Feb. 20, 1940. F. N. ROSS 2,191,192

ATTACHMENT UNIT WITH MULTICORNERED SHANK

Filed March 12, 1938 3 Sheets-Sheet 1

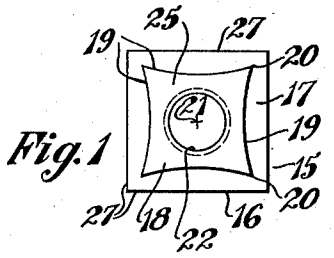


Fig. 1

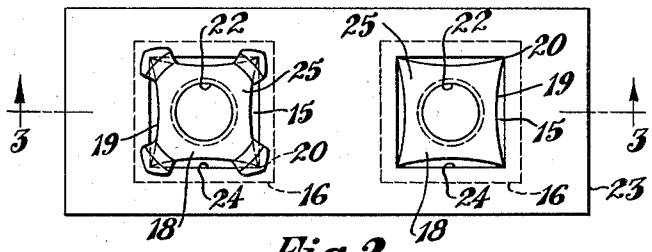


Fig. 2

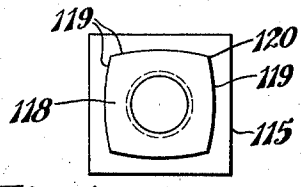


Fig. 4

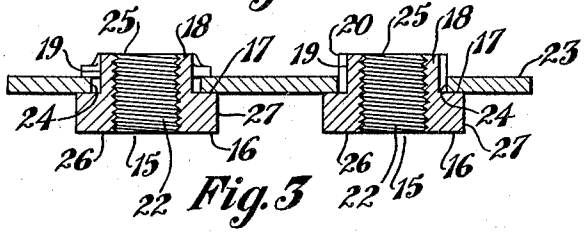


Fig. 3

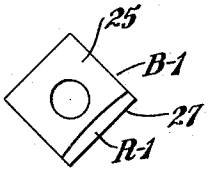


Fig. 5

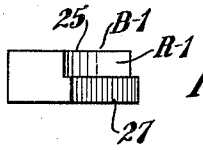


Fig. 6

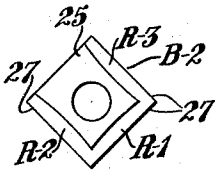


Fig. 7

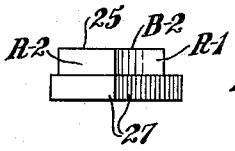


Fig. 8

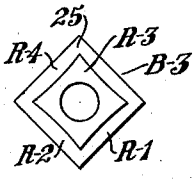


Fig. 9

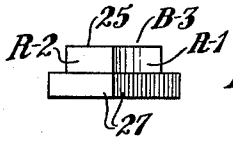


Fig. 10

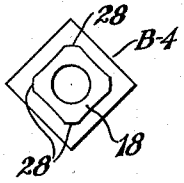


Fig. 11

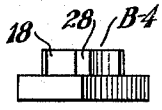


Fig. 12

Inventor

Frederick N. Ross

By Fleasr and Bishop

Attorneys

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ATTACHMENT UNIT WITH MULTICORNERED SHANK

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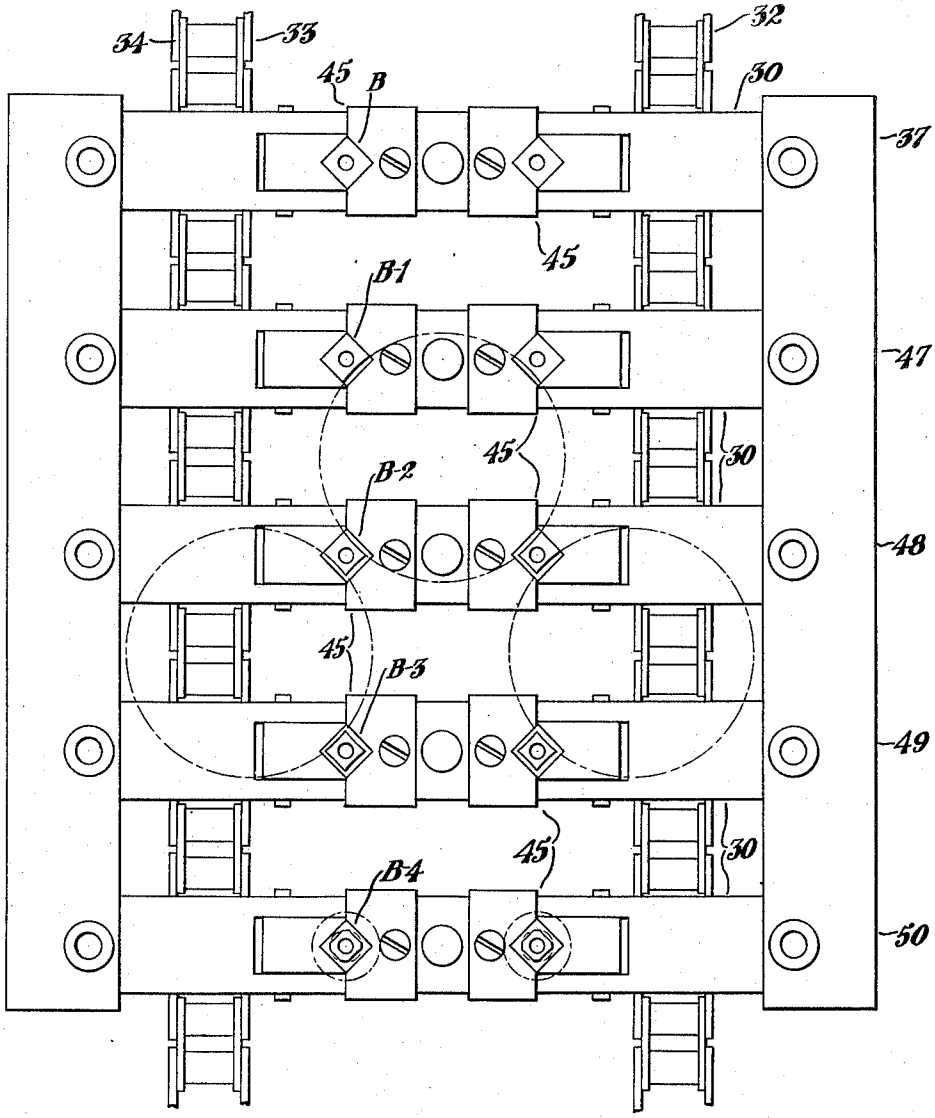


Fig. 13

Inventor

Frederick N. Ross

By Pease and Bishop

Attorneys

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ATTACHMENT UNIT WITH MULTICORNERED SHANK

Filed March 12, 1938 3 Sheets-Sheet 3

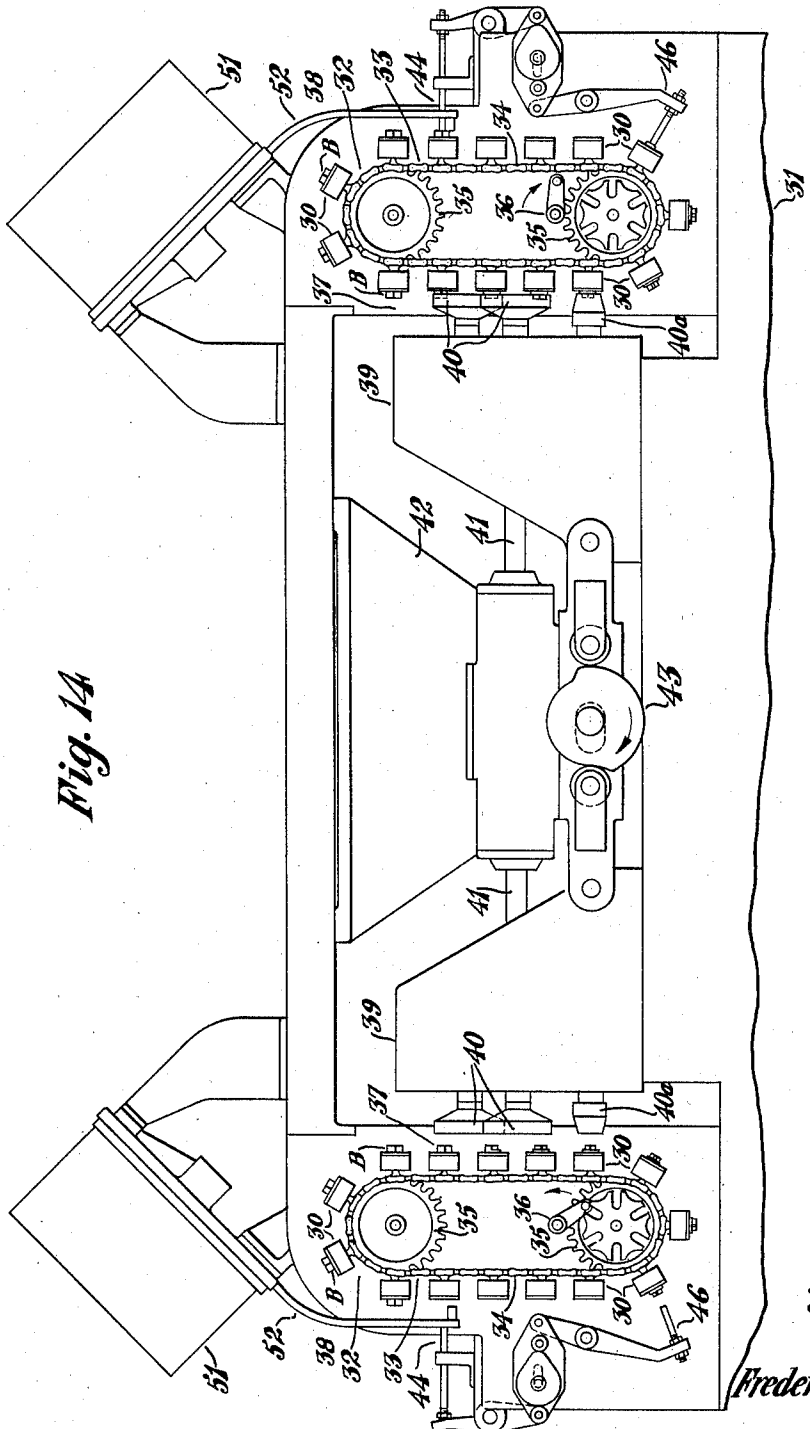


Fig. 14

Inventor

Frederick N. Ross

By Frease and Bishop

Attorneys

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2,191,192

UNITED STATES PATENT OFFICE

2,191,192

ATTACHMENT UNIT WITH MULTICORNERED SHANK

Frederick N. Ross, Grosse Pointe Park, Mich., assignor to Ash Products Corporation, Detroit, Mich., a corporation of Michigan

Application March 12, 1938, Serial No. 195,596

11 Claims. (Cl. 85—32)

My invention relates to articles of manufacture, and more particularly to attachment articles, units, or parts such as clinch-on nuts having flanged portions and shanks extending from the flanged portions, the shanks being multicornered for insertion into multicornered apertures of sheet material such as sheet metal and the like so as to prevent turning of the shanks in the apertures, and the flanged portions which may be heads being adapted for abutting against one face of the sheet material on which the articles may be applied; and the articles when in the form of attachment units such as clinch-on nuts being preferably made of metal so that portions of the shanks may be clinched over against the other face of the sheet material in opposition to the flanged portions whereby the articles are securely clinched on the sheet material and cannot turn with respect to the sheet material.

In my prior application for U. S. Letters Patent, Serial No. 140,217, filed May 1, 1937, which is a continuation of application Serial No. 48,610, filed November 7, 1935, I disclose attachment articles with multicornered shanks, in which the shanks have D or C shapes, and with flanges forming seats extending entirely around the shanks, such attachment articles being preferably in the form of clinch-on nuts which are preferably made from blanks having opposite faces, preferably flat blanks, such as flat nut blanks or standard nuts.

The attachment articles of my said application Serial No. 140,217, having D or C shape shanks, for proper use must be inserted in D shape holes or apertures in the sheet material to which they may be applied.

The D shape holes are usually punched into the sheet material, and it is relatively difficult to accurately located the D shape holes when punched separately, or the multiple punches and dies for gang punching the same.

Square holes are, however, relatively easy to accurately locate in a sheet of material to be punched, whether the square holes are to be punched separately or by the use of multiple punches and dies.

The provision of an attachment unit with an accurately square shank, that is with a shank having flat faces and equally spaced corners is very difficult, and is not believed to be adaptable to mass production methods.

The objects of the present improvements include the provision of an article such as an attachment unit or part with a multicornered shank, which may be a clinch-on nut, and which has substantially all the advantages of an article with an accurately square shank, and which is adapted for mass production.

Further objects of the present improvements include the provision of an improved method of making articles such as attachment parts or units with multicornered shanks by mass production machining operations.

The foregoing and other objects are attained by the articles of manufacture, parts, combinations, and sub-combinations, and methods of making the same, which comprise the present invention, and the nature of which is set forth in the following general statement, and preferred embodiments of which articles and of a machine for carrying out the method are set forth by way of example in the following description, and which are particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

The nature of the improved attachment article of the present invention may be stated in general terms as including preferably in a one-piece metal article made from a blank having opposite faces by machining operations performed entirely upon one face of the blank, a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having side faces, each side face being curved and preferably cylindric and having corners formed preferably by cylindric elements, the cylindric elements being angled with respect to the flange seat face. The side faces are preferably equal and preferably four in number, and the corners are preferably equally spaced from and parallel with an axis angled with respect to the flange seat face.

From another standpoint, the improved article may be described as including a body having two opposite transverse end faces, side faces bounding the end faces, and arcuate rabbets between one of the end faces and the side faces, one rabbet for each side face, and each rabbet having a transverse seat face located between the end faces and a preferably cylindric arcuate face at an angle with the seat face and the one end face.

The improved articles are preferably made by the improved method hereof which may be stated in general terms as including machine cutting a plurality of curved or arcuate rabbets in one end portion of a blank having opposite end faces so as to form a shank having preferably cylindric curved side faces and a plurality of corners.

By way of example, preferred embodiments of the improved articles of manufacture hereof in the form of clinch-on nuts, and of the blanks from which the improved articles are preferably made after having had performed thereon several steps of the preferred improved methods of making the same, and a machine for carrying out the improved methods, are illustrated in the accompanying drawings forming part hereof, in which

Figure 1 is a top plan view of one embodiment of the improved article hereof in the form of a clinch-on nut;

Fig. 2, a top plan view showing a sheet of material with square apertures formed therein, and a nut of Fig. 1 inserted in one aperture, and another similar nut inserted in another aperture and clinched on the sheet;

Fig. 3, a transverse sectional view thereof as on line 3—3, Fig. 2;

Fig. 4, a top plan view of a second embodiment of the improved article hereof;

Fig. 5, a top plan view of a nut blank, after having had performed thereon the first step of the improved method of making from the same the improved article of Fig. 1 hereof;

Fig. 6, an elevation view thereof;

Fig. 7, a view similar to Fig. 5 showing the nut blank after having had performed thereon the second operation of the improved method hereof;

Fig. 8, an elevation of the partially formed nut of Fig. 7;

Fig. 9, a view similar to Figs. 5 and 7, illustrating the nut blank thereof after having had performed thereon the third operation of the improved method hereof;

Fig. 10, an elevation view of the finish formed nut blank of Fig. 9;

Fig. 11, a plan view illustrating the nut blank of Fig. 9 after having had performed thereon an additional operation to form a third embodiment of the improved article hereof;

Fig. 12, an elevation view of the nut blank of Fig. 11;

Fig. 13, a fragmentary diagrammatic view looking towards the chucking faces of chuck bar means of a preferred machine adapted for carrying out the improved method hereof; and

Fig. 14, a diagrammatic elevation view of the preferred machine for carrying out the improved method hereof.

Similar numerals refer to similar parts throughout the drawings.

One embodiment of the improved attachment article or unit of the present invention in the form of a clinch-on nut is illustrated in Fig. 1 and indicated generally by 15, and includes a head or flange 16 having a transverse seat face 17 and a shank 18 extending from the flange seat face. The shank 18 is multicornered, and for the purposes of a clinch-on nut preferably has four equal side faces 19, each side face being cylindric and being concave outwardly and having side corners 20 forming the corners of the shank. The side corners 20 of the cylindric side faces are preferably common for each set of adjacent faces 19 and are preferably cylindric elements of the cylindric side faces 19. In other words, the side faces 19 preferably join each other at the corners 20.

The corners 20 and the cylindric elements are substantially normal to the flange seat face 17; and the corners 20 are preferably equally spaced from and parallel with an axis of reference 21 extending preferably at right angles to the plane of the transverse seat face 17.

The corners 20 are thus located in the same positions which they would occupy if the shank 18 had an accurately square transverse cross-section; and thus for purposes of use as a substantially square shank clinch-on nut, the improved nut 15 with the concave cylindric shank side faces 19 has all the advantages of an accurately square shank clinch-on nut since the locations of the corners of the shank is the characteristic thereof permitting relatively easy location of the punches and dies for punching the shank receiving apertures in the sheet material to which the clinch-on nut 15 may be applied.

The clinch-on nut 15 furthermore includes coaxial with the axis 21 an internally threaded aperture 22.

In Figs. 2 and 3 is illustrated a sheet of material, as shown a metal sheet 23, having two square apertures 24 formed therein as by punching, the corners of which apertures 24 are located for fitting and receiving the corners 20 of clinch-on nuts 15, one of which is shown at the right in Figs. 2 and 3 inserted into one of the apertures 24 before being clinched on, and another of which is shown at the left of Figs. 2 and 3 after being inserted in the other aperture 24 and being clinched on the metal sheet 23.

From another standpoint, the nut 15 may be described as a body having two preferably flat and preferably parallel opposite end faces 25 and 26 with a head having four side faces 27 bounding the end faces, and rabbets between the end face 25 and the head side faces 27, one rabbet for each side face, and each rabbet having a transverse seat face comprising a portion of the seat face 17, and each rabbet having a cylindric shank face 19 substantially normal to the seat face 17 and the end face 25.

In Fig. 4 is illustrated a second embodiment of the improved attachment article hereof in the form of a clinch-on nut 115 which is generally similar to the nut 15, excepting that the nut 115 has a shank 118 with outwardly convex cylindric side faces 119, common cylindric side elements of the side faces 119 forming the shank corners 120.

Each of the clinch-on nuts 15 and 115 as above set forth, thus include a shank having a plurality of cylindric side faces and a plurality of corners formed by side edges of the side faces, the center of curvature of each side face being off-set from the centers of curvature of the other side faces, and each cylindric side face being one face of a rabbet, whereby the clinch-on nuts 15 and 115 are adapted to be made from preferably square nut blanks having preferably opposite faces by machine forming the nut blanks by rotary cutting tools, the feed of which is along the axis of rotation and which is directed at an angle, preferably at right angles to one end face of the nut blanks.

End milling cutters are preferably used for this purpose and may be said to have end feed, and the machining of the blanks to make the improved attachment articles of the present invention by end feeding only of milling cutters, provides for very low cost mass production, preferably by the method hereinafter set forth.

In Figs. 5 and 6, a partially formed nut blank B—1 is illustrated, which is preferably a square nut blank with an unthreaded aperture therein, and which is shown after having had performed thereon the first step or operation of the improved method, by which a cylindric end milling cutter has been end fed into the end face 25 and

has cut one rabbet R—1 between the end face 25 and one of the head side faces 27.

In Figs. 7 and 8 is illustrated a partially formed nut blank B—2, which is the nut B—1 after having had performed thereon the second operation of the improved method, by which two cylindric end milling cutters have, by end feeding thereof into the face 25, cut two opposite rabbets R—2 and R—3 between the end face 25 and two opposite head side faces 27, the rabbets R—2 and R—3 extending from the ends of the first cut rabbet R—1.

In Figs. 9 and 10 is shown a nut blank B—3 which is the nut blank B—2 after having had performed thereon the third operation of the improved method, by which the fourth rabbet R—4 has been cut by end feeding a cylindric end mill cutter into the face 25, the rabbet R—4 extending between the ends of the second cut rabbets R—2 and R—3.

The nut blank B—3 may be used as an attachment article in itself, but the aperture thereof is preferably and usually internally threaded to form the clinch-on nut 15.

In Figs. 11 and 12, a nut blank B—4 is shown, which is the nut blank B—3 after having had performed thereon a fourth operation, when desired, whereby a hollow end mill has cut rounded or cylindric corner faces 28 on the shank 18, attachment articles with shanks having a plurality of rounded corner faces being sometimes desired.

Fig. 13 is a fragmentary diagrammatic view looking towards the work holding sides of chuck bar means 30 of a preferred machine adapted for carrying out the improved method hereof which is indicated generally by 31 and a diagrammatic elevation view of which is illustrated in Fig. 14.

The machine 31 includes equally spaced chuck bar means 30 included in two opposite work holding and positioning mechanisms indicated generally by 32, and in each of which the chuck bar means 30 are mounted on preferably endless chain conveyor means 33 including an endless chain 34, as shown operating on two vertically spraced sprockets 35.

Step by step drive means indicated generally by 36 are provided for each chain conveyor means 32 for intermittently advancing the chuck bar means 30 successively from station positions to succeeding positions located a distance from the first position equal to the spacing of the chuck bar means 30.

Each work holding and positioning mechanism 32 has a machining side 37 where work or blanks held by the chuck bar means 30 are machined, and a loading and unloading side 38 where work or blanks are loaded and unloaded on and from the chuck bar means 30.

At the machining side of each work holding and positioning mechanism 32 a tool head indicated generally by 39 is operatively associated.

Each tool head 39 has a plurality of shafts operatively mounted therein which carry on their outer ends cutting tools, preferably end milling cutters 40, and when desired, a hollow milling cutter 40a. All the tools on each tool head are operatively driven by a splined shaft 41, which extends from the adjacent side of drive mechanism indicated generally by 42.

Each tool head 39 is operatively arranged for feed movement towards and away from the machining side of its associated work holding and positioning mechanism 32 as by cam and follower means indicated generally by 43. On the loading and unloading side of each work holding and positioning mechanism, work loading means indicated generally by 44 insert work or blanks, such as nut blanks B, into the chucks 45 of the bar means 30.

As shown, there are operatively associated with each chuck bar means 30, two chucks 45.

On the loading and unloading side 38 of each work holding and positioning mechanism 32, work unloading means indicated generally by 46 remove the work, such as the finish machined nut blanks B—3 or B—4 from the chucks 45 of the chuck bar means 30 passing the work unloading means 46.

As best shown in Fig. 13, each tool head 39 includes a plurality of three triangularly spaced end milling cutters 40 which are adapted to simultaneously cut by end feeding thereof in the direction along their axis of rotation into all the blanks held in the chucks of the chuck bar means 30 at stations 47, 48, and 49 at the machining side 37 of each work holding and positioning mechanism 32.

Likewise, when the hollow mill cutter 38 is utilized on each tool head 39, a hollow milling operation is simultaneously performed at station 50.

The machine 31 is arranged so that when the blanks are being machined on one work holding and positioning mechanism 32, the other work holding and positioning mechanism 32 operates to move the chuck bar means 30 thereof one step, that is, each chuck bar means 30 at the stations on the machining side 37 is advanced from one station to the other.

Accordingly, in the machine 31, each of the different method steps is being performed simultaneously on different blanks, that is to say, the machining of a complete blank is effected during each feed movement of each tool head 39 for each chuck 45 in each chuck bar means 30.

In the illustrated machine 31, two completely machined nut blanks are thus finished for each cutting feed movement of each tool head 39.

As shown, each blank loading means 44 has blanks delivered thereto from hopper means 51 through guide means 52.

I claim:

1. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having a plurality of side faces, each side face being cylindric and having side corners, the elements and the corners of the cylindric side faces being substantially normal to the flange seat face, and the cylindric side faces being externally concave.

2. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having a plurality of side faces, each side face being cylindric and having side corners, the elements and the corners of the cylindric side faces being substantially normal to the flange seat face, and the cylindric side faces being externally convex.

3. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having a plurality of side faces, each side face being cylindric and having side corners, and the corners being equally spaced from an axis substantially normal to the flange seat face.

4. An article of manufacture adapted for use

as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having a plurality of side faces, each side face being cylindric and having side cylindric elements forming corners, and the corners being parallel with and equi-distant from an axis substantially normal to the flange seat face.

5. A article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having four side faces, each side face being cylindric and having side corners, and the corners being equally spaced from an axis substantially normal to the flange seat face.

6. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having four side faces, each side face being cylindric and having side cylindric elements forming corners, and the corners being parallel with and equi-distant from an axis substantially normal to the flange seat face.

7. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having a plurality of equal side faces, each side face being cylindric and having side corners, the elements and the corners of the cylindric side faces being substantially normal to the flange seat face.

8. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having four equal side faces, each side face being cylindric and having side corners, the elements and the corners of the cylindric side faces being substantially normal to the flange seat face.

9. An article of manufacture adapted for use as an attachment unit and the like, including a flange having a transverse seat face, and a shank extending from the flange seat face, the shank having four equal side faces, each side face being cylindric and having side cylindric elements forming corners, the cylindric elements being substantially normal to the flange seat face.

10. An article of manufacture adapted for use as a clinch-on unit and the like, including a body having two transverse end faces spaced from each other along a reference axis extending normal thereto, side faces bounding the end faces, and rabbets between one of the end faces and the side faces, one rabbet for each side face, and each rabbet having a transverse seat face located between the end faces and extending substantially normal to the reference axis and a cylindric face substantially normal to the seat face.

11. An article of manufacture adapted for use as a clinch-on unit and the like, including a body having two flat transverse opposite end faces, side faces bounding the end faces, and rabbets between one of the end faces and the side faces, one rabbet for each side face, and each rabbet having a transverse seat face located between the end faces and a cylindric face substantially normal to the seat face and the one end face.

FREDERICK N. ROSS.