

March 17, 1959

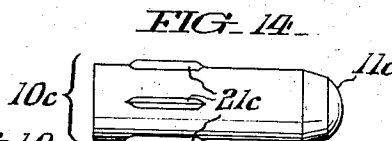
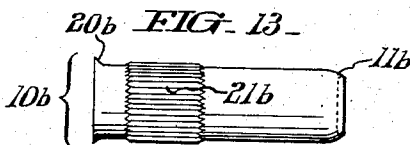
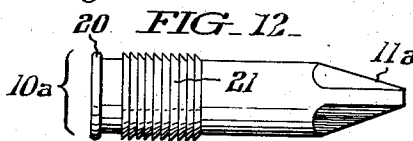
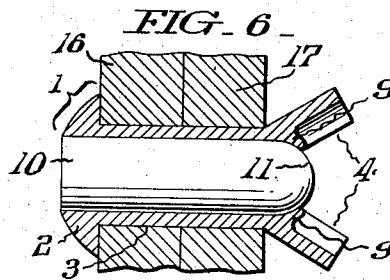
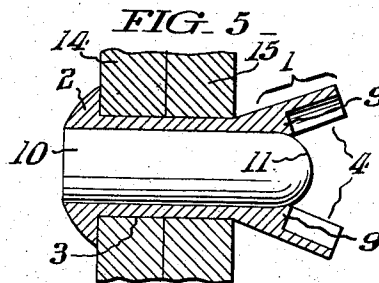
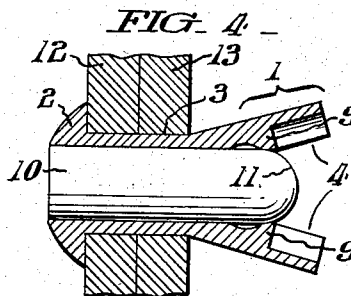
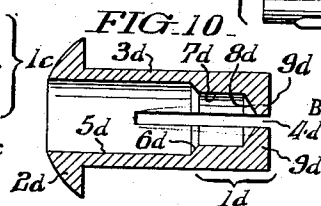
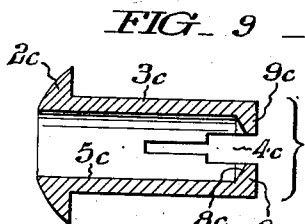
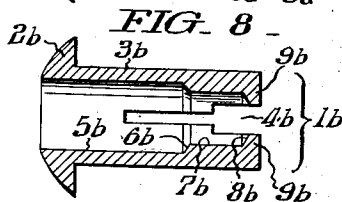
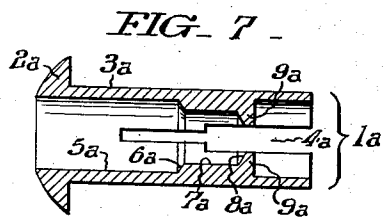
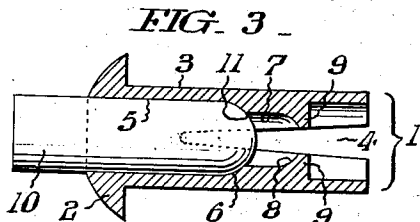
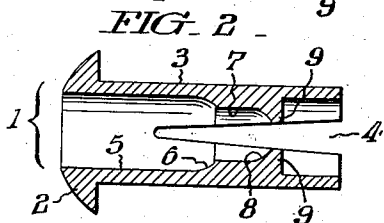
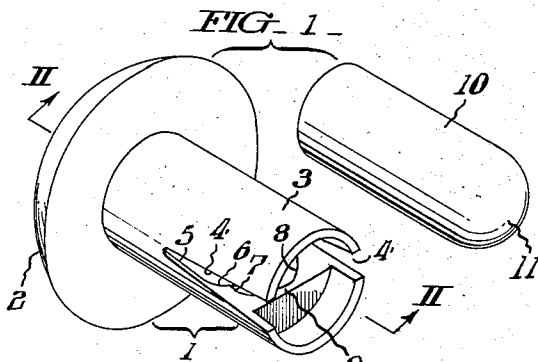
J. K. BARRY ET AL

2,877,682

HOLLOW RIVET HAVING TWO INTERNAL SHOULDERS

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2 Sheets-Sheet 1



INVENTORS.
John K. Barry &
Michael R. Tuozzo,
Paul & Paul
ATTORNEYS.

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FIG. 11

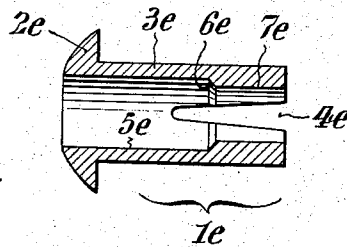


FIG. 15

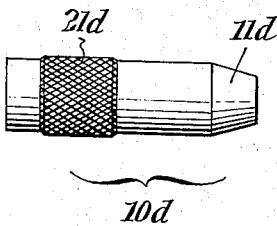
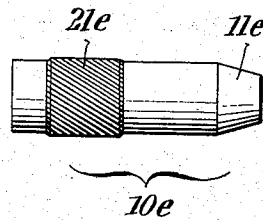


FIG. 16



INVENTORS:
John K. Barry &
Michael R. Tuzo,
BY Paul & Paul
ATTORNEYS.

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HOLLOW RIVET HAVING TWO INTERNAL SHOULDERS

John K. Barry, Philadelphia, and Michael R. Tuozzo, Prospect Park, Pa., assignors to South Chester Corporation, Chester, Pa., a corporation of Delaware

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6 Claims. (Cl. 85—40)

This invention relates to fastening devices. More specifically, it is concerned with a fastening device of the general type disclosed in U. S. Patent 2,668,468 granted to Howard A. Flogaus on February 9, 1954 ordinarily known as blind rivets, useful in securing together structural elements such as metallic plates, panels of wood, plastic sheets and the like, and consisting of a headed tubular main component with a split shank, and an expander pin adapted to be driven into said main component, after insertion of the shank of the latter into registering holes in the parts to be united, and outwardly expand or spread the protruding distal split segmental end or prong portions of the shank.

The chief aim of our invention is to provide a fastening device of the kind referred to capable of securing together a plurality of structural elements whose aggregate thickness may vary over a wide range, without danger of overstressing the shank of the main component, cracking or breaking the prong ends incident to bending and cross sectional reformation or in any way weakening the device.

A further aim of our invention is to provide a fastening device of the kind referred to of which the main component is so proportioned that but a minimum of effort or force is required to drive home the expander pin to fix the device in permanent relation to the elements connected thereby.

Another object of our invention is to attain the foregoing advantages in a fastening device which is simple in construction, and which lends itself to ready fabrication in quantity at small cost.

Other objects and attendant advantages will appear from the following detailed description of the attached drawings, wherein:

Fig. 1 is a perspective view showing the two component parts of a fastening device conveniently embodying our invention in one form.

Fig. 2 shows the main component of the device in axial or longitudinal section.

Fig. 3 shows the two parts assembled in readiness in preparation for the use of the device.

Figs. 4, 5 and 6 are fragmentary sectional views showing the manner in which plural structural elements of different aggregate thicknesses are permanently secured together by the device of Fig. 1.

Figs. 7, 8, 9, 10 and 11 show, in longitudinal section, various modifications of the main component of the device; and

Figs. 12, 13, 14, 15 and 16 show different alternative forms of the associated component or spreader pin.

With more detailed reference, first more particularly to Figs. 1-3 of these illustrations, the form of my improved fastening device there depicted, comprises a tubular main component 1 having a rounded head 2 and a cylindrical shank 3. The shank 3 is diametrically split longitudinally as at 4, inwardly from its distal end through a portion of its length, the slit having in this instance straight con-

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tinuous sides and being tapered inwardly from its mouth end. Instead of but a single slit, the shank of the component 1 may be provided with additional such slits if desired. The large entrant portion 5 of the bore in the component 1 terminates at a point medially of the length of the slit, i. e., at a point somewhere between the ends of said slit 4. The diametrically-reduced smaller intermediate portion 7 of the bore in the main component 1, in turn, terminates short of the distal end of the shank 3. The remaining end portion of the bore in the shank 3 of the component 1 may be of the same diameter as that of the entrant end. As a result of this construction, there are formed on the prongs defined by the slit 4, shoulders 6 and 8 in spaced relation, and inwardly-projecting lugs 9 fronted by the latter shoulders. The shoulders at 6 and 8 may be spherically or parabolically rounded as shown.

The device further comprises an expander pin 10 which is cylindrical and substantially of the same diameter as the entrant end 5 of the bore in the component 1, and which is rounded as at 11 at one end. In preparation of the device for the market, the pin 10 is ordinarily pre-assembled with the component 1 as in Fig. 3.

In the use of the device to secure together two relatively thin structural elements such as plates or sheets 12 and 13 for example as in Fig. 4, the shank 3 of the component 1 is inserted into registering holes in said plates until stopped by the head 2. With the device so placed, the pin 10 is driven inward of the component 1 by means of a hammer or a suitable power tool, applied to its flat end. As the pin 10 is so driven the surrounding split portion of the shank 3 of the component 1 may be first expanded laterally within the hole in the element 13 by action of the rounded end of the pin 10 as the latter is forced into and through the small portion 7 of the bore past the shoulders 6 with attendant progressive displacement of the material of the shank in this region and partial outward expansion of said prongs. As the pin 10 continues, in its advance, it acts upon the shoulders 8 on the prongs of the shank 3 and gradually spreads the protruding end portions of said prongs apart radially at complementary angles as in Fig. 4, the points of bending being in the plane of the exposed face of the plate 13. Slight enforced elongation and lateral expansion of the shank of the component 1 takes place, of course, with attendant flow of the material and corresponding change in the cross sections of the segments or prongs of the split at the regions of the bends, this is controlled within the proportional limit of the metal. As a result it will be seen that the elements 12 and 13 are drawn together and tightly and rigidly united permanently and the device securely lodged within them against the possibility of subsequent displacement.

In Fig. 5, where the aggregate thickness of the structural elements or plates 14 and 15 is somewhat greater, the protruding end portions or prongs of the shank 3 of the component 1 are bent outward radially at the same complementary angles as in Fig. 4, about axes in the plane of the exposed face of the plate 15, by action of the rounded end of the spreader pin 10 upon the shoulders 6 and 8. In this instance, it will be noted that the projections 9 have been transformed into solid wedge sections by enforced linear flow and outward displacement of the metal of the split segments or prongs of the shank 3.

When the device is used to secure together structural members or plates 16 and 17 whereof the combined thickness is still greater as in Fig. 6, the protruding end portions of the prongs of the shank 3 of the component 1 are spread apart to the same extent and bent outwardly at approximately the same complementary angles about

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axes in the plane of the exposed face of the plate 17, with the cross section of the projections 9 changed to sharper wedge form through enforced flow and displacement of the metal in the regions of the bends.

Over expansion of the segments or prongs of the shank 3 of the component 1 is controlled in all of the above instances of application of the device by the width of the slit or slits 4 at the locations of the bends, and over-stressing of said segments or prongs in tension is prevented by causing the wall behind the spreader hole to fail first, allowing the pin 10 to pass forwardly to relieve the tension.

In the alternative embodiment of our invention shown in Fig. 7, the slit 4a in the shank 3a of the headed component 1a is stepped rather than tapered, and bore portions 5a and 7a terminated in beveled shoulders 6a and 8a.

The modified main component 1b of Fig. 8 is identical with that of Fig. 7 except in that the shank 3a terminates at the projections 9b.

In Fig. 9, the shank 3c of the main component 1c is like the component 1b of Fig. 8, except in that it has a single bore 5c which terminates in beveled shoulders 8c at the projections 9c.

The modified main component 1d of Fig. 10 is identical with that of Fig. 8 except for having a slit 4d with parallel, instead of sloping side edges.

The modified main component depicted in Fig. 11 and designated 1e is like that of Fig. 10 in that it has a head 2e, shank 3e with large and small bore portions 5e and 7e and beveled shoulders 6e on its prongs but lacks the projections 9d of the form of Fig. 10.

The modified expander pin 10a of Fig. 12 has a fluted tapered terminal end 11a; a narrow circumferential flange 20 at its drive end, and a roughened or serrated portion 21 adjacent said drive end.

In Fig. 13, the modified pin 10b has a truncated rounded terminal end 11b; a flare 20b at its drive end, and a fluted or knurled portion 21b adjacent said drive end.

In Fig. 14, the pin 10c has tapered terminal end 11c with a rounded tip, and a series of circumferentially-spaced sharp longitudinal ridges 21c adjacent its drive end.

In the modified pin 10d of Fig. 15, the portion 21d is knurled and the tip 11d of the pin is frusto-conical.

The pin 10e of the alternative form in Fig. 16 has a frusto-conical tip 11e like that of Fig. 15 but here the portion 21e is spirally grooved.

Either of the various modified expander pins of Figs. 12-16 may be used in lieu of the plain pin 10 with any of the different forms of headed components hereinbefore described, with attainment of the same ultimate results as described in connection with Figs. 4-6 in securing together a plurality of plates or other structural elements which are to be permanently united. The advantage of the modified pins 10a, 10b, 10c, 10d and 10e is that more effective anchorage of the fastening devices is insured due to biting of the roughened portions 21a, 21b, 21c, 21d or 21e into the wall of the bore portions 5, 5a, 5b, 5c, 5d and 5e of the headed components 1, 1a, 1b, 1c, 1d and 1e with which they may be interchangeably used, the flanges 20a or 20b of the pins 10a and 10b serving as stops against the heads of the main components.

In all cases, the advantages which have been pointed out as a consequence of proportioning the component parts of the device as shown and described through which the yield strength of the metal of the main components is equalized, and the binding grip of the device is made

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equally effective irrespective of variations in the aggregate thickness of the elements secured together by it.

It is to be understood that our improved fastening devices may be fabricated of metal or any other suitably ductile material and to different sizes depending upon the particular uses for which they are intended. Also, the heads of the main components may be shaped otherwise than herein shown by way of example.

Having thus described our invention, we claim:

1. A fastening device for fastening together a plurality of plates or the like of varying aggregate thickness comprising a rivet-like tubular main component having a head and an elongated shank of substantially uniform outside diameter, said component having a first bore of substantially constant diameter extending from the head into the shank thereof, said first bore terminating in inwardly extending first shoulder means facing the head, said component having a second bore of constant diameter less than the diameter of the first bore extending from said first shoulder means toward the distal end of said shank for a substantial distance, said second bore terminating in inwardly extending second shoulder means facing the head, and the shank having a diametral slit which extends inwardly from the distal end thereof to a terminal point inwardly beyond said first shoulder means; the radial thickness of the shank surrounding the second bore being not more than twice the thickness of the shank surrounding the first bore; and nose-ended expander pin means having a diameter corresponding to the diameter of said first bore for radially expanding the shank portion of said component by causing the material of said first shoulder means to flow toward the distal end of said shank and by causing said second shoulder means to separate about said diametral slit.

2. The invention according to claim 1 wherein the end of the pin is rounded spherically, and wherein the shoulders of the bore in the shank of the main component are rounded on a radius substantially equal to that of rounded end of the pin.

3. The invention according to claim 1 wherein the surface of the shank of the expander pin is roughened for greater security against axial and rotative displacement after it has been driven into place.

4. The invention according to claim 1 wherein the width of the diametral slit is reduced stepwise from the distal end of the shank to its terminal point.

5. The invention according to claim 1 wherein the shank extends beyond the second shoulder means at its distal end.

6. The invention according to claim 1 wherein the expander pin completely fills the shank within the length of the shank within the plates being fastened together.

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