United States Patent

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[54] **TERMINAL JUNCTION**

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[52] **U.S. Cl.**.....**339/217 S,** 339/205

[51] **Int. Cl.** **H01r 9/08**

[58] **Field of Search**.....339/217 S, 248, 47, 204, 205

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[57] **ABSTRACT**

A terminal junction being provided with a housing of rigid dielectric material enclosing flexible triangularly shaped female sockets. A male pin-type connector having a radial shoulder portion is inserted in a respective female socket making electrical contact therewith while end-play movement of the connector is prevented by a spring tang and tab assembly bearing against the front and rear surfaces of the radial shoulder portion when the connector fully engages the socket.

9 Claims, 8 Drawing Figures

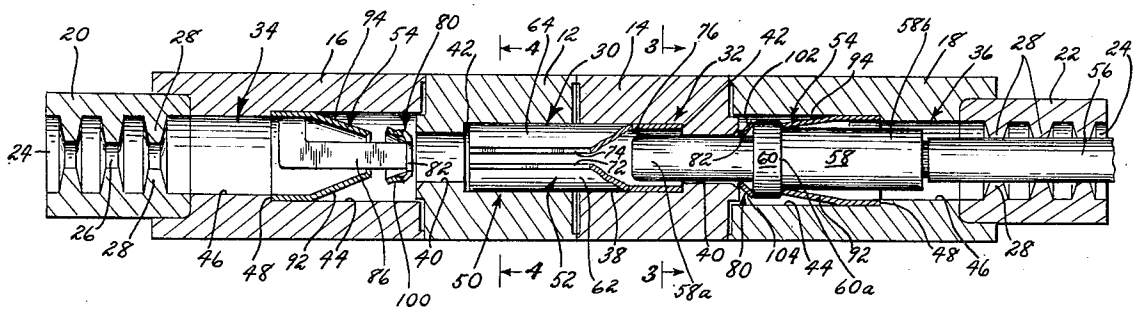
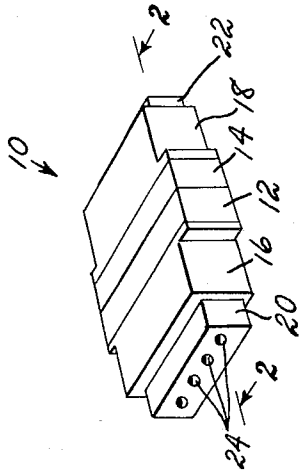


Fig. 1



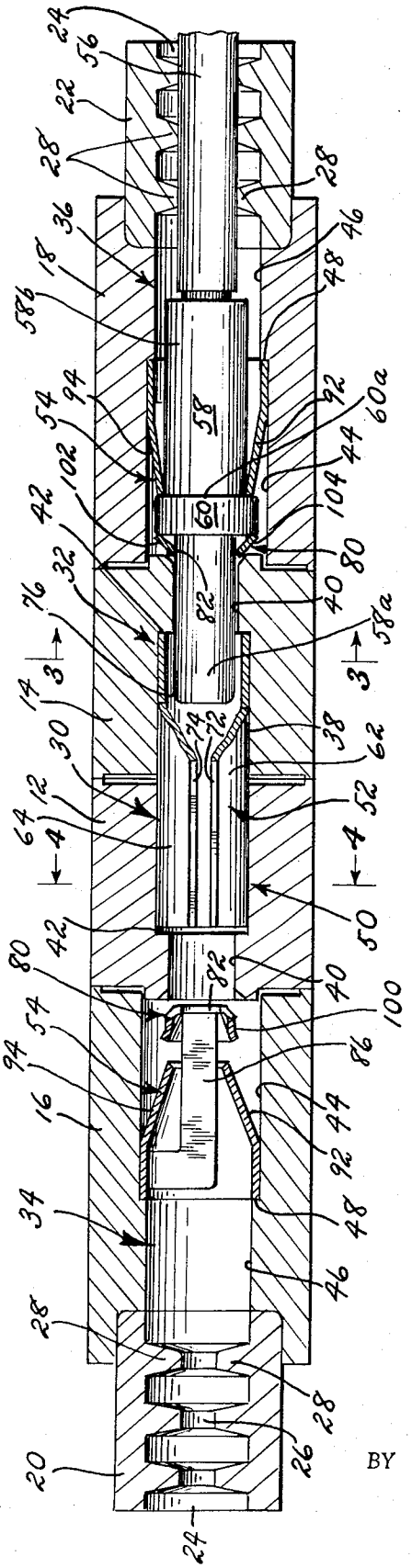


Fig. 2

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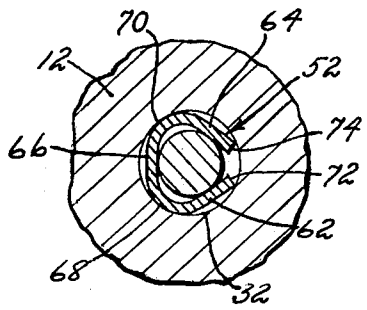


Fig.3

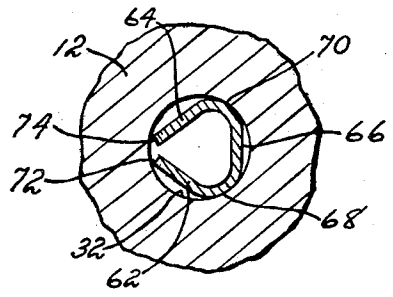


Fig.4

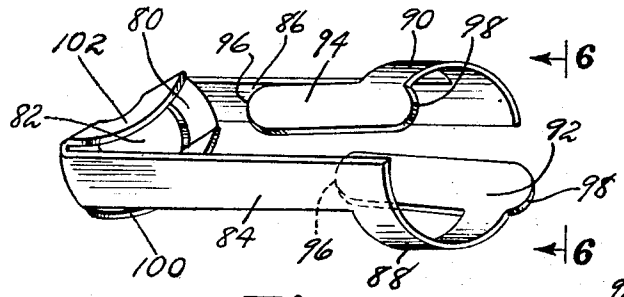


Fig.5

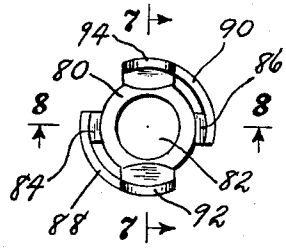


Fig.6

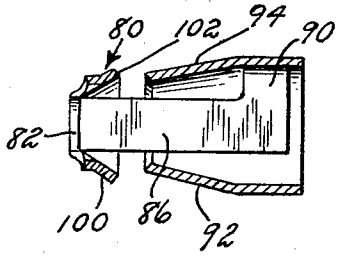


Fig.7

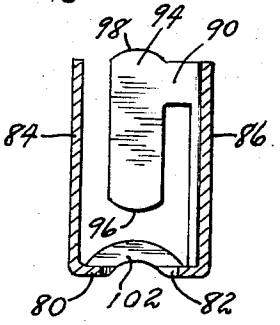


Fig.8

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TERMINAL JUNCTION

BACKGROUND OF THE INVENTION

This invention relates to a terminal junction, and more particularly, to a terminal junction including pin and socket type electrical connections.

With the advent of solid state circuitry, small scale terminal junctions are finding increasing use. Such junctions generally house female socket members adapted to receive male contact pin connectors for making electrical connections. Prior terminal junctions are often relatively unreliable due to the nature of the physical contact made between the male pin and female socket. In addition, such terminal junctions fail to rigidly hold the connector pin in place resulting in undesirable end-play movement of the connector, detracting from the quality of the electrical connection made therewith. Although several designs exist for mounting means holding the connector pin within the terminal junction, these fail to adequately achieve their purpose. When terminal junctions are utilized in air craft and space vehicles, it may be appreciated that such reliability is extremely significant.

The electrical connection made between the pin and socket members in the terminal junction may not be permanent. To disconnect these members, suitable removal means are provided which easily and conveniently enables the connector pin to be withdrawn from the terminal junction. Unfortunately, with some prior art terminal junctions, it is often difficult to achieve the efficient removal of such connectors.

An object of the present invention is to provide a terminal junction in which an improved electrical connection between a connector pin and mating female member is achieved.

Another object of the present invention is to provide a terminal junction including means for rigidly holding such connector to prevent end-play movement.

Still another object of the present invention is to provide a terminal junction which is relatively light in weight and compact.

Another object of the present invention is to provide a terminal junction including mounting means for rigidly holding an electrical pin-type connector, yet permitting easy removal thereof.

Other objects, advantages and features of the present invention will become more apparent from the following description.

SUMMARY OF THE INVENTION

In accordance with the principles of the present invention, the above objects are accomplished by providing a terminal junction including a block of rigid dielectric material comprising central and end mating sections. A female socket member is provided in a bore in the central mating sections capable of receiving an inserted male pin-type connector. The end sections are provided with bores which align with those in the central mating sections enabling the male contact to be inserted through the end sections to engage a female socket member in the central section. The socket member is provided with a triangular or horseshoe shape and is made of a flexible conducting material. In its normal unflexed position, the central opening of the socket is less than the diameter of the distal end of the connector. When the tip of a contact pin is inserted in the female socket, the sides of the triangular-shape female socket separate and firmly grasp the contact pin providing an electrical connection between the pin and socket. Such a pin and socket assembly may be placed in back-to-back relationship with another similar assembly, thereby providing an electrical connection from one end to the other of the terminal junction in a manner similar to that of a bus bar.

The connector pin includes an integral collar portion which is rigidly held between a flexible tang and tab assembly to eliminate end-play movement. The clearance between the tang and tab members is less than the thickness of the collar portion and when the pin connector is inserted in the terminal junction, the front surface of the collar portion bears against the tab permitting the tang member to flex behind and bear against the rear surface of the collar.

Additional objects and advantages of the invention will become apparent in the course of the following specification when taken in connection with the accompanying drawings, in which:

FIG. 1 is a perspective view of a terminal junction made in accordance with the present invention;

FIG. 2 is an enlarged sectional view taken generally along line 2—2 of FIG. 1;

FIG. 3 is a section taken along line 3—3 of FIG. 2 showing one of the internal contact members with a contact pin inserted therein;

FIG. 4 is a section taken along line 4—4 of FIG. 2, and showing a contact member with no pin inserted therein;

FIG. 5 is a perspective view of the pin locking member included in the terminal junction of the present invention;

FIG. 6 is an end elevational view of the pin locking member as viewed along line 6—6 of FIG. 5;

FIG. 7 is a section taken along line 7—7 of FIG. 5; and

FIG. 8 is a section taken along line 8—8 of FIG. 5.

DETAILED DESCRIPTION

Referring in detail to the drawings, there is shown a terminal junction **10** constituting, by way of example, one standard type of terminal junction module in which a group of pins are inserted in one end and make contact with corresponding pins of a second group inserted in the other end of the module. It is to be understood, however, that the structure of the present invention may be incorporated in other types of terminal junction modules.

As shown in FIG. 1, the terminal junction **10** includes a housing formed of sections which are separately molded and then secured together after the internal metal contact members and pin-locking members have been inserted in a manner to be presently described. Thus the aforementioned housing comprises a pair of mating central sections **12**, **14** held together at their inner facing ends and a pair of end sections **16** and **18** attached to the outer ends of central mating sections **12** and **14** respectively. Sections **12**, **14**, **16** and **18** may comprise a rigid dielectric material or a softer type elastomer dielectric. Conventional silicone or rubber end seals **20** and **22** are secured to the outer surfaces of end sections **16** and **18**, respectively, and are provided with outer apertures **24** which communicate with

through passages in the terminal junction housing. By way of illustration, four apertures 24 are shown in FIG. 1, so that the terminal junction would have four registering through passages, each containing a contact member and pin-locking member of the present invention, as will be presently described. It will be appreciated that the terminal junction may be provided with any desired number of through passages, depending upon its size.

As shown in FIG. 2, the end seals 20 and 22 are formed with a plurality of through bores 26 terminating at one end in a respective aperture 24. The end seals 20 and 22 are made of a flexible material and are formed with internal projections or holding elements 28 which extend into bore 26 to partially obstruct the same. The holding elements 28 engage and grip the circumference of an electrical cable or wire inserted through the end seal, to form a weatherproof seal thereabout.

In FIG. 2, one of the four through passages in the housing of terminal junction 10 is shown. This passage is formed by through bores 30 and 32 in the respective central sections 12 and 14, and registering through bores 34 and 36 in the respective end sections 16 and 18.

The bores 30 and 32 of central sections 12 and 14 are identical, and each comprises an inner cylindrical bore section 38 and an outer cylindrical bore section 40 of smaller diameter, with an annular shoulder 42 formed therebetween. The bores 34 and 36 are also identical, each comprising an inner cylindrical bore section 44 and an outer cylindrical bore section 46 of smaller diameter, with an annular shoulder 48 formed therebetween.

When the terminal junction module 10 is assembled in the manner shown in FIG. 2, with the inner faces of central sections 12 and 14 cemented or otherwise secured together and the inner faces of the end sections 16 and 18 cemented or otherwise secured to the outer faces of the respective central sections 12 and 14, the inner bore sections 38 register to form a central cavity 50 receiving a female or socket type contact member 52 therein. In addition, in the assembled condition of the module, the bore sections 44 of each of the housing end sections 16 and 18 provide cavities for receiving and mounting pin locking members 54.

Each through passageway, formed by the communicating bores 30, 32, 34 and 36, is sized and adapted to permit insertion of a pin-headed lead wire in each end thereof, and passage of the wires therethrough until each pin thereof engages the central contact member 52 and establishes electrical contact therewith, so that the two pins make electrical contact with each other through said contact member 52. In FIG. 2 one such lead wire 56 is shown in inserted position, said wire 56 terminating in a contact pin 58 formed with an annular collar 60 intermediate its tip 58*a* and body portion 58b. To bring wire 56 to the inserted position shown, the contact pin 58 has been inserted through aperture 24 and bore 26 of end seal 22, and then pushed through bore 36 and into bore 32 until the contact pin 58 penetrates and makes contact with the contact member 52. In a similar manner, another lead wire (not shown) terminating in an identical contact pin 58 is inserted from the other side of the module until the contact pin penetrates and makes contact with the opposite end of contact member 52.

FIG. 4 shows one end of the contact member 52 before a contact pin is inserted therein. The contact member 52 is formed of a strip of flexible conductive metal bent into the form of a split tube, which, as shown in FIG. 4 is generally triangular in cross-section. The contact member 52 thus comprises a pair of flexible leg members 62 and 64 connected to a base member 66 by arcuate bights 68 and 70. The leg members 62 and 64 are inclined toward each other and their respective free ends 72 and 74 are spaced from each other. The leg members 62 and 64 define with the base member 66 an opening concentric with the central cavity 50, and in the unflexed position of FIG. 4, said opening is smaller than the diameter of the contact pin to be received herein.

As shown in FIG. 2, the tip 58*a* of contact pin 58 has a distal end 76 which is tapered to facilitate insertion thereof into the end of the contact member 52. FIG. 3 shows a contact pin inserted within one end of the contact member 52. As the contact pin 58 is so inserted, the flexible leg members 62 and 64 separate, causing the free ends 72 and 74 thereof to press against the inner surface of bore section 32. In this manner, the contact member 52 is rigidly held in place while firmly holding contact pin 58.

The triangular cross-sectional shape of the contact member 52 serves to insure that in the unflexed condition, the bights 68, 70 and the free ends 72, 74 are always in engagement with the surface of central cavity 50 so that the contact member is maintained concentric with said cavity 50. It will be seen in FIG. 4 that the arms 62, 64 and the base member 66 partially obstruct the central cavity 50, but in such a manner that the tapered end of contact pin 58 is never prevented from entering the interior of the contact member by the leading edge of the latter. In addition, the triangular shape of contact member 52 assures good contact with the pin 58, it being seen in FIG. 3 that said pin makes firm line contact with the interior surface of contact member 52, namely at the central portions of arms 62, 64 and base member 66.

In accordance with another feature of the present invention, a spring locking member 54 is utilized to grasp and retain each inserted contact pin 58 in firm contact with its respective contact member 52, minimizing the end-play movement encountered with convention terminal junction devices. Each spring locking member 54 comprises an integral unit stamped from a sheet of thin springy metal and bent into the substantially tubular form shown in FIG. 5, to provide an generally circular end member 80 having a central aperture 82 therein. Extending perpendicularly from diametrically opposed circumferential portions of the circular end member 80 are a pair of parallel elongated arms 84 and 86 which are curved concavely to conform to the tubular shape of the locking member 54, as best seen in FIG. 6. Formed integrally with the arms 84, 86 at the free ends thereof are respective perpendicularly extending arm extentions 88, and 90 which are curved along their longitudinal extents to conform to the contour of the locking member 54.

The free ends of the arm extensions 88 and 90 carry respective, integrally-formed locking tangs 92 and 94, which, as shown in FIG. 8 are elongated and have rounded front and rear ends 96 and 98. As shown in FIG. 7, the locking tangs 92 and 94 are diametrically

opposed and in registry with each other, and are bent inwardly toward each other, that is to say, the free ends of the locking tangs **92**, **94** are bent inwardly toward the central longitudinal axis of the locking member **54**. The normal distance between the free ends of the locking tangs **92** and **94** is appreciably less than the other diameter of the pin collar **60** and preferably slightly less than the diameter of pin body **58***b*, for a purpose to be presently explained.

The circular end member **80** is bent to form a pair of integral tabs **100** and **102** which extend radially from opposite sides thereof and are bent forwardly toward the opposite end of locking member **54**, but are inclined outwardly, away from the central longitudinal axis of said member **54**. These tabs **100** and **102** are located so that they are longitudinally aligned with the respective locking tangs **92** and **94**, as shown in FIGS. **5**, **7** and **8**.

Locking tangs **92** and **94** are flexible and in their normal inwardly-bent positions partially obstruct the passageway for pin **58** through bore section **46**. As shown at the left-hand side of FIG. **1**, the free ends of tangs **92** and **94** are spaced from the respective tabs **100** and **102** by a distance which is less than the thickness of pin collar **60**, so that when pin **58** is inserted to its locked position, as to be presently described, the tabs **100** and **102**, which are also flexible, are compressed.

In assembly of the terminal junction **10**, a locking member **54** is inserted into each of the inner bores **44** of end sections **16** and **18** and the central sections **12** and **14** are fitted to said end sections and securely sealed thereto. The locking members **54** are thus encased in the bores **44**, with the end of each member **54** abutting the shoulder **48**, as shown in FIG. **1**. In addition, the normal outer diameter of each locking member **54** is somewhat greater then the diameter of the corresponding bore **44**, so that, upon insertion, the locking members are compressed and frictionally retained within said bores **44**, thereby preventing any end-play movement of said locking members.

When a contact pin **58** is inserted in the appropriate bore of the terminal junction **10**, it passes through the rubber end seal **20** or **22**, and into the outer bore section **46**. The tip portion **58***a* of the contact pin **58** then passes between the locking tangs **92**, **94** and through the circular aperture **82** in end member **80**, said aperture being sufficiently large to permit free passage of said tip **58***a*. The collar **60** then moves between locking lugs **92**, **94** causing said tangs to flex outwardly away from each other and toward the wall of bore **44**. As soon as the collar **60** passes the free ends of locking tangs **92**, **94**, the tangs snap inwardly into engagement with the surface of pin body **58**b immediately behind the collar **60** and in engagement with the shoulder **60***a* formed thereby. In this position, the forward surface of collar **60** presses against the flexible tabs **102**, **104** on the end member **80**, compressing said tabs and causing them to exert a counter force upon the collar. This biasing pressure of the compressed tabs **102**, **104** on collar **60** maintains the latter pressed firmly against the free ends of the locking tangs **92**, **94**, so that the contact pin is now firmly locked in its inserted position and is restrained from any end-play movement in either direction.

The rounded front and rear ends **96** and **98** of each of the tangs **92** and **94** are provided to prevent undesirable twisting of the tangs during use. Such twisting would tend to occur if the tangs were provided with straight end edges, the corners of which would engage the collar **80** or the shoulder **60***a*, exerting an oblique, force on the tang. The rounded ends **96** and **98**, however, insure that the end surfaces of the tangs make perpendicular contact with the collar **80** and shoulder **48**, thereby eliminating said twisting tendency.

The locking members **54** are spaced from the corresponding contact members **52** by such a distance that when the locking tangs **92**, **94** lock a contact pin **58** in its inserted position, the pin tip **58***a* is received well within the end of said contact member **52**, as shown in FIG. **1**, to make good electrical contact therewith.

In their inserted positions the contact pins **58** cannot be withdrawn from the contact members **52** by pulling outwardly, because of the holding action of locking members **54**. To enable a contact pin to be disconnected and removed, it is necessary to employ a suitable tool (not shown) which has a hollow, cylindrically-shaped body capable of being inserted from the rear of the contact pin. Such tool when inserted passes between the tangs **92**, **94** spreading them apart until they clear collar **60** and permit the contact pin to be withdrawn.

While a preferred embodiment of the present invention has been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in such embodiment without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrical connector assembly for receiving a contact pin having a radially projecting collar thereon, said assembly comprising an insulating body having a bore extending inwardly from at least one end thereof, an electrical contact member mounted within the interior of said bore and adapted to receive and make electrical contact with a contact pin inserted within said bore from said one end of said body, and a pin locking member mounted in said bore between said contact member and said one end of said body, said pin locking member constituting a unitary assembly comprising a general cylindrical tubular body having a circular end member, a pair of diametrically opposed and parallel arms formed integrally with said end member and extending perpendicularly from the periphery thereof, curved arm extensions extending laterally from said arms, a pair of spring tangs formed integrally with the ends of the respective arm extensions, said spring tangs being inclined inwardly toward the central axis of said bore with their free ends normally spaced apart by a distance smaller than the diameter of said pin collar, and a pair of spring tabs spaced from said tangs and located between said tangs and said contact member, said tabs being inclined outwardly away from the central axis of said bore, said tangs and tabs being spaced apart in a direction parallel to the longitudinal axis of said bore by a distance less then the thickness of the collar on said pin, whereby when said contact pin is inserted into said bore into engagement with said contact member, said collar is received under spring tension between said tangs and tabs and said pin is locked in inserted position by said pin locking member.

2. An electrical connector assembly according to claim 1 in which said tabs are formed integrally with the circular end member of said tubular body.

3. An electrical connector assembly according to claim 1 in which the free ends of said spring tangs are located to be engaged and spread apart by the circumferential surface of the collar of an inserted contact pin as said collar approaches said spring tabs, said spring tabs being positioned to be engaged and compressed by the forward surface of said collar as the free ends of said spring tangs clear the circumferential surface of said collar and snap into engagement with the body of said pin and the rear surface of said collar.

4. An electrical connector assembly according to claim 3 in which the free ends of said spring tangs are curved to prevent twisting when said free ends are in engagement with the rear surface of said collar.

5. An electrical connector assembly according to claim 1 in which said circular end member has an aperture of sufficient size to permit the tip of an inserted contact pin to pass therethrough into engagement with said contact member.

6. An electrical connector assembly according to claim 1 in which said bore has a first section sized to receive said pin locking member snugly therein, and a second bore section communicating with said first bore section and located between the latter and said one end of said body, said second section being of smaller diameter than said first section and forming therebetween a shoulder engaging the end of said pin locking member and preventing rearward movement thereof.

7. A terminal junction according to claim 1 in which said contact member comprises a split tube of springy metal having a triangular cross-section defined by a pair of flat, elongated leg members connected by a flat base member, the free ends of said leg members being spaced from each other.

8. A terminal junction according to claim 7 in which said leg members are inclined toward each other to provide with said base member a generally triangular passageway through said contact member, said passageway being normally of lesser dimension than the diameter of a contact pin to be received therein, said leg members spreading apart when said contact pin is inserted therebetween to enlarge said passageway, whereby said legs and said base each make line contact with said inserted pin.

9. A terminal junction according to claim 8 in which the free ends of said leg members and the junctures of said leg members with said base engage the surface of said body bore to maintain said contact member concentrically mounted in said bore.

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