May 26, 1953 R. P. ARTHUR 2,640,183

MULTIPOINT PLUG AND JACK

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FIG. 1

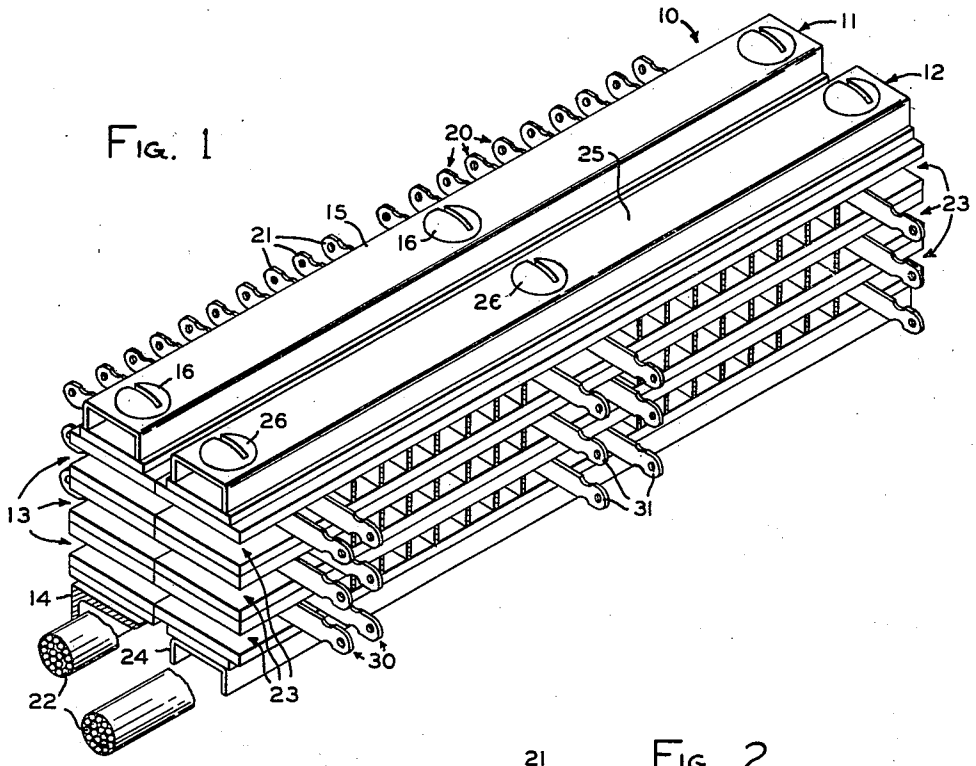

FIG. 2

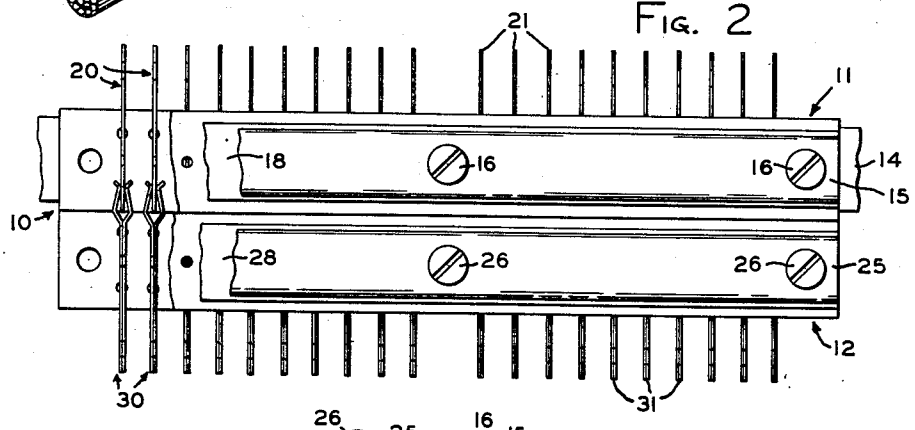

FIG. 3

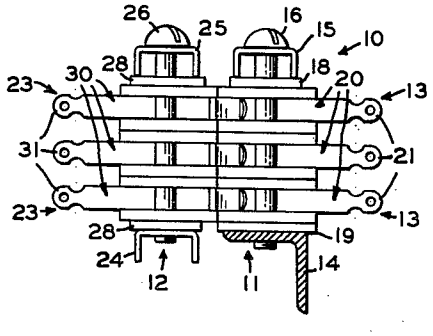

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FIG. 4

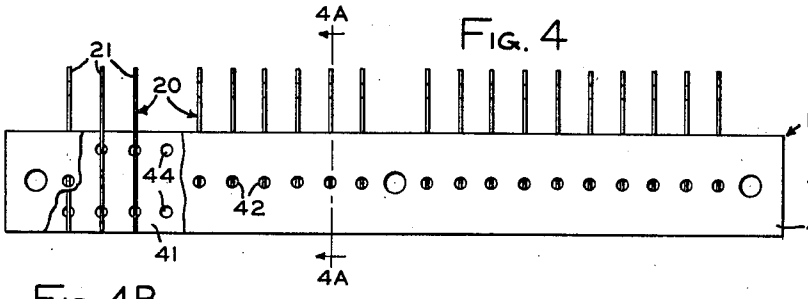

FIG. 4A

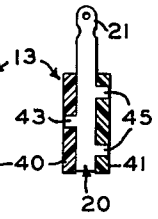

FIG. 4B

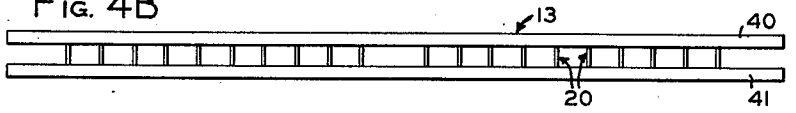

FIG. 5

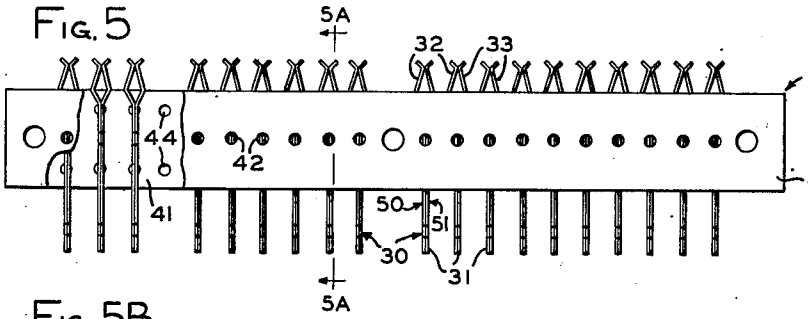

FIG. 5A

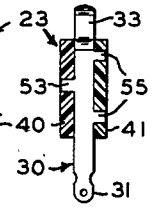

FIG. 5B

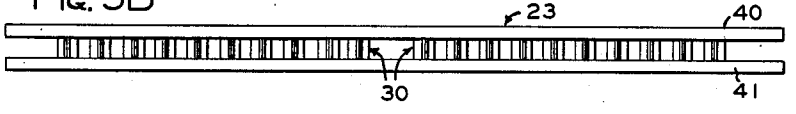

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FIG. 6

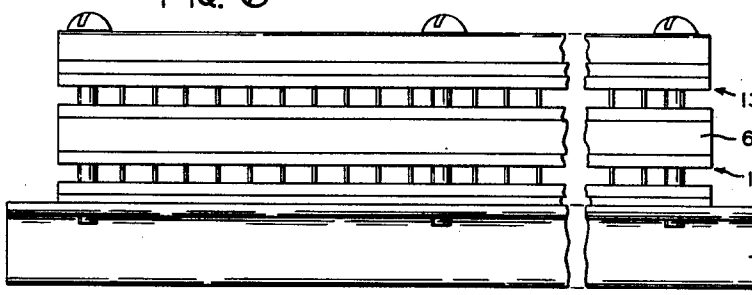


FIG. 6A

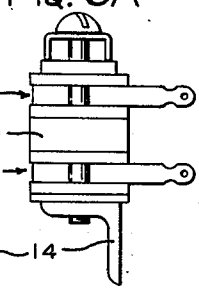


FIG. 7

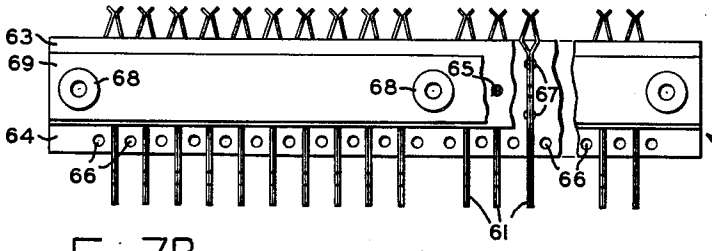


FIG. 7A

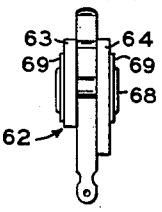


FIG. 7B

FIG. 8

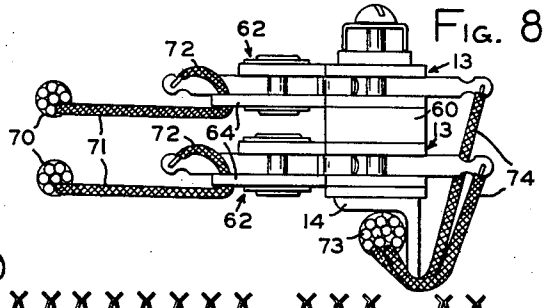


FIG. 9

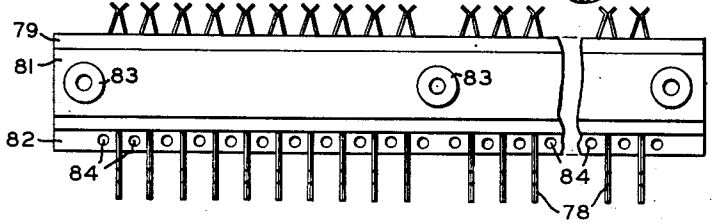
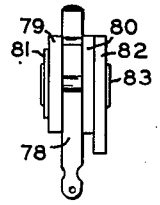


FIG. 9A



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UNITED STATES PATENT OFFICE

2,640,183

MULTIPOINT PLUG AND JACK

Richard P. Arthur, Chicago, Ill., assignor, by mesne assignments, to Kellogg Switchboard and Supply Company, a corporation of Delaware

Application March 24, 1950, Serial No. 151,778

2 Claims. (Cl. 339—192)

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This invention relates to multi-point plug and jack units, particularly those which are suitable for use in automatic telephone switchboards and the like, where a large number of conductors must be detachably secured to a unit of apparatus. Its general object is to provide improved and economical multi-point connectors, or plug and jack units, which may be readily constructed in any one of a number of capacities, each requiring but a relatively small space.

A specific object is to provide connector apparatus of the noted character in the form of preassembled strips of plugs and of jacks which may be used in single-level formation, or in multi-level assembly according to the number of conductors to be handled or the space available for the connector apparatus.

Another object is to provide plug and jack units of the foregoing character so constructed that either unit may be supported by the other when they are brought together.

In accomplishing the stated objects, the connector apparatus herein disclosed utilizes principles of terminal-block construction disclosed in the pending application of Rose, for a Terminal-Pin Block, Serial No. 135,400, filed December 28, 1949, and in the application of Arthur et al. for Terminal-Pin Blocks, Serial No. 144,536, filed February 16, 1950. Attention is further directed to the pending application of Earle et al. for Compression-Connecting Terminal Apparatus, Serial No. 66,172, filed December 20, 1948, now Patent 2,559,715, dated July 10, 1951.

An important feature of the invention resides in the simplicity and symmetry of the elements making up the plug and jack units, and the ease with which they may be produced by simple punch-press and assembly operations.

Another important feature is that the jacks of a strip project from their supports to permit them to pass between the supports of a plug strip to mate with the plugs thereof, thereby providing for support of either strip from the other when such other unit is fixedly mounted.

Still another feature resides in the ease with which strain-relief provisions may be incorporated in a unit to minimize the strain effects on the leads connected to the terminals thereof.

Other objects and features will appear as the description progresses.

Fig. 1 is an oblique view of a plug and jack assembly embodying the principles of the invention:

Fig. 2 is a plan view of the structure of Fig. 1 with an upper portion broken away to show the manner in which elements of the plug and jack units are associated to effect electrical connections;

Fig. 3 is an end view of the structure of Fig. 1;

Figs. 4, 4A and 4B show respectively a top plan view of a strip of plug members used in constructing the plug unit of the connector, a sectional view taken along line 4A—4A, and a front view of the strip of plugs;

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Figs. 5, 5A and 5B are respectively a top plan view of a strip of jack members of the type used in constructing the jack unit of the connector, a sectional view taken along line 5A—5A, and a rear view of the strip of jacks;

Figs. 6 and 6B show respectively a rear view and an end view of another plug unit embodying the principles of the invention;

Figs. 7, 7A and 7B are respectively a top plan view, an end view and a rear view of another embodiment of the jack strip of the invention in which provisions are made for strain relief at terminal connections;

Fig. 8 is an end elevational view of a connector utilizing jack strips of the type shown in Fig. 7 and illustrating the manner in which cable and lead distribution is effected thereon; and

Figs. 9 and 9A are respectively a top plan view and an end view of another jack strip incorporating the principles of the present invention.

In greater detail, Figs. 1, 2, and 3 illustrate a connector 10 comprising a multi-plug unit 11 and a multi-jack unit 12 in mated relation.

The plug unit 11 comprises a number of plug strips 13 assembled in a vertical stack secured to a base support member 14 of angular shape which readily permits a fixed mounting of the plug unit. The plug strips 13 are held in stacked relation by a number of spaced securing bolts 16 which pass through apertures provided in the strips and which tighten a relatively narrow clamping bar 15 against the top of the stack upon being threaded into holes provided in the support member 14. Since the clamping bar 15 and the support member 14 are usually of metal conducting material, such as aluminum or iron, a flat insulating strip 18 is interposed between the clamping bar 15 and the top of the stack so that the possibility of contact of the plug members with the clamping bar is minimized. Correspondingly a similar but somewhat wider insulating strip 19 is interposed between the support 14 and the bottom of the stack.

The jack unit 12 comprises a number of jack strips 22 clamped in stacked relation between a lower and an upper channel-like clamping bar 24 and 25, respectively, secured by spaced bolts 26 which pass through the jack strips 23 and make threaded engagement with the lower bar 24. A pair of insulating strips 28 at the top and bottom of the stack separate the metal clamping bars from the upper and lower jack strips 23 to minimize the possibility of their effecting faulty contact with jack members in the unit. The jack unit 12 as thus constructed is, in a sense, portable with respect to the plug unit 11 since it is movable and is designed to become fixed in position only when mated with the plug

unit. Mating of the units is effected merely by matching the jack members of unit 12 with the corresponding plug members of unit 11 and then pushing the jack unit into full engagement with the plug unit where it is held, as shown in Fig. 2, by the association of elements of both units.

Electrical connection of leads to the plug and jack units of the connector is effected through terminals 21 and 31 which project from the rear of their respective units. In such rearward location the terminals are readily accessible for connection to leads branched off from a pair of multi-conductor cables 22 disposed below the individual units. The cable 22 carrying leads for the plug unit 11 is secured to the under surface of the horizontal flange of the angle support 14 by means such as lacing or clips. Conductors are then branched off from the cable for connection to terminals 21. Similarly, leads connected to the jack terminals 31 of the unit 12 are branched off from the second cable 22 secured below the lower clamping bar 24.

Figs. 4, 4A, and 4B illustrate the manner in which the individual plug strips 13 of the plug unit 11 are assembled. Each strip 13 comprises a plurality of blade-like plug members 20 aligned on edge in side-by-side relation to permit their being secured between a pair of longitudinal insulating support strips 40 and 41, respectively. The body or jack engaging portions of the plug members are arranged to reside within the space between the support members, while their terminal members project beyond the limits of such space to make them accessible to wire leads connected thereto. Three securing projections, or tabs, are provided on opposite edges of each of the plug members 20, comprising a pair of projections 45 spaced apart on one edge of the body portion, and a third projection 43 intermediate of the two on the opposite edge of the plug member. The spacing between each pair of projections 45 is somewhat greater than the width of the single projection 43, but less than the width of the support strip 41 with which it is associated so that the projections on each plug will be longitudinally spaced in staggered relation. Such an arrangement of projections permits vertical stacking of plug strip assemblies without causing projections of plugs in adjacent levels to extend into close proximity to each other. Assembly of the plug strips is accomplished by reason of the support member 40 being provided with a series of centrally aligned apertures 42 into which projections 43 on one side of the aligned plug members 20 are inserted in press-fit relation. Correspondingly, the other insulating support strip 41 is provided with apertures 44 aligned in two rows to accommodate the securing projections 45 on the opposite side of the aligned plug members in press-fit relation.

Construction of the jack strips 23 is illustrated in Figs. 5, 5A, and 5B. It will be seen that strips identical to strips 40 and 41 are utilized to secure the jacks and they are accordingly so identified. Each jack 30 comprises a pair of longitudinal blade-like jack elements 50 and 51 having three securing projections or tabs 53 and 55 distributed on opposite edges in the same manner in which securing projections were provided on the plug members 20. Each pair of the jack elements 50 and 51 is held together in side-by-side abutting relation by a press-fit association of their securing projections 53 and 55 within the same apertures of support strips 40 and 41, respectively. The elements 50 and 51 are made of spring material such as nickel silver and are shaped identically in elevational configuration but different in lateral shape in that the plug receiving portions or tongues 32 and 33 thereon are bent outwardly and then inwardly in confronting contacting relation to cause them to be tensioned against each other. The thickness of each of the elements 50 and 51 is substantially half that of the individual plug members 20 so that when a pair is mated to form a jack, the single projections 53 on one edge, and the double projections 55 along the other edge will be of a thickness which will cause them to fit in press-fit securing relation within their respective apertures.

The projections 53 and 55 are centrally located on the jack elements so that the tongue portions 32 and 33 will extend beyond the edges of their support strips 40 and 41 on one side of the jack strip, while the terminal ends 31 extend beyond the edges on the other side of the jack strip. The height of the jacks 30 is substantially equal to the height of the body portion of plug members 20 so that the rows of elements in both units 11 and 12 will be spaced apart an equal distance, thereby permitting the jacks and plugs to be mated in snug relation between the supports 40 and 41 of the plug strips 13. The snug association of elements in this manner affords a means for support of the jack unit in that the jack elements are arranged to bear against the overlying and underlying support strips 40 and 41 of the plug strip 13.

It will be readily apparent, in view of the above description that instead of having the jack tongues 32 and 33 project from their jack strips, they might be alternatively arranged to reside within the space between the supports with which they are associated and correspondingly, that the plugs of the plug strips 13 might be arranged to project from their supports to permit association with the jacks between the jack supports. An advantage lies in having the jack tongues extend from their respective supports, however, since a greater number of elements then become active in providing support for the jack unit when it is mated with the plug unit. That is, when the plug unit is fixed in position, and the jack unit is supported therefrom, the weight of the jack unit is more evenly distributed over the plug supports when the edges of the jacks are used as bearing edges since twice as many jack elements exist as plug elements.

Fig. 6 illustrates another form of plug unit built up of a pair of plug strips 13 on a support 14 in a manner similar to unit 11, except that a relatively large spacer 60, made of insulating material, is interposed between the plug strips. This arrangement gives much more room between the rows of plugs of the unit and enables easier connection of wire leads to the terminals thereof. This plug unit also enables use of a different type of jack strip than was used in the previous embodiment by reason of the additional space which is provided between plugs.

Figs. 7, 7A, and 7B illustrate a jack strip 62 somewhat similar to jack strip 23 in the embodiment of Figs. 1 and 5 except that the upper and lower jack-supports 63 and 64 respectively, differ in width, the lower support being the wider of the two. The upper support strip 63 has a single line of apertures 65 for accommodation of the single row of securing projections on one

side of the aligned jack members 61 included therein, while the wider support strip 64 is provided with two rows of such securing apertures 67, as well as an additional row of lead-in apertures 66 along the back or terminal edge of such strip. The additional row of apertures 66 enables wire connections to be made to the jack terminals with strain relief provisions as subsequently explained and also permits the extended portion of the support strip 64 containing these apertures to act as a fanning strip for the wire leads. Since jack strips of this type are used individually, and not in stacks, the apertures in their upper and lower surfaces would normally be open, thereby causing the jack securing projections contained therein to be exposed, unless some provision was made to cover them. Accordingly, a pair of cap members 69 are secured to the strip 62 to cover the upper and lower apertures in the support strips. The members 69 are secured by a series of eyelets or rivets 68 spaced along the length of the strip and in addition to securing the cap members in place, they incidently provide additional strength and rigidity for the jack strip.

Fig. 8 illustrates the manner in which jack strips of the type shown in Fig. 7 are mated with the plug unit of Fig. 6, and also the manner in which multi-conductor cables carrying the connecting leads are associated with the connector. It will be seen that the individual jack strips 62 are associated with separate rows of plugs in the unit independently of others, and accordingly, greater flexibility in the use of the connector apparatus is effected in that changes of connections in any one row of the units may be made without disturbing other connections. Leads connected to the terminals of each jack strip 62 are carried by separate multi-conductor cables 70. The conductors are branched off from the cable and are passed through the openings 66 in the lower support 64, when connections are made. Thus, at least a short portion 72 of each conductor 71 is held relatively stationary at a point immediately adjacent its terminal connection regardless of the amount of movement that might exist in leads 71. The strain on connections normally incident to movement of leads connected to terminals is thereby relieved. The leads 74 connected to the plug unit are supplied by a multi-conductor cable 73 secured to the underside of the unit by fastening means such as lace, or steel clips.

Figs. 9 and 9A illustrate still another form of the invention in which a combination fanning and strain relief portion is incorporated in an insulating cap 82 of the jack strip. The jack strip itself is like the jack strip shown in Fig. 5, in that it has a plurality of jacks 78 set in side-by-side relation between a pair of support strips 79 and 80 where they are held by projections press-fit in apertures in the support strips. The support strip 79 is provided with a single row of apertures for jack projections which are covered by an insulating cap member 81. The opposite support strip 80 contains two rows of apertures for jack projections which are covered by a somewhat larger cap member 82 having a fanning and strain relief portion extending part way under terminal portions of the jacks 78. Rivets 83 clamp both the cap members 81 and 82 into position and at the same time strengthen the strip itself. The fanning and strain relief portion of the cap member 82 is provided with openings 84 to enable lead connections to be made to the jack terminals with strain relief as in Fig. 8. An advantage of this construction lies in its ease of manufacture which is enabled by the fact that the jack strips may be made with standard type support strips like those shown and utilized in the embodiment of Fig. 1. It will be noted that the mere addition of two cap members thereto results in the performance of four added functions namely: covering the securing apertures, providing for the fanning of leads, providing strain relief at connections, and increasing the strength of the assembly.

I claim:

1. In a multiwire connecting apparatus, two edgewise-registering assemblies each having a terminal edge and a contact-making edge and including a row of elongated blade-like contact makers each disposed on edge and extending across the row, each assembly further including two parallel, mutually overlapping support strips disposed respectively above and below the row and engaging opposite edge portions of the contact makers thereof to hold them firmly in place while leaving the interstrip space unobstructed between adjacent contact makers, the contact makers of each assembly extending freely beyond one edge of the support strips to facilitate the attachment of respective conductors thereto along the terminal edge of the assembly, the contact makers comprising a group of first contact makers and a group of respectively corresponding second contact makers, each first contact maker extending freely beyond its support strips at the contact-making edge of its assembly to provide a flexible engagement part which is received between the support strips of the other assembly and which flexibly yields sidewise to engage the side of its corresponding second contact maker of the latter assembly when the two assemblies are brought edgewise together with their contact-making edges in registry, lateral and edgewise-rotational displacement of either assembly relative to the other being limited by contact between the edges of said engagement portions of one assembly and the inside surfaces of the support strips of the other assembly.

2. In a multiwire connecting apparatus as set forth in claim 1, the said flexible part of each said first contact maker comprising a pair of mutually facing blade parts which grippingly engage the corresponding second contact maker of the other assembly when the assemblies are brought together as set forth, each said second contact maker terminating in the vicinity of the edge of its support strips which is nearest to the contact-making edge of the assembly, thereby permitting the support strips of the two assemblies to reach a position of abutting relationship when brought together as set forth.

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