Sept. 4, 1945. M. H. LEES, JR 2,384,321

RIVET CONSTRUCTION

Filed March 29, 1944 3 Sheets-Sheet 1

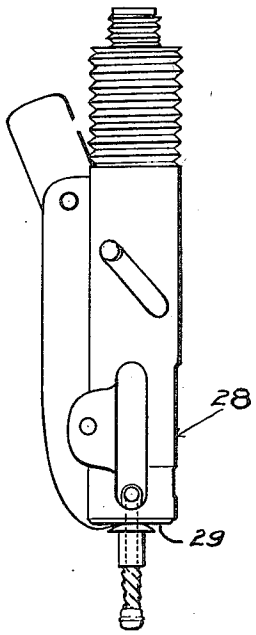


Fig.1

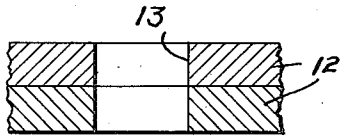


Fig.2

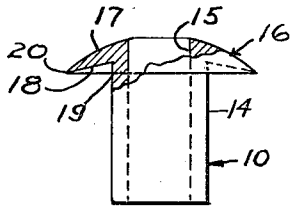


Fig.3

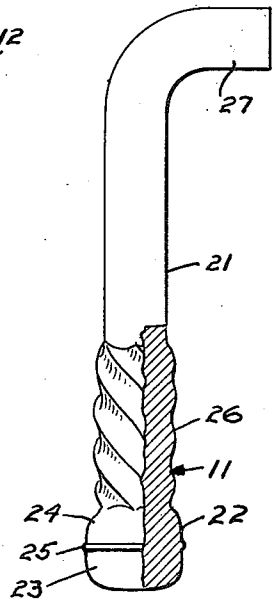


Fig.4

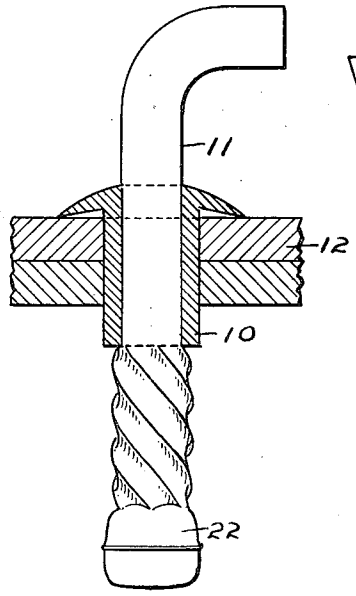


Fig.5

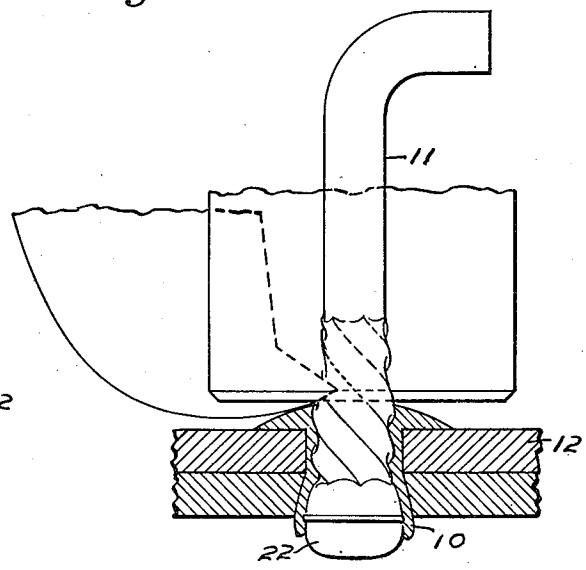


Fig.6

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Sept. 4, 1945. M. H. LEES, JR 2,384,321

RIVET CONSTRUCTION

Filed March 29, 1944 3 Sheets-Sheet 2

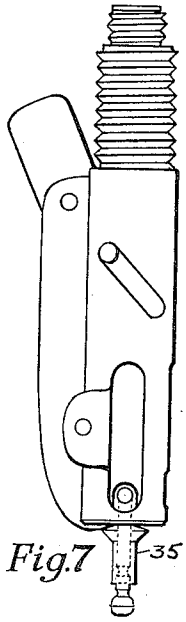


Fig.7

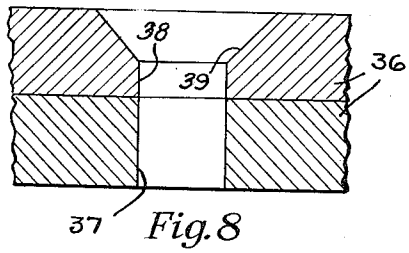


Fig.8

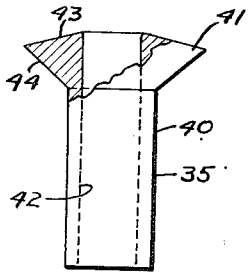


Fig. 9

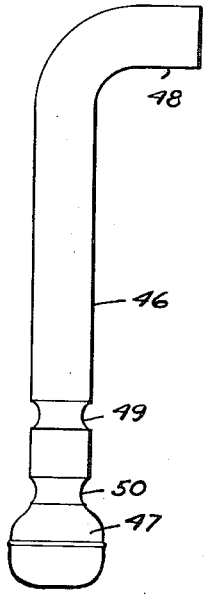


Fig.10

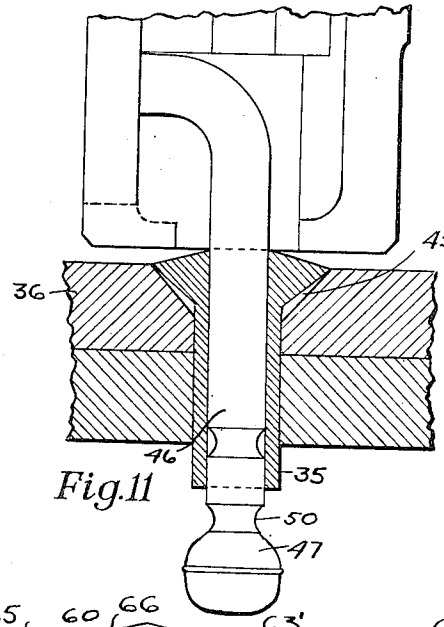


Fig.11

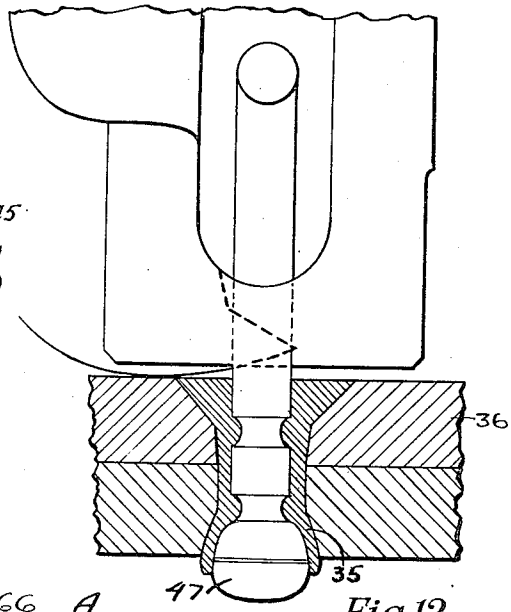


Fig.12

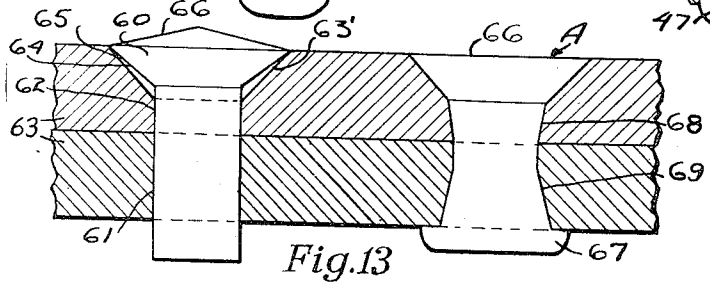


Fig.13

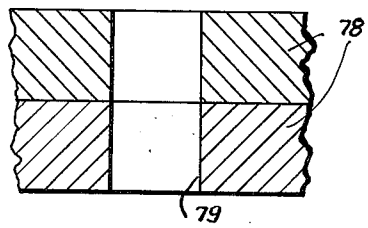
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RIVET CONSTRUCTION

Filed March 29, 1944 3 Sheets-Sheet 3

Fig. 15



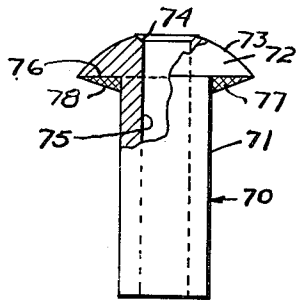


Fig. 16

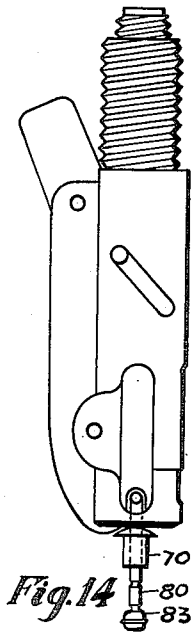


Fig. 14

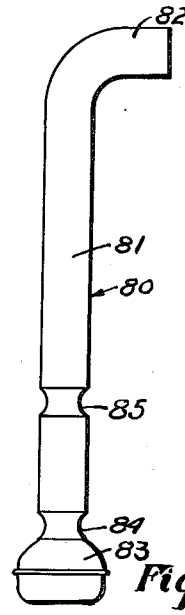


Fig. 17

Fig. 18

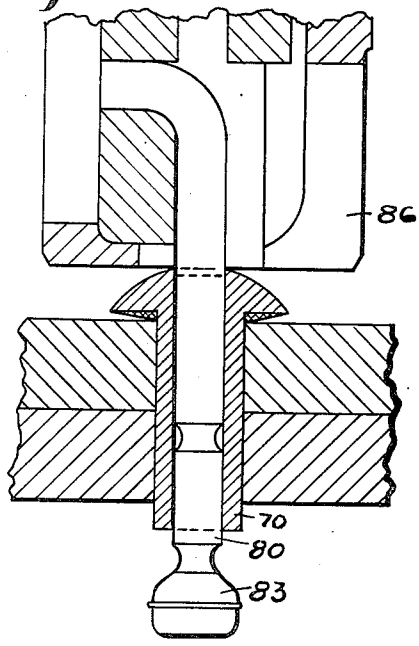
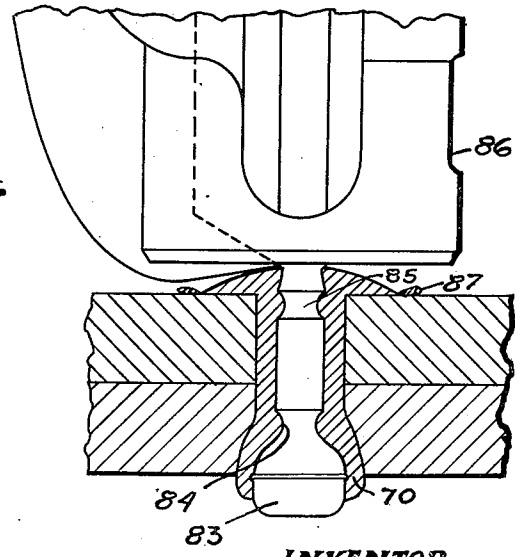


Fig. 19



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Patented Sept. 4, 1945

2,384,321

UNITED STATES PATENT OFFICE

2,384,321

RIVET CONSTRUCTION

Milton H. Lees, Jr., Pasadena, Calif.

Application March 29, 1944, Serial No. 528,632

2 Claims. (Cl. 85—40)

This invention relates to a rivet construction.

The general object of the invention is to provide an improved rivet which is so constructed that a joint of maximum strength is secured.

A further object of the invention is to provide an extrusion rivet having a mandrel shank member of novel shape.

A further object of the invention is to provide an extrusion rivet wherein the mandrel has novel serrations or kerfs in its periphery thus providing a greater area of contact between the shank and the tubular portion of the rivet.

A further object of the invention is to provide an extrusion rivet having a novel head member on the shank of the mandrel portion.

A further object of the invention is to provide an extrusion rivet mandrel which has a laterally extending portion permitting it to be readily engaged and pulled.

A further object of the invention is to provide a flush type of rivet of the mandrel extrusion type wherein the head of the tubular member is of novel construction.

A further object of the invention is to provide a rivet including a head member and having a relatively soft deformable washer beneath the head to initially hold the head spaced from the adjacent layer when the riveting operation is started.

Other objects and the advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a side elevation of a rivet embodying the features of my invention and showing it engaged by a pull member;

Fig. 2 is a fragmentary section showing layers of material to be united;

Fig. 3 is a side elevation, partly in section, showing the tubular rivet element;

Fig. 4 is a side elevation, partly in section, showing the mandrel portion of the rivet;

Fig. 5 is a central sectional view showing the material and rivet tubular portion and showing the mandrel in elevation;

Fig. 6 is a view similar to Fig. 5 and shows the mandrel pulled to riveting position and the initiation of the severance of the shank;

Fig. 7 is a view similar to Fig. 1 showing a modified rivet;

Fig. 8 is a sectional view showing the layers of material to be united;

Fig. 9 is a side elevation, partly in section, showing the tubular member of the rivet;

Fig. 10 is a side elevation showing the modified mandrel;

Fig. 11 is a sectional view, with the mandrel in elevation, showing the rivet prior to the riveting operation;

Fig. 12 is a view similar to Fig. 11 showing the riveting operation completed;

Fig. 13 shows a further modified rivet prior to and after riveting;

Fig. 14 shows an additional modified assembly and pull member before insertion in the layers to be united;

Fig. 15 shows the layers to be united;

Fig. 16 is a side elevation, partly in section, showing the tubular member;

Fig. 17 is a side elevation showing the mandrel member;

Fig. 18 is a sectional view showing the rivet inserted and ready to be pulled, and

Fig. 19 shows the completed joint made by the rivet.

Referring to the drawings by reference characters, I have shown my invention as embodied in a rivet which is indicated generally at 10. As shown the rivet is of the mandrel extrusion type and is employed with a mandrel, indicated generally at 11. The rivet is employed in securing layers of material such as 12 together. These layers are preferably of relatively soft metal and are provided with aligned apertures 13 which are of a diameter to receive the shank 14 of the rivet. The rivet shown is hollow, having a bore 15, and is provided with a mushroom head 16.

The head 16 is generally rounded as at 17 on the upper surface and the lower surface 18 is in the shape of a truncated cone with the apex directed upwardly and intersecting the shank at 19 while the lower or outer end of the truncated portion forms a sharp edge 20 where it meets the upper surface 17 of the rivet.

The mandrel member 11 includes a shank 21 having a head 22 thereon. The head is shown as including an outer end portion 23 and an inner portion 24 with a bead 25 at the juncture of the portions 23 and 24. The shank nearest the head is provided with a steep pitch, corrugated, thread-like, portion 26, the outer diameter of which is greater than the diameter of the bore 15. The end of the shank remote from the head is bent as at 27.

In assembly the mandrel is inserted in the bore 15 of the rivet (see Fig. 5) and the end 27 is then formed. This end 27 serves to prevent separation of the head and mandrel and also serves to engage a pull member 28.

In operation the rivet is arranged in the apertures 13 of the material to be united. The pull member 26 is then coupled to the free end of the mandrel so that its head 29 engages the head 16 of the rivet. The pull member is operated (by means and in a manner not shown) thus causing the head 29 of the pull member to push downwardly on the head 16 of the rivet while the mandrel is pulled upwardly and is turned as it moves so that the parts assume the position shown in Fig. 6.

The pushing of the head 18 downwardly causes the tubular portion of the rivet adjacent to the head to be forced inwardly into the aperture 13 and into the grooved portion 26 while the head shifts from the position of Fig. 5 to the position of Fig. 6. At the same time the portion 23 of the mandrel enters the lower end of the rivet and forces this lower end outwardly as shown in Fig. 6. After the rivet is secured in position as shown in Fig. 6 the mandrel shank is cut off.

In Figs. 7 to 12, inclusive, the rivet 35 is employed to secure layers 36 of material together. The material layers are provided with aligned holes 37 and 38, the hole 38 having a countersunk portion 39 which is generally frusto-conical.

The rivet 35 includes a shank 40 having a head 41 thereon. The rivet is provided with a bore 42. The head is chamfered on its upper surface as at 43 and the lower surface of the rivet head is frusto-conical in shape as at 44. The pitch of the portion 44 is less steep than that of the countersunk portion 39 so that when the rivet is inserted in the holes as shown in Fig. 11 there is an upwardly converging generally frusto-conical space 45 beneath the rivet head.

It will be seen that the rivet head is arranged in the position shown in Fig. 11 when it is first inserted and during the riveting operation the head moves to the position shown in Fig. 12 as will be later described. Within the bore 42 I arrange a mandrel which has a shank 46 and a head 47 thereon similar to the head 22 previously described. The shank 46 is bent as at 48 to prevent separation of the shank from the rivet 35 and also to provide a means of engagement with a riveting member. The shank 46 is provided with spaced grooves 49 and 50.

In operation the rivet is inserted as shown in Fig. 11 and the mandrel is then pulled. The head 41 moves from the position shown in Fig. 11 to position shown in Fig. 12 and the surplus metal enters groove 49. The head 47 enters the lower portion of the bore 42 and expands this bore as shown in Fig. 12, with some of the metal entering the groove 50. The rivet shank is then cut off.

In Fig. 13 the rivet 60 is fitted in holes 61 and 62 in layers 63. The hole 62 is countersunk as at 63' and the rivet head has a lower face 64 similar to the face 44 previously described so that a space 65 similar to the space 45 is provided. The top of the rivet is cone shaped as at 66. When the rivet 60 is set the head 66 moves to the position shown at A in Fig. 13, with the head flush with the adjacent material. The shank of the rivet is formed with a head 67.

The space 65 is filled by material from the head and as the head moves downwardly in the hole and the shank moves upwardly frusto-conical portions 68 and 69 are formed on the shank of the rivet so that a very secure riveted joint is provided.

In Figs. 14 to 19 I show a modification wherein a rivet 70 has a shank 71 and a head 72. The head has a rounded upper surface 73 with a chamfer 74 at the top of the head. The rivet has a bore 75 therethrough and the under surface of the rivet is shown as plane at 76. About the shank of the rivet I arrange a spacing member or washer 77. The upper end of this member is plane and engages the plane face 76. The lower face of the member 77 is frusto-conical as at 78. The member 77 may be made of lead, copper, wax or other material.

The rivet 70 is employed in securing layers 78 of material together. The layers 78 are provided with aligned apertures 79 in which the shank 71 is inserted as shown in Fig. 18. The spacer 77 holds the rivet head slightly spaced from the top of layer 78 as shown in Fig. 18.

The rivet 70 is shown as employed with a mandrel 80 which is similar in all respects to the mandrel shown in Fig. 10 and previously described. The mandrel 80 includes a shank 81 having a bent end 82. Opposite the bent end 82 the shank has a head 83 and the shank is provided with grooves 84 and 85.

In operation the rivet is inserted as shown in Fig. 18 and a pull member 86 pulls the mandrel by engaging the portion 82 thereof.

The head 72 of the rivet is forced downwardly during the riveting operation as the mandrel is pulled upwardly. The material constituting the spacer 77 is deformed and may be extruded outwardly from beneath the head, forming a ring 87 while the surplus material of the head 72 is forced into the groove 85. At the same time the head 83 moves inwardly causing material to enter the groove 84 so that the rivet is firmly secured in place.

It will be noted that in each type of rivet I employ means which causes the head end of the rivet to be spaced a slight distance from the top layer of material when the rivet is first inserted; thus during the riveting operation the shank adjacent the head end of the rivet moves into the material while at the same time the shank portion at the other end moves into the material and towards the head. Thus there is a similar movement of material at both ends of the rivet so that a tight joint is secured.

From the foregoing description it will be apparent that I have invented a novel rivet which is easy to make and can be readily secured in place and which provides a very tight joint in the finished structure.

Having thus described my invention, I claim:

1. A rivet including a head and a shank, said shank having a bore therethrough, said head having a rounded upper surface, the lower surface of said head being planar, a deformable, frusto-conical washer on said shank engaging the head, the washer serving to limit movement of the head towards the material when the rivet shank is inserted into a hole in the material, the washer being of extrudable material and deformable to permit the shank to move into the hole until the lower surface of the rivet head engages the material about the hole when the rivet is secured in place, a mandrel including a stem inserted in said bore, said mandrel having a bent end beyond the head end of the rivet, said mandrel at the end remote from the bent end having an enlarged head, said head being bulbous in shape, said mandrel stem adjacent to the head having a corrugated portion which is adapted to enter the hole when the rivet is being set.

2. A rivet including a head and an elongated shank, said head and shank having a bore there-

through, said bore being cylindrical throughout, a mandrel in said bore, said mandrel including a cylindrical portion longer than the shank bore and slidable in the shank bore, said cylindrical portion having a diameter substantially equal to the diameter of the shank bore, said cylindrical portion extending beyond the head, said mandrel beyond the rivet shank and remote from the rivet head having a spirally corrugated portion, the external diameter of the spirally corrugated portion being greater than the diameter of the shank bore, the spirally corrugated portion being adapted to enter the shank bore and to expand the rivet shank when the rivet is being set, said mandrel beyond the spirally corrugated portion and at the end of the mandrel remote from the rivet head having an enlarged bulbous head which is larger in diameter than the spirally corrugated portion and which is adapted to enter the rivet shank bore.

MILTON H. LEES, JR.