This invention relates to improvements in corrugated fasteners.

The invention of this application is an article of manufacture disclosed in my co-pending application pertaining to machines and methods of producing corrugated fasteners of the parallel and of the divergent type, one of which co-pending applications is serially numbered 615,512, filed June 6th, 1932, another 632,338, filed September 9th, 1932, another 673,197, filed May 27, 1932, another 633,611, filed September 17, 1932 and still a further application serially numbered 681,688, filed July 22, 1933.

In the two applications first named, the invention disclosed therein pertains to machines for swage-beveling and swage-severing a metallic ribbon into sharpened beveled edged strips, and for bending and rebending the strips to form parallel or divergent corrugations as desired, and for subsequently severing the strips into suitable length forming fasteners, and for driving corrugated fasteners, whereas, the third and fourth applications are for a method. The aforesaid applications pertain to a metallic strip which is swage-beveled, swage-hardened and swage-severed from a metallic ribbon without loss of metal, thereby producing a smooth burnished hardened beveled surface and a knife-like swage-hardened continuous sharp-cutting toothed penetrating end at the entering end of the strip, said strip adapted to the manufacture of fasteners and particularly to corrugated fasteners. The swage-sharpened flat strip is thereafter provided with parallel or divergent corrugations as desired and then severed into suitable lengths.

The article produced by the aforesaid machines and in accordance with the aforesaid methods constitutes the subject matter of this application.

One object of the invention is to provide a fastener which is characterized preferably by at least four salient features of novelty, one of which is a swage-beveled, swage-hardened, swage-sharpened penetrating end, and another feature is a body portion having a central wedge-shaped web and abutting corrugations integral with the web and a continuous, undulating cutting edge extending the length of the penetrating end and following the configuration of the corrugations, and still another is a series of curved teeth having rounded apexes and rounded roots, and still another is a flat wedge-shaped central web functioning to cause transverse movement of the material being joined across the flat surfaces of the central web, thereby effecting clean draw-shear cutting of the fibre and easy driving of the fastener when driven either with or across the grain of the material with practically no tendency to crush the fibre in the driving operation as the driven fastener descends into the material and the opposed pieces approach each other into forced fixed relation.

In one embodiment of my invention I provide a divergently corrugated fastener which comprises a single piece of relatively thin metallic strip having a central plane web section, the opposite side edges of which are in divergent relation so as to impart a flat wedge-shaped appearance thereto, the penetrating end comprising a continuous swage-hardened toothed cutting edge, the web at the inclined side edges thereof having a corrugated section unitary with said web and parallel to the divergent side edges thereof, the corrugated members being oppositely inclined and adapted to embed themselves in the direction of their length into the material during the driving of the fastener, thereby providing anchorage in the material and preventing separation of the opposed pieces.

The penetrating end of the wedge-shaped central web is provided with beveled teeth each preferably having an undulating entrant and re-entrant portion comprising a rounded beveled apex and a rounded beveled root, said teeth being flat at the flat central web and curved at the corrugations. The teeth thus formed cause the pieces being joined to simultaneously slide across the flat surfaces of the central web during the forced approach thereof and simultaneously exert a draw-shear cutting action of the serrated entering end on the fibre of the material both in the direction of approach of the opposed pieces and in the direction of the penetration of the fastener.

It will be appreciated that divergently disposed corrugations or a flat central web, or the combination of divergently disposed corrugations and a flat central web are not essential to the attainment of all of the advantages of the present improvements.

Other and further objects will appear hereinafter.

The above mentioned advantages of the invention are accomplished by means of the improvements disclosed in the accompanying drawings forming a part of the specification, and in which:

Figure 1 is a face elevation of one embodiment of the improved fastener.
Fig. 2 is an underneath plan view of the fastener showing the cutting edge. Fig. 3 is a cross section taken on line 3—3 of Fig. 1, illustrative of the beveled cutting edge.

Fig. 4 is a cross sectional view of a modified form of the beveled cutting edge. Fig. 5 is an enlarged view of a short section of the flat serrated beveled penetrating end and cutting edge shown in either Fig. 3 or 4 and illustrative of the draw-shear cutting action of the rounded entrant apexes re-entrant serrated tooth portions on the fibre of the material being joined.

Heretofore toothed fasteners have been produced by first corrugating a metallic strip and thereafter grinding, shearing or milling one edge to produce a series of teeth on the penetrating end of the fastener, or by slitting a ribbon into strips producing blunt teeth and then corrugating and thereafter sharpening the teeth. Such prior fasteners were not characterized by teeth having a swage-hardened penetrating end, or by a continuous swaged cutting edge along the penetrating end thereof, or by curved teeth, or by curved teeth having rounded apexes and rounded roots, or by a flat central web having swage-beveled teeth.

The finished fastener, in the embodiment of my invention shown in Fig. 1, comprises a relatively thin piece of metal having a wedge-shaped preferably flat central web 7 and corrugations 8 and 9, said web being between the corrugations. The edges of the web at the sides thereof are inclined at 10 and 11 so that the web is narrower at the driving end 12 of the fastener than at the penetrating end 13. The single-beveled penetrating end 13 of the fastener is swaged, beveled and serrated to produce a continuous swage-hardened beveled undulated surface 15 and an uninterrupted undulated sharp-cutting edge 14 unitary with one of the relatively wide longitudinal side faces 20 of the fastener. This swage-hardened edge is better adapted to withstand deformation during the driving of the fastener, and to effect a drawing cutting action of the fibre than the soft cutting edges of fasteners of the prior art.

The swage-hardened metal 15 of the penetrating end 13 is hardened by compression during the swage-beveling and swage-severing of the metallic ribbon into strips and is indicated by the closely shaded portion 10 in Fig. 3 and the portion 12a in Fig. 4.

In the preferred embodiment of my fastener I employed a single-beveled swaged penetrating end 13 of toothed or serrated appearance in plan view as is best illustrated in Figs. 1, 2 and 3. The penetrating end has a beveled swaged surface 15 oblique to the median plane of the fastener as illustrated in Figs. 2 and 3, the cutting edge being unitary with one of the two relatively wide longitudinal side faces of the fastener and extending the length of the penetrating end therewith, thereby forming a single-beveled penetrating end 13 provided with a series of rounded entrant apexes 16 and rounded re-entrant roots 17 the outer edges of which form a continuous serrated knife-like cutting edge 14 defining a series of teeth, each tooth having a relatively narrow swage-beveled side face 15 which is curved and extends oblique the median plane of the fastener. The reference characters 6a, 1a, 12a, 19a and 20a of Fig. 4 correspond to elements 5, 7, 12, 19 and 20 respectively of the other figures of the drawing.

I find that to secure straight driving of the fastener into the material, namely to preclude deflection of the fastener either to the right or to the left of a given line during the driving operation, this can be accomplished in one of several ways, one of which is by increasing or decreasing the pitch of the teeth and the beveled angle thereof. Another method is by positioning the cutting edge 14 of the fast central web at an oblique distance from the medial plane Y-Y of Fig. 2 of the fastener. The configuration of the penetrating end may be produced in a variety of beveled toothed formations and the swage-hardened cutting edge 14 may be unitary with one relatively wide longitudinal side face of the fastener as shown in Figs. 2 and 3, or the cutting edge 14a may be formed by the intersection of two swage-beveled surfaces 15a—15a defining a cutting edge lying within the confines of the longitudinal side faces 2a—2a of the strip as shown in Fig. 4.

In the divergent type fastener the oppositely inclined corrugations 8 and 9 are integral with the side edges of the web and the cutting edge 14 follows the contour of the corrugations 8 and 9 respectively. In the divergent type fastener where the central web 7 is straight and lies in a plane parallel to the median plane of the fastener, as indicated by the line Y-Y of Fig. 2, the corrugations 8 and 9 project laterally from the inclined sides 10 and 11 of the web. The corrugations 8 and 9 project laterally from the inclined edge 11 of the web, and thus the corrugations 8 and 9 occupy a divergent relation to each other.

By swage-beveling, swage-hardening, swage-serrating and swage-severing a metallic ribbon into strips, each strip has a swage-beveled hardened serrated sharp-cutting edge on the penetrating end thereof, and is adapted to the manufacture of my improved corrugated fasteners with no further treatment except to corrugate the strip transversely the penetrating end and to sever suitable lengths thereby producing finished fasteners, which are burnished and buff-free, without loss of metal.

In practice I find it desirable to produce fasteners with relatively fine teeth. In the prior practice where the teeth are formed subsequent to the corrugating operation, the apexes of the teeth are disposed in the median plane of the fastener. Some of the apexes of the teeth of my fasteners may be in such median plane or they may be in parallel lines at each side of the median plane or they may be unsymmetrically arranged, depending on the size of the teeth with reference to the depth of the corrugation. Thus various tooth patterns are available for particular uses or for use with different varieties of wood.

In corrugating my fasteners subsequent to forming the teeth, I form curved beveled toothed surfaces at the crest of the corruga-
tions in combination with a wavy cutting edge transverse the toothed edge and following the configuration of the corrugations as shown in Figs. 1 and 2.

The beveled formed projection of the entrant and re-entrant portions of the penetrating end of the fastener comprises rounded apexes merging into rounded roots 17, and in combination with the continuous inclined swage-hardened sharp-cutting edge 14 thereof form gage-75
shaped cutting edges at each tooth root thereby enabling the fastener to penetrate the material easily and to shave-cut its way cleanly through the fibre with a draw-shear action similar to that of a woodworker's gouge. The fastener thus drives easily and cuts its way cleanly through the wood or other material when driven either with or across the grain. The divergent relationship of the corrugated members 8 and 9 imparts to the fastener a characteristic action in drawing together two pieces of wood or other material 18, so that the pieces are drawn into forcible contact by the act of driving the fastener, and the material freely slides across the flat surfaces of the central web during the forced approach of the opposed pieces of material. The fibre of the material is compressed and caused to contact simultaneously the curved inclined beveled cutting edges 14 of the apexes 16 and the roots 17 of the entrant and re-entrant portions of the teeth or serrations, as is shown in Fig. 5, thereby producing a draw-shear shaving action on the fibre both in the direction of approach of the opposed pieces of material and in the direction of penetration of the fasteners.

As a result of my novel rounded entrant and re-entrant, beveled, serrated construction of the penetrating end of the flat central wedge-shaped web, the web portion of my fastener, when driven, penetrates the material without producing voids or air spaces adjacent the flat surfaces of the central web and the material hugs the flat sides of the web thus providing close firm contact between the material and the fastener throughout its length.

I contemplate as being included in these improvements all such changes, variations and departures from what is thus specifically illustrated and described as fall within the scope of the appended claims.

I claim:

1. A divergent serrated fastener comprising a swage-hardened, beveled, sharp-cutting, serrated edged strip, swage-severed from metallic ribbon, said strip having a relatively flat web and corrugated portions at the respective side edges of the web in divergent relation to each other, said relatively flat web having a serrated, beveled, continuous, sharp-cutting edge on one side edge of the fastener, said cutting edge lying in a plane parallel with the medial plane of the corrugations of the fastener.

2. A divergent corrugated fastener having a flat central web, comprising a strip of metal swage-beveled and swage-severed from metallic ribbon to provide a swage-hardened continuous sharp-cutting toothed entering end consisting of a series of teeth each defined by inclined intersecting side surfaces, said series of teeth having rounded tooth apexes and rounded tooth roots, said entering end being oppositely beveled and of V-shaped appearance when viewed in transverse cross section, said fastener being corrugated transverse the toothed edge to produce a wavy cutting edge adjacent to the central flat web.

3. A fastener as defined in claim 2 in which the entering end is serrated throughout its length and the flat central web is wedge-shaped with the sides thereof diverging from the driving to the central end, the corrugations on the opposite sides of said web being parallel with the sides of the web respectively such that said fastener when driven into abutting pieces of wood is adapted to draw said pieces into forced fixed contact by the act of driving the fastener, thereby causing the pieces to simultaneously slide across the flat surfaces of the central web during the forced approach thereof and simultaneously exert a draw shear cutting action of the serrated entering end on the fiber of the material both in the direction of approach of the opposed pieces and in the direction of the penetration of the fastener.

4. A fastening device comprising a length of metallic strip having a relatively thin wedge-shaped web and corrugations on either side of said web, a penetrating end on one edge of said strip having a beveled serrated surface defining a series of teeth having rounded tooth apexes and rounded tooth roots the outer edges of which together form a continuous serrated knife-like cutting edge.

5. A fastening device comprising a length of metallic strip having a relatively thin wedge-shaped web and corrugations on either side of said web, a penetrating end on one edge of said strip having a beveled serrated surface defining a series of teeth having rounded tooth apexes and rounded tooth roots, the apexes of said teeth being unsymmetrically positioned with respect to the medial line of the corrugations and the outer edges of said teeth together forming a continuous serrated knife-like cutting edge.

6. A corrugated fastener comprising a metallic strip having a swaged, beveled, sharpened serrated penetrating end on one edge of the strip and an intermediate, wedge-shaped central web, corrugations on the opposite sides thereof parallel with the sides of the web respectively, said penetrating end having a continuous undulating cutting edge extending the full length thereof, said serrations having rounded apexes and rounded roots unsymmetrically arranged along the contour of the penetrating end presenting a series of relatively small teeth, said serrations each having curved beveled side surfaces merging with said rounded apexes and rounded roots, said serrations adapted to draw shear cut the material penetrated both with and across the grain during the driving of the fastener.

7. A divergent corrugated fastener having a relatively thin wedge-shaped central web comprising a strip of metal swage-beveled and swage-severed from metallic ribbon to provide an entering end consisting of a series of teeth each defined by inclined intersecting side surfaces, said series of teeth having rounded tooth apexes and rounded tooth roots, said entering end being beveled on both sides and V-shaped when viewed in transverse cross section defining a cutting edge lying within the confines of the longitudinal side faces of the strip, said fastener being corrugated transversely on either side of said central web to produce an undulating cutting edge adjacent thereto.

8. A divergent corrugated fastener having a flat central web, comprising a strip of metal swage-beveled and swage-severed from metallic ribbon to provide a swage-hardened continuous sharp-cutting toothed entering end consisting of a series of teeth each tooth being defined by a beveled side surface which is curved and extends oblique to the medial plane of the fastener, said series of teeth having rounded tooth apexes and rounded tooth roots, said fastener being corrugated transverse the toothed edge to produce a wavy cutting edge adjacent to the central flat web.
9. A fastener as defined in claim 8 in which the entering end is serrated throughout its length and the flat central web is wedge-shaped with the sides thereof diverging from the driving to the entering end, the corrugations on the opposite sides of said web being parallel with the sides of the web respectively such that said fastener when driven into abutting pieces of wood is adapted to draw said pieces into forced fixed contact by the act of driving the fastener, thereby causing the pieces being joined to simultaneously slide across the flat surfaces of the central web during the forced approach thereof and simultaneously exert a draw shear cutting action of the serrated entering end on the fiber of the material both in the direction of approach of the opposed pieces and in the direction of the penetration of the fastener.

10. A fastener comprising a length of corrugated metal having a series of teeth, each of said teeth being defined by a beveled side face which is curved and extends oblique the medial plane of the fastener.

11. A swaged toothed fastener comprising a metallic strip having a series of relative narrow faces at its blunt driving end and swaged toothed penetrating end and intermediate relatively wide faces which are bent and rebent to form corrugations extending transverse the driving end and the toothed penetrating end, the face of each said teeth at the penetrating end being defined by a relatively narrow swaged beveled side face which is curved and extends oblique the relatively wide corrugated faces.

12. A swaged toothed fastener comprising a metallic strip having a series of relatively narrow faces at its blunt driving end and swaged toothed penetrating end, and intermediate relatively wide faces which are bent and rebent to form corrugations extending transverse the driving end and the toothed penetrating end, the face of each said teeth at the penetrating end being defined by a relatively narrow swaged beveled side face which extends oblique the relatively wide corrugated faces.

13. A toothed fastener comprising a relatively thin flat metal strip having a beveled swaged toothed penetrating end, each said teeth being defined by a beveled curved face oblique to the wide face of the strip, said strip adapted to be driven into adjoining pieces of wood or like material to prevent the relative movement thereof.

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