrom protuberances as indicated at **63** and **64**. The protuberance **63** and **64** are in axial offset relationship as contrasted with the protuberance **59** and recess **60** of the collet portion **49**. Also provided in the collet portion **49** are a pair of U-shaped cutouts **66** and **67**, bight portions **66***a* and **67***a* of which face in the direction of the clamping ring portion **50**. The cutouts **66** and **67** form a pair of tines **68** and **69**, useful in retaining the pin contact **36** in the bore 13_a as will be described more fully hereinafter.

It is noted that the sheet-form member **48** is generally axisymmetric about the axis which extends from the top to the bottom thereof and through the center of the bridge portion **51**. As a consequence, the bridge portion **51**, which is relatively narrow in a transverse direction, is disposed in a neutral position with respect to the clamping ring portion **50**, thus enabling the collet portion **49** and the clamping ring portion **50** to expand and contract independently of one another in the assembled configuration of the sheet-form member **48**

After the structure **48** has been stamped to provide the geometry illustrated in FIG. **6**, it is rolled into the generally tubular configuration thereof as illustrated in FIGS. **7** and **8**, and the tine portions **68** and **69** are bent slightly radially inwardly. The transverse distance between the sidewalls **57** and **58** of the collet portion **49** is such so that the structure **48** may be rolled or turned into a tubular configuration and nevertheless be of a diameter sufficiently small to enable it to be inserted into the bore 13_a of the terminal block body **11**.

Thus, the tubularly configured sheet-form member **48** is inserted, with the clamping ring portion **50** at the end, leading into a front end **70** of the bore 13_a and then pushed forwardly into the bore until the transverse wall **52** of the collet portion **49** is situated adjacent and end wall **71** of an enlarge diameter portion **72** of the bore **13***a*.

When this occurs, that is, when the transverse wall **52** of the sheet-form member **48** becomes axially aligned with the radial wall **71**, the collet portion **49** expands, due to the natural spring action of the sheet-form member **48**, into snap-in axially locked relation with the radial wall **71**. Thus, in the expanded, free-state, assembled configuration of the sheet-form member **48**, the transverse wall **52** thereof abuts the radial wall **71** to prevent axial withdrawal of the sheet-form member **48** out the front end **70** of the bore 13_a.

Furthermore, as the member **48** is being inserted into the bore 13_a, the clamping ring portion **56** expands and passes over the tines **28—31** of the socket contact **17** and envelopes the same in the surrounding relation as it engages in snap-in relation of pair of radial shoulders, formed on the socket contact **17**, one of which is indicated at reference numeral **75** and the other of which is provided by the flared end **46**. The bridge portion **51** which intersects the collet and clamping ring portions **49** and **50** is disposed adjacent the distal ends **46** of the socket contact **17**.

To electrically engage the socket contact **17** with the pin contact **36**, the pin contact is the inserted into the end **70** of the bore 13_a. The diameter of the peripheral wall **41** of the rib **40** is slightly greater than the diameter of the distal ends of the tines **68** and **69** and thus as the pin contact **36** is inserted into the sheet-form member **48**, the rib **40** spreads the tines **68** and **69** until the rib moves beyond ends **73** of the tines **68** and **69**, whereupon the tines, due to the inherent spring-action thereof, snap back to the free-state or unstressed angular

disposition thereof and in contact with a rearward portion 74 of the pin contact 36.

Thus disposed, the ends 73 of the tines 68 and 69 provide stops to prevent axial withdrawal of the pin contact 36 out of the bore 13_n. For example, were an axially rearward force the pin contact 36, the radial wall 43 of the rib 40 would abut the ends 73 of the tines 68 and 69. The greater the force with which the radial wall 43 abuts the ends 73, the greater the force tending to force the tines into axial abutting engagement with the radial wall 43 and radial abutting engagement with the rearward portion 74 of the pin contact 36.

As the nose end 33 of the pin contact 36 is telescopically received in the socket contact 17, the tines 28—31 are subjected to a slight spreading action. A reactive force is applied to the tines 28—31 by the C-shaped clamping ring portion 50 of the sheet-form member 48. Thus, the clamping ring portion 50 tends to apply a radially inwardly direction force to oppose the spreading force of the nose end 33 of the pin contact 36, thus enhancing the electrical engagement between the pin contact 36 and the inner surface 32 of the tines 28—31.

It is noted that in the assembled configuration of the sheet-form member 48, the proturberance 49 extending from the sidewall 57 is disposed in alignment wit the notch 60, and the protuberances 63 and 64 of the clamping ring portion 50 are disposed in side-by-side offset relation. Thus, viewing the sheet-form member 48 in the assembled configuration thereof, a substantially tubular geometry is presented as is shown in FIG. 8.

One important advantage in locating the bridge portion 51 in coincidental relation with the central axis of the entire member 48 including the centerline of the clamping ring portion 50 resides in the resulting ability of the collet portion 49 and the clamping ring portion 50 to expand and contact diametrically completely independently of one another. Thus, the bridge portion 51 is disposed at the neutral axis of the C-shaped clamping ring portion 50 to the end that the portion 50 may be expanded about the tines 28—31 of the socket contact 17 without effecting the diameter of the collet portion 49, and conversely the diameter of the collet portion 49 may expand upon insertion of the sheet-form member 48 into the snap-in locked condition thereof in the bore 13_n without affecting the free-state or unstressed diameter of the clamping ring portion 50.

In the illustrated embodiment of the terminal block 10, power may be supplied to the bus bar 19 by inserting a power-connected pin contact 36 into any of the bores 13_n—13_r, and power takeoff can be supplied to any one of the other four pin contacts by virtue of the insertion thereof into any or all of the remaining bores in row 13. Similarly, power or any other electrical signal can be transmitted from a single source to any one of four pin contacts by virtue of the utilization of the other bus bar which electrically interconnects all of the bores 14_n—14_r in row 14. It will be appreciated of course, that the bus bars in the terminal block 10 can be variously arranged so that any two or more socket contacts 17 may be electrically interconnected as requirements may dictate.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably come within the scope of our contribution to the art.

What We claim is:

1. A terminal block for receiving and interconnecting a plurality of cylindrical circumferentially ribbed pin contacts comprising:

a body member having plural bores opening to one side thereof,

a corresponding plurality of socket contacts fixedly secured in said bores, each comprising a tubular sleeve portion slit axially to provide a plurality of axially extending tines for telescopically receiving and engaging and applying a radial force to the cylindrical body of a pin contact inserted thereinto through said one side of said body member,

contact clamping and retention means fixedly disposed in each of said bores for retaining in its corresponding socket contact, the pin contact inserted thereinto and for applying a radial reactive force to the tines of its socket contact when the pin contact is inserted thereinto, and

means for electrically bussing together different ones of said socket contacts.

2. The invention as defined in claim 1 wherein said socket clamping and retention means comprises an axially split annular ring surrounding the tines of its respective socket contact.

3. The invention as defined in claim 1 wherein said tubular sleeve portion of each of said socket contacts comprises an outer surface having axially spaced radially extending shoulders formed thereon and wherein said socket clamping and retention means comprises an axially split annular ring carried in snap-on relation on said tubular sleeve portion between said shoulders.

4. The invention as defined in claim 1 wherein said socket clamping and retention means further comprises a tubular axially split collet for receiving the pin contact therein and having a plurality of radially inwardly inclined tines for engagement with the rib of the pin contact to prevent the removal thereof and wherein said collet and the wall of its corresponding bore comprise cooperating radial shoulder means for preventing the removal of the collet from the bore.

5. The invention as defined in claim 1 wherein each of said socket contacts comprises an elongated axially extending proturberance projecting out of its respective bore and wherein said bussing means comprises a bus bar apertured to receive the protuberances of the respective socket contacts electrically bussed thereby.

6. The invention as defined in claim 1 wherein each of said contact clamping and retention means comprises:

a sheet-form member stamped from flat shape to have spaced generally centrally aligned rectangularly shaped collet and clamping ring portions and a bridge portion interconnecting said collet and clamping ring portions,

said sheet-form member being rolled into a generally cylindrically shaped configuration in the assembled state thereof and said bridge portion enabling said collet portion and said clamping ring portion to increase and decrease in diameter in a springing action independently of each other.

7. For use in a terminal block having a plurality of bores formed therein, tined socket contacts securely fastened in the bores to receive ribbed pin contacts and bussing means for bussing given ones of the socket contacts together, a contact clamping and retaining means comprising:

a sheet-form member having a generally central axis and including a collet portion adapted to hold a pin contact within a bore of the terminal block, an axially spaced clamping ring portion adapted to surround and radially inwardly bias the tines of the socket contact and a bridging portion interconnecting said collet portion and said clamping ring portion,

said sheet-form member being constructed of flexible material and being bendable into a generally tubular configuration for insertion thereof into a terminal block bore and being constructed and arranged so as to be readily contractable and expandable within the bore, said collet portion and said clamping ring portion each having axially extending substantially parallel edges separated from each other a predetermined distance in the expanded state of said sheet-form member within the bore and separated from each other a distance less than said predetermined distance in the contracted state thereof, and

U-shaped cutouts in said collet portion forming tines adapted to engage the rib of a corresponding pin contact,

the axial and radial dimensions of said clamping ring portion being substantially less than the corresponding dimensions of said collet portion, and

said bridging portion having a sufficiently reduced transverse dimension to enable said collet portion and said socket clamping portion to expand and contract independently of each other.

8. The invention as defined in claim 7 wherein said U-shaped cutouts extend generally axially and the transverse bight portions thereof face said clamping ring portion.

9. The invention as defined in claim 7 wherein said generally central axis of said sheet-form member comprises an axis about which the member is generally symmetric.

10. The invention as defined in claim 9 wherein said bridging portion is symmetrical about said axis in the flat, unrolled state of the sheet-form member.

11. The invention as defined in claim 7 wherein said collet portion comprises an end wall forming a circumferential radially extending shoulder adapted to engage a radial shoulder formed in the aforesaid bore to prevent withdrawal of said sheet-form member from the bore and wherein said clamping ring portion comprises a pair of circumferential spaced parallel radially extending walls constructed and adapted so as to be received between a pair of cooperating shoulders formed on the aforementioned socket contact for preventing axial displacement and disengagement of said sheet-form member and the socket contact.