My invention refers to sheet metal shapes (which expression is meant to comprise also endless sheet metal strips, bands, sheets and the like) and it concerns more particularly the distribution of metal in such shapes and the manner of changing the distribution of metal and at the same time also the configuration of the shape. It is a particular object of my invention to change the configuration of narrow sheet metal strips by reducing or increasing the length and curving the strip in its own plane without producing folds in the metal.

According to the present invention this change of configuration is brought about by means of a device comprising two pairs of gripping jaws, the jaws of each pair of jaws being arranged to be pressed against each other so as to grip part of the metal and the pairs being arranged to be then moved towards or away from each other about a common centre so as to upset or stretch the piece of sheet metal enclosed between them.

The advantage offered by this mode of proceeding is particularly conspicuous when bending angular and similar pieces, it being thus rendered possible, for instance, to upset one web of an angle iron in longitudinal direction so as to curve it in its own plane without the other web suffering any change of form other than a simple bending. In consequence of this mode of proceeding the strength of the material is not impaired and owing to the fact that the upsetting results in an accumulation of metal in certain parts of the strip or other shape thus acted upon certain parts can even be made stronger by this method.

In applying this invention to particularly thin sheet metal I prefer using pairs of jaws in which the jaws disposed on the same side of the sheet metal shape are formed with interlocking projections resembling combs, whereby these jaws are enabled to prevent the sheet metal from giving way during the upsetting operation. In this manner the formation of folds is rendered impossible, even in the case of very thin sheet metal.

The operation of the work piece between the jaws by means of a pedal lever, the jaws being then moved towards each other by means of a hand lever, so that the attendant is enabled to guide the work piece with one hand and to bring about the upsetting movement with the other hand. I may, however, also effect both these operations by means of a single pedal lever which first operates the closing of the jaws and thereafter the upsetting movement. Obviously the pedal and hand levers can also be replaced by mechanical means driven by an engine of some sort.

In the drawings affixed to this specification and forming part thereof several forms of a device and a sheet metal shape embodying my invention are illustrated diagrammatically by way of example. In the drawings

Fig. 1 is a plan view illustrating a pair of jaws arranged for upsetting sheet metal shapes on being moved in a circle about a central point.

Fig. 2 is a similar view showing the position of the jaws after the upsetting operation has come to an end.

Figs. 3-5 illustrate an angular shape before and after undergoing the upsetting operation, it being understood that the thickness of the walls of this shape is greatly exaggerated in the drawing.

Fig. 3 is a plan view showing in dotted lines how upsetting one of the webs is effected in its own plane.

Figs. 4 and 5 are perspective views of this shape before and after upsetting, respectively.

Fig. 6 is a side elevation of an upsetting machine provided with jaws resembling those shown in Figs. 2 and 3.

Fig. 7 illustrates another form of upsetting device, and

Figs. 8, 9 and 10 illustrate several details of the device shown in Fig. 7, these details being, however, drawn to a larger scale.

Fig. 11 is a plan view illustrating at a smaller scale a device allowing upsetting and stretching the work piece in a single operation.

In the modification illustrated in Figs. 1 and 2, only one jaw of each pair of superim-
posed jaws is shown. The jaws 2 and 5 which are here shown are formed after the manner of cylinder segments. In order to prevent the work piece from giving way sideways, whereby folds would be formed, the jaws are formed with tooth-like extensions 9 and 10, the extensions of one pair of jaws projecting into the gaps between the extensions of the other pair, and the abutting surfaces of these extensions being very slightly recessed in order to prevent their clamping between them that portion of the work piece which shall be upset, such upsetting being accompanied by an accumulation of metal in the upset portion. The interlocking extensions 9 and 10 are formed on circular lines. The jaws are mounted on two cylinder segments 11 and 12, which are, however, smaller than half-cylinders and are surrounded by a casing 13 in which the cylinder segment 11 is fixed by a key, while segment 12 can be moved by means of a lever 28 relative to segment 11 about its centre in the direction of the arrow 30. With a pair of jaws such as here shown an upsetting of a piece of sheet metal can be effected as shown by a hatched portion 14 in Fig. 3, this segment, however, disappearing altogether in the finished article, inasmuch as the metal contained in this segment is forced into the adjoining portion of the work piece. Several such upsetting operations produced in the points 15, 15 in Fig. 3 result in a curving of the strip in its own plane without the other web of the angular shape shown in Figs. 3–5 and extending at right angles thereto suffering any change of form except a slight bending, provided that the work piece be applied against the jaw in such a manner that this web always extends through the centre point of the cylinder segments 11, 12, as shown in dotted lines in Figs. 1 and 2.

Fig. 5 shows that the web which has been upset between the jaws presents an accumulation of metal which is exaggerated in the drawing for the sake of clearness. In the upsetting machine illustrated in Fig. 6, 13 is the casing surrounding the two bottom cylinder segments 11, 12, while 16 is the casing surrounding the top cylinder segments 17, 18. The locking bolt 19 serves as a stationary abutment for the top cylinder segments, another bolt 20 movable in the casing 13 can be lifted and lowered by means of a rod 21 and pedal lever 22. Of the top cylinder segments one is fixed in place, while of the bottom cylinder segments the one corresponding to the fixed top segment is secured against rotation but can be displaced axially in the casing 13.

Upsetting is effected in this device by means of a hand lever 23, forming part of the lower bottom segment 12, this hand lever carrying a pin 24 which extends into the eye of a corresponding lever 25, extending from the corresponding upper cylinder segment 18, so that the two angularly movable cylinder segments are coupled for common angular movement, while being free to be displaced axially relative to each other.

In the upsetting device illustrated in Fig. 7, which is, for instance, used in upsetting plane sheet metal strips, the means for gripping the work piece as well as the upsetting means are operated one after the other by means of a single pedal lever. The jaws are mounted on a plate 31, carried by a support 30. Two pairs of jaws 32, 33 and 34, 35, respectively, which are substantially like those shown in Figs. 2 and 3, are mounted on arms pivoted to a common journal 46. The arms of the top jaws 32, 33 have thin flexible portions and allow being bent so that the top jaws can be forced down upon the bottom jaws. The pairs of jaws can be moved relative to each other by rocking the arms about their pivot in opposite directions. The gripping of the work piece and the operation of the upsetting device are controlled by a pedal lever 36 which is connected by a link 37 to a cam shaft 38. Upon the pedal lever being depressed the shaft 40 is rotated and a cam 39 on the shaft is made to act on two parallel rock levers 42, the free ends of which engage two vertical slides 44, 45, extending through holes in the jaws and fixed to the top jaws 32, 33 so as to force the latter down upon the bottom jaws and to grip the work piece. On a further depression of the pedal lever 36 cam 40 will force a tooth 47 formed thereon onto an extension 52 formed on a connecting rod 48 having its ends pivoted to two pairs of toggle levers 49 linked together by the shaft 48 being depressed by the tooth 47 the toggle levers 49 will be rocked so as to forcibly move the slides 44, 45 and the pairs of jaws towards each other, thereby upsetting the work piece. Two springs 50, 51 inserted between the slides 44, 45 serve for forcing the jaws back into their initial position after the pedal lever has been released and the top jaws have been returned into their position of rest.

The pair of jaws illustrated in Fig. 11 is arranged for circular rocking motion about a common centre. A sheet metal strip 70 inserted between the two pairs of jaws of this kind, will, on the jaws being rocked about their centre, be upset in the portion adjoining one of its edges, while the portion adjoining the other edge will be stretched as shown by way of example in the drawing.

I wish it to be understood that I do not desire to be limited to any details of configuration, operation and construction shown and described for obvious modifications will occur to a person skilled in the art. I claim: 1. The method of producing a change of form in a piece of sheet metal, comprising...
gripping by their opposite surfaces two portions of such piece and forcibly moving said portions in opposite directions around a common center in the plane extending between said surface while preventing the intermediate portion from bending or folding.

2. Device for producing a change of form in a piece of sheet metal, comprising two pairs of gripping jaws movable in opposite directions relative to each other around a common axis extending at right angles to the plane extending between the jaws of each pair.

3. Device for producing a change of form in a piece of sheet metal, comprising two pairs of gripping jaws movable in opposite directions relative to each other around a common center and arc-shaped extensions on adjoining edges of the jaws of each pair, the extensions of one jaw projecting into the gap separating the extensions of the other jaw.

4. Device for producing a change of form in a piece of sheet metal, comprising two pairs of gripping jaws having the form of cylinder segments, each pair being capable of a closing movement and of an additional movement at right angles thereto.

5. Device for producing a change of form in a piece of sheet metal, comprising two pairs of gripping jaws movable in opposite directions relative to each other around a common axis extending at right angles to the plane extending between the jaws of each pair.

6. Device for producing a change of form in a piece of sheet metal, comprising two pairs of gripping jaws having the form of cylinder segments, each pair being capable of a closing movement and of an additional movement at right angles thereto, and a cylindrical casing surrounding said jaws.

7. In a sheet metal deforming device, two pairs of gripping jaws spaced from each other and movable around a common axis toward and away from each other, and means for engaging the metal between the spaced pairs of jaws to positively prevent lateral bending or folding between said spaced pairs of jaws during the deforming operation.

8. A device for producing a change in form in a piece of sheet metal comprising two spaced pairs of gripping jaws for gripping at spaced points the metal to be deformed, said jaws being movable relative to each other in opposite directions around a common axis at right angles to the plane of the sheet metal clamped between the jaws, and means between the spaced pairs of jaws to support the opposite surfaces of the metal to prevent bending or folding during said deformation.

9. A device for deforming relatively thin sheet metal comprising pairs of spaced gripping jaws, the jaws of each pair having a closing movement for gripping the opposite surfaces of the metal to be deformed, and an additional circular deforming movement around a central axis at right angles to the closing movement, and metal supporting means between the spaced pairs of jaws to positively support the opposite surfaces therebetween during said circular deforming movement.

10. A device for deforming sheet metal comprising two spaced pairs of segmental gripping jaws, the jaws of each pair being capable of a closure movement to clamp the opposite surfaces of the metal, and a circular movement at right angles to the aforesaid closing movement, and supplemental means intermediate the spaced pairs of jaws to prevent lateral bending or folding of the sheet metal between the spaced gripping jaws during their secondary circular movement.

11. In a sheet metal deforming device of the class described, pairs of clamping jaws, the jaws of each pair being relatively movable toward each other to grip the opposite surfaces of the sheet metal, the pairs of jaws being relatively movable around a common center with respect to each other to deform the metal therebetween, means arranged between the spaced pairs of jaws to engage the opposite surfaces of the metal during the deforming operation to positively prevent bending or folding of the sheet metal between said spaced pairs of clamping jaws, and common means for causing clamping movement of the jaws of each pair and subsequent circular deforming movement of the pairs of jaws.

12. The method of producing a change of form in a piece of sheet metal which comprises gripping the metal at spaced points and moving the gripped portions in opposite directions around a common center while preventing the portion intermediate the gripped points from bending out of the plane of movement of the metal.

13. The method of producing a change of form in a piece of angularly shaped sheet metal which comprises gripping one flange of the piece at spaced points and moving the gripped portions toward each other and the other flange about a common center, and preventing the metal intermediate the gripped points from bending out of the plane of movement of the metal in the gripped flange.

In testimony whereof I affix my signature,

Hugo Junkers.