July 7, 1936. O. E. GIBSON 2,046,621

METHOD AND APPARATUS FOR EXPANDING SHEET METAL

Filed March 22, 1935 4 Sheets-Sheet 1

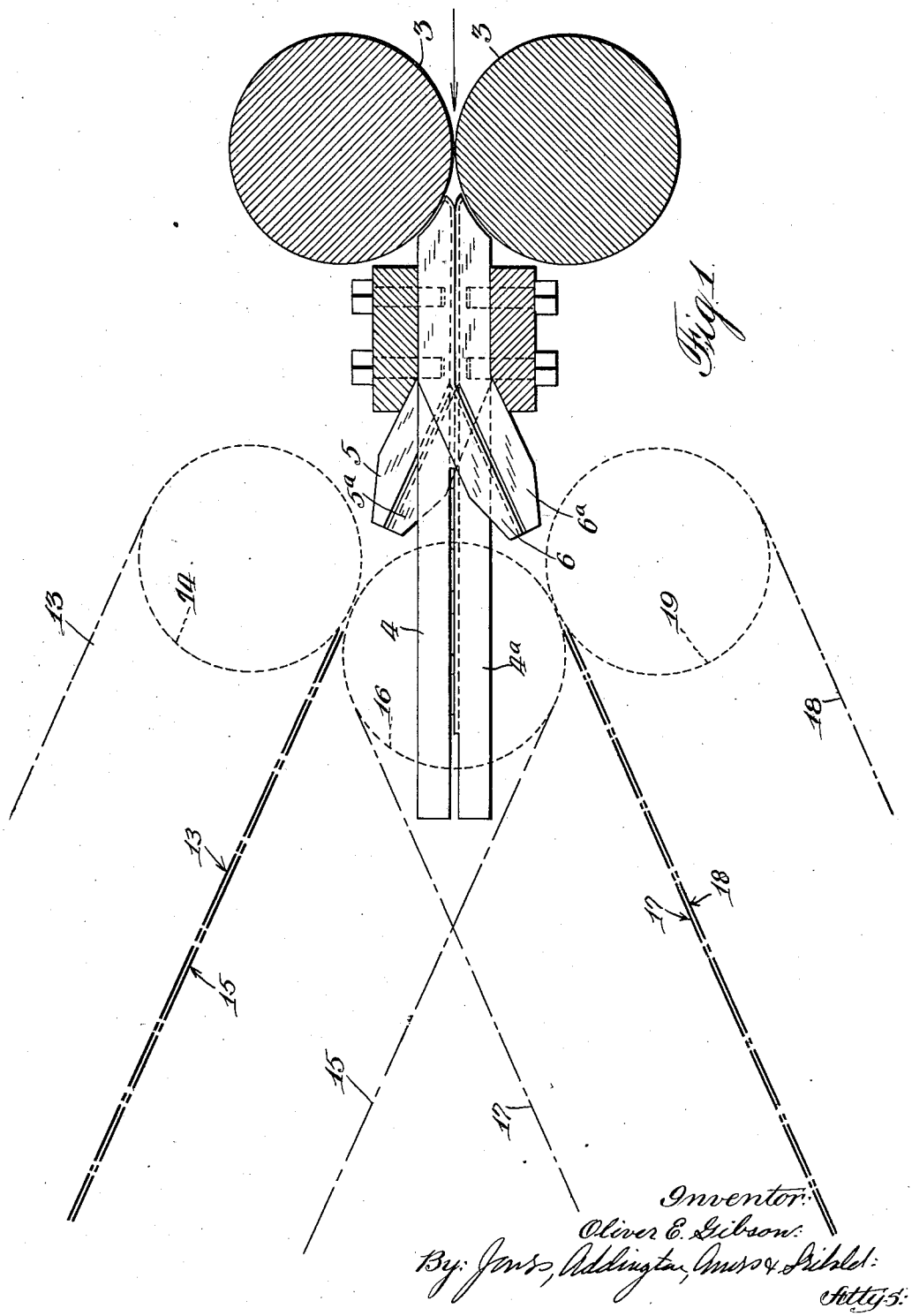

Fig. 1.

Inventor:
Oliver E. Gibson:
By: Jones, Addington, Ames & Bibler:
Attys.

July 7, 1936. O. E. GIBSON 2,046,621

METHOD AND APPARATUS FOR EXPANDING SHEET METAL

Filed March 22, 1935 4 Sheets-Sheet 2

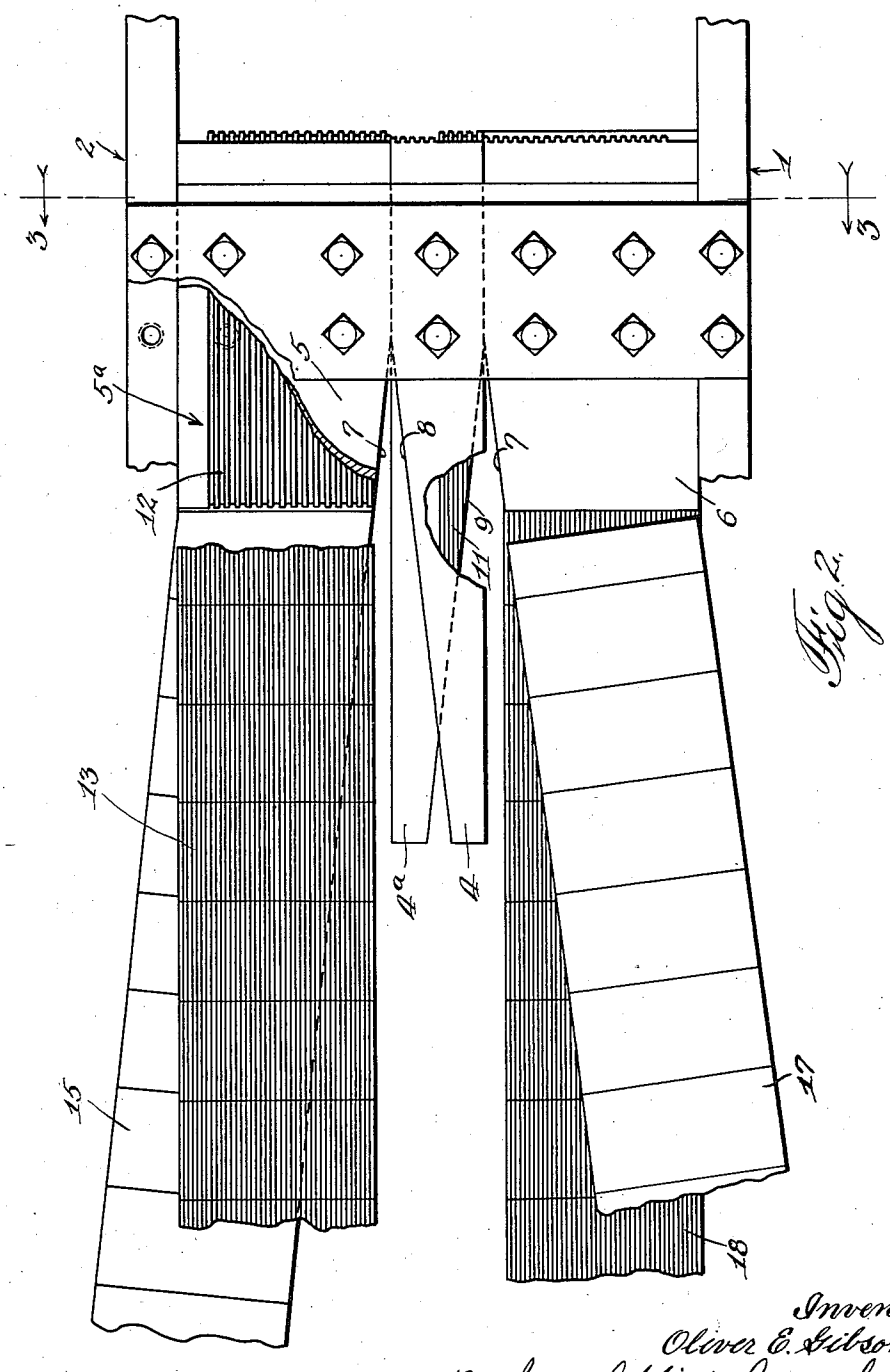

Fig. 2.

Inventor:
Oliver E. Gibson.
By: Jones, Addington, Ames & Seibold.
Attys.

July 7, 1936. O. E. GIBSON 2,046,621

METHOD AND APPARATUS FOR EXPANDING SHEET METAL

Filed March 22, 1935 4 Sheets-Sheet 3

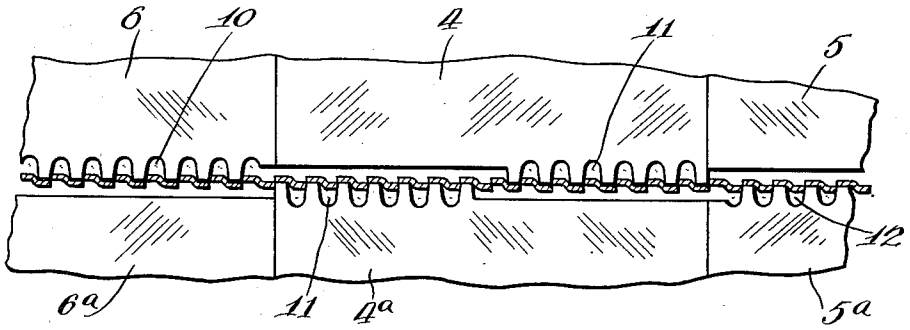

Fig. 3.

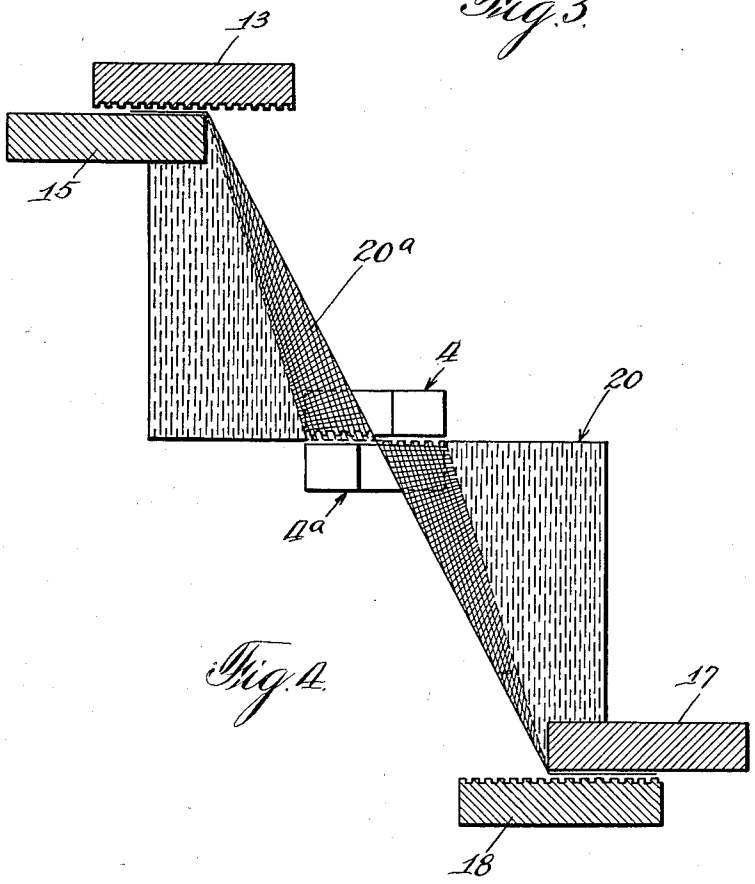

Fig. 4.

Inventor:
Oliver E. Gibson:
By: Jones, Addington, Moss & Seibold:
Attys.

July 7, 1936. O. E. GIBSON 2,046,621

METHOD AND APPARATUS FOR EXPANDING SHEET METAL

Filed March 22, 1935 4 Sheets-Sheet 4

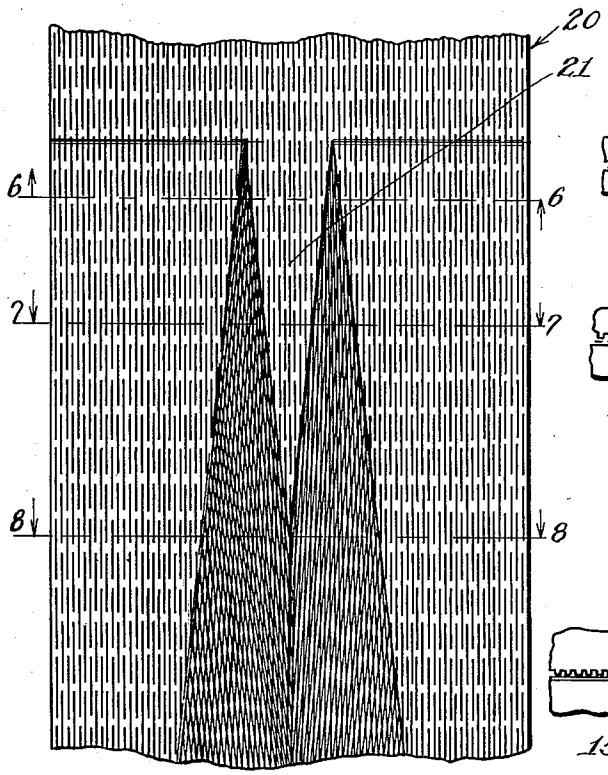

Fig. 5.

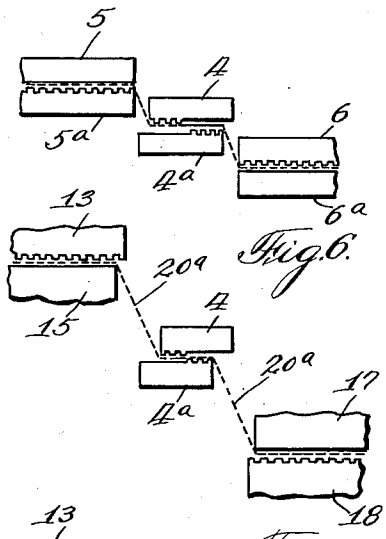

Fig. 6.

Fig. 7

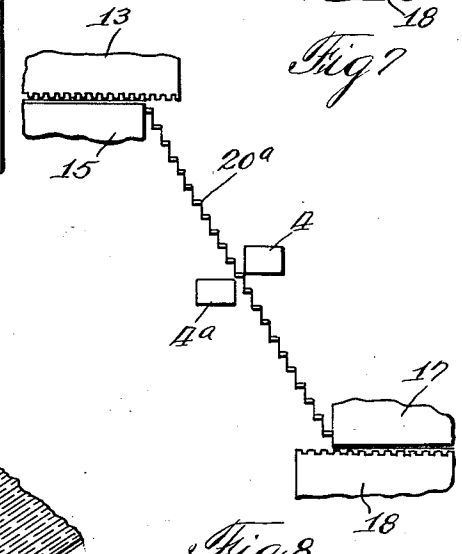

Fig. 8.

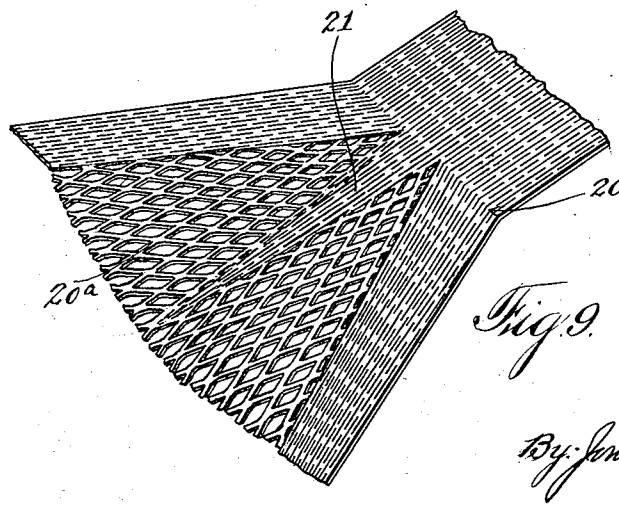

Fig. 9.

Inventor:
Oliver E. Gibson.
By: Jones, Addington, Ames & Seibald.
Attys

Patented July 7, 1936

2,046,621

UNITED STATES PATENT OFFICE

2,046,621

METHOD AND APPARATUS FOR EXPANDING SHEET METAL

Oliver E. Gibson, Chicago, Ill., assignor to United States Gypsum Company, Chicago, Ill., a corporation of Illinois

Application March 22, 1935, Serial No. 12,400

23 Claims. (Cl. 164—6.6)

This invention relates to a method and apparatus for expanding sheet metal, and more particularly to a method and apparatus whereby so-called expanded metal may be produced with the usual rapidity and the finished product be greatly improved.

The present invention is an improvement over existing machines wherein slitted sheet metal is expanded in a manner substantially as disclosed in Patent No. 917,715, issued to L. E. Curtis on April 6, 1909. In this patent the sheet of slitted metal is moved longitudinally over two diverging arms or supports which are arranged to deflect the sides of the sheet in opposite directions from the plane of the sheet, one-half of the sheet being deflected upwardly and the other half downwardly. The diverging supports are preferably moving feed chains between which the unexpanded sheet metal is directed and which are fixed in position relative to the sheets. The production of expanded sheet metal in this manner is common practice, and further explanation is believed to be unnecessary.

In producing expanded sheet metal by means of machines of the type disclosed in the above-named patent, the metal is expanded in a continuous V-shaped formation at an angle to the plane of the moving sheet as the slitted sheet is advanced, and it has been found that, due to the unequal stresses set up in the metal throughout the V-shaped formation, the transverse mesh and connecting bonds are not in straight lines when finally expanded but, instead, form curved transverse lines across the sheet, the transverse lines of the mesh being curved inwardly in the direction opposite the direction of movement of the metal. This forms what is commonly termed a fishtail alignment of the mesh and bonds. This results in a loss of material and detracts from the appearance of the product.

It is an object of the present invention to provide a method and apparatus for expanding slitted sheet metal in which the so-called fishtail is substantially completely eliminated and in which all of the transverse rows of mesh and bonds connecting the strands of the mesh are in substantially parallel straight lines.

Further objects will be apparent from the specification and the appended claims.

In the drawings:

Figure 1 is a somewhat diagrammatic side view of the one embodiment of the present invention with the feed rollers and a portion of the frame in section;

Fig. 2 is a top view of the embodiment illustrated in Fig. 1 with the feed rollers omitted and portions broken away for purposes of illustration;

Fig. 3 is a transverse sectional view through the fixed guide plates and taken on a line substantially corresponding to line 3—3 of Fig. 2;

Fig. 4 is a diagrammatic front end view of the partially expanded sheet as it is advancing through the machine with certain of the guide members and chains diagrammatically illustrated;

Fig. 5 is a fragmentary top view of one of the slitted sheets after being partially expanded;

Fig. 6 is a diagrammatic transverse sectional view taken on a line substantially corresponding to lines 6—6 of Fig. 5 and illustrates the relation of the guide members at a point where the metal has been slightly expanded;

Fig. 7 is a transverse sectional view taken substantially on line 7—7 of Fig. 5 and illustrates the relation of the guide members after the metal has been expanded somewhat more than illustrated in Fig. 6;

Fig. 8 is a diagrammatic view similar to Fig. 7 but taken on a line corresponding to line 8—8 of Fig. 5 and illustrates the expansion of the material at the point of release of the metal from the central guide plates; and

Fig. 9 is a perspective view of the slitted sheet after being partially expanded.

Referring to the drawings in detail, the embodiment illustrated may comprise any suitable frame for supporting the various parts and which may be provided with side members 1 and 2, between which the slitted sheet metal may be guided. Feed rollers 3 are driven from any suitable power source and arranged transversely of the machine, whereby the sheet metal may be fed therebetween in the direction of the arrow in Fig. 1.

The sheet metal is moved by the feed rollers 3 between suitable sets of closely associated guide plates which are mounted in superposed cooperating pairs on the frame, as illustrated in Figs. 1 and 2. These guide members comprise comparatively narrow elongated central plates 4 and 4a and closely associated guide plates 5 and 5a on one side, and plates 6 and 6a on the other side of the central guide members. The ends of all of these guide plates adjacent the feed rollers 3 are substantially in alignment, as illustrated, and the sheet metal is guided between the guide plates in a substantially horizontal plane during the first part of its movement therebetween. The opposite ends of the guide plates 5 and 5a and 6 and 6a diverge, as illustrated in Fig. 1, whereby the

opposite side portions of the slitted sheets are guided upwardly and downwardly, respectively, at predetermined angles to the plane of the moving sheet. The elongated guide bars or plates 4 and 4a extend considerably beyond the point of divergence of the side guide plates and are arranged to maintain a V-shaped central portion of the sheet unexpanded until released from the angular edges of the bars. The inner edges of the outside guide plates also diverge laterally from the point of vertical divergence and along the line indicated by the reference character 7. The top central guide bar 4 also diverges along its edge 8 relative to the line 7, while the edge of the lower bar 4a diverges along a line 9 relative to the edge 7 of the side plate.

Fig. 3 is a transverse section through these guide plates showing the plates grooved to provide a better guiding means for the slitted sheet metal. These grooves are arranged to correspond substantially to the width of the offset strands of the slitted metal, the metal being shown in section through the line of the bonds between the strands. As illustrated in this figure, as well as in Fig. 1 and diagrammatically in several of the other views, the top guide plate 6 is provided with grooves 10 while its associated lower guide plate 6a is provided with a smooth surface. As shown in Fig. 1, these plates 6 and 6a diverge downwardly from the plane of the sheet, and the inner edges of these plates also diverge laterally as shown in Fig. 2. It is desirable that the upper plate 6 should be grooved in order that the strands of the sheet metal may be retained in alignment until they are released from the grooves which terminate at the angular edge of the plate and are expanded by being drawn upwardly over the corner of the plate 6 as they are consecutively released from the grooves along the laterally diverging edge 7.

The edge 9 of the lower elongated guide bar 4a diverges laterally from the oppositely disposed edge 7 of the side guide plates and, therefore, substantially one-half of this lower plate is provided with grooves 11 adjacent the edge 9 whereby the metal guided between the plates 4 and 4a may be released and drawn over the angular edge of the bar 4a as the strands are released from the corrugations along the angular edge.

In a similar manner, and due to the fact that the plates 5 and 5a diverge upwardly, the upper guide bar 4 may be made interchangeable with the guide bar 4a so that, when superposed, the grooves 11 of the guide bar 4 will be oppositely disposed from the corresponding grooves in the bar 4a. The side plates 5 and 5a are the reverse of the plates 6 and 6a and, therefore, the plate 5a is provided with grooves 12, while the surface of the upper plate 5 is smooth. It will be apparent that the location of the grooves in all of the various plates might be reversed and satisfactory results would still be obtained. However, it has been found that somewhat better results may be obtained by an arrangement such as that just described.

After the diverging portions of the slitted sheet leave the guide members they are received between suitable movable guides or feed members which are angularly positioned so that the material continues to move in alignment with the diverging guide plates. These guide members are commonly called diverging arms and may comprise cooperating pairs of feed chains, similar to those illustrated and described in the previously mentioned patent.

In the present instance the upwardly diverging arm comprises an upper chain 13 which may be formed of links having parallel grooves therein, as illustrated in Fig. 2. This chain 13 is mounted on a suitable sprocket or pulley 14 and is parallel with the line of travel of the slitted sheet metal. An associated chain 15 is mounted on a pulley or sprocket 16 and is provided with links having a smooth surface, as illustrated. The chains 13 and 15 provide a feeding means for the unexpanded portion of one side of the sheet. The opposite unexpanded side is fed by downwardly diverging arms comprising an upper chain 17 mounted on a sprocket substantially in alignment with the sprocket 16 and having links providing a smooth surface, and a lower chain 18 mounted on a suitable sprocket 19 and having links provided with a surface having parallel grooves therein. The grooved chains 13 and 18 diverge vertically only, while the chains 15 and 17, which are the smooth surface chains and over the edge of which the metal is expanded, diverge both vertically and laterally, as illustrated in Fig. 2.

The movement of the sheet metal between the diverging chains is best illustrated in Fig. 4, in which the advancing edge of a sheet of slitted metal 20 is indicated by the reference character 20a. The angular edges 8 and 9 of the guide bars 4 and 4a allow the strands of the advancing sheet metal to be expanded thereover and retain a forwardly extending V-shaped horizontal portion 21 of the metal unexpanded, as shown in Fig. 5, thereby providing two V-shaped continuously expanding portions having a central unexpanded portion 21 therebetween.

Fig. 6 diagrammatically illustrates the beginning of the expansion of the metal by the fixed guide members and it will be apparent that by maintaining the central portion 21 unexpanded the metal will not be expanded at the beginning of the operation as rapidly as in prior devices wherein the rapid divergence of the arms cause an immediate rapid expansion of the mesh adjacent the point of divergence, thereby causing a fishtail alignment of the mesh and bonds transversely of the expanded sheet.

Fig. 7 indicates the relation of the chains and central guide bars at a point somewhat in advance of that illustrated in Fig. 6.

Fig. 8 illustrates the relation of the parts substantially at the apex of the unexpanded portion 21.

Fig. 9 illustrates the angular alignment of the mesh adjacent the unexpanded portion 21, and it will be noted that the transverse line of the mesh forms an angle having its apex on the median line of the sheet. This provides a convex or obtuse-angled transverse line of the mesh at this point, and it has been found that this angular formation is substantially entirely removed during the further expanding of the metal. In other words, the tendency for the transverse lines to become concave is compensated for by maintaining a portion of the sheet unexpanded beyond the apex of the divergence of the arms thereby maintaining a convexity or angular formation which compensates for the further tendency to produce concave lines.

Further modifications will be apparent to those skilled in the art and it is desired, therefore, that the invention be limited only by the prior art and the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. An apparatus for expanding slitted sheet

metal comprising means for causing the sheet to travel substantially longitudinally with respect to the slits, means for guiding and releasing an intermediate portion of the sheet along lines extending diagonally with respect to the slits, and means for guiding and releasing the two side portions of the sheet along lines extending diagonally with respect to the slits.

2. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane.

3. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having sheet releasing means diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having sheet releasing means diverging from the plane of the sheet oppositely to the divergence of said first sheet releasing means and also diverging laterally from said perpendicular plane.

4. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having two releasing edges lying substantially in the plane of the sheet being fed to the guiding means.

5. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having sheet releasing means diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having sheet releasing means diverging from the plane of the sheet oppositely to the divergence of said first sheet releasing means and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having two sheet releasing means lying substantially in the plane of the sheet being fed to the guiding means.

6. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having two releasing edges lying substantially in the plane of the sheet being fed to the guiding means and converging toward each other.

7. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having a releasing edge diverging from one of the aforesaid releasing edges.

8. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having a releasing edge diverging from one of the aforesaid releasing edges and lying substantially in the plane of the sheet being fed to said guiding means.

9. An apparatus for expanding slitted sheet metal comprising means for guiding and releasing an intermediate portion of the sheet, and means for guiding and releasing the two side portions of the sheet, the guiding and releasing means for one side portion of the sheet having a releasing edge diverging from the plane of the sheet being fed to the guiding means and also diverging laterally from a plane extending longitudinally of said sheet and perpendicularly thereto, the guiding and releasing means for the other side of the sheet having a releasing edge diverging from the plane of the sheet oppositely to the divergence of said first releasing edge and also diverging laterally from said perpendicular plane, said medial guiding and releasing means having a releasing edge diverging from one of the afore-

said releasing edges and lying substantially in the plane of the sheet being fed to said guiding means, the guiding and releasing means for the side portions of the sheet comprising means traveling with the guided portions of the sheet.

10. Apparatus for expanding slitted sheet metal comprising means for causing the sheet to travel substantially longitudinally with respect to the slits, and means for simultaneously expanding two laterally spaced V-shaped formations of the slitted sheet metal lying in two different planes, both of which are at an angle to the general plane of the sheet before it is expanded.

11. Apparatus for expanding slitted sheet metal comprising means for causing the sheet to travel substantially longitudinally with respect to the slits, means for expanding successive V-shaped forms of one portion of the slitted sheet, and means for simultaneously expanding successive V-shaped forms of another laterally spaced portion of the slitted sheet.

12. Apparatus for expanding slitted sheet metal comprising means for causing the sheet to travel substantially longitudinally with respect to the slits, means for expanding successive V-shaped forms of one portion of the slitted sheet, and means for simultaneously expanding successive V-shaped forms of another laterally spaced portion of the slitted sheet, said V-shaped forms lying in two different planes, both of which are at an angle to the general plane of the sheet before it is expanded.

13. A machine for expanding slitted sheets of metal comprising spaced diverging expander arms for guiding and expanding said sheets, and guide arms to guide a portion of said metal in a plane through the point of divergence, said guide arms cooperating to form a V-shaped expanding edge with the base of said V substantially on a line through the point of divergence.

14. In an expanding machine for a slitted metal sheet, laterally spaced diverging arms for guiding and expanding said metal, and forwardly extending guide arms arranged to retain a central portion of the metal sheet unexpanded beyond the point of divergence and in the plane of the sheet.

15. In an expanding machine, means for angularly expanding metal, and means within the included angle to retain a portion of said metal unexpanded and to enable its expansion as it moves beyond said last means.

16. In an expanding machine, movable feeding and guiding means to angularly expand sheet metal, and fixed guide means to retain a portion of said metal unexpanded within the included angle and enable its expansion as it moves therefrom.

17. A method of expanding slitted sheet metal comprising causing the sheet to travel in the general direction of the slits in the metal and expanding two laterally spaced V-shaped formations of the slitted metal as the sheet travels, all of the lines of the V-shaped formations extending diagonally with respect to the slits.

18. A method of expanding slitted sheet metal comprising causing the sheet to travel in the general direction of the slits and expanding successive V-shaped formations of one portion of the slitted sheet and also simultaneously expanding successive V-shaped formations of another laterally spaced portion of the slitted sheet as the sheet travels, all of the lines of the V-shaped formations extending diagonally with respect to the slits.

19. A method of expanding slitted sheet metal comprising expanding two laterally spaced V-shaped formations of the slitted metal, said two V-shaped formations lying in two different planes, both of which are at an angle to the general plane of the sheet before expansion, all of the lines of the V-shaped formations extending diagonally with respect to the slits.

20. A method of expanding slitted sheet metal comprising causing the sheet to travel in the general direction of the slits progressively expanding adjacent V-shaped areas in different planes and directing the expanded portions to merge in the same plane.

21. A method of expanding slitted sheet metal comprising expanding two laterally spaced V-shaped forms of the slitted metal while maintaining unexpanded a portion of the sheet between the expanded portions, all of the lines of the V-shaped formations extending diagonally with respect to the slits.

22. A method of expanding slitted sheet metal comprising expanding V-shaped forms of the slitted metal while maintaining unexpanded a V-shaped portion of the sheet between the expanded portions, all of the lines of the V shapes extending diagonally with respect to the slits.

23. Apparatus for expanding slitted sheet metal comprising means for causing the sheet to travel in the general direction of the slits, means for expanding two laterally spaced V-shaped portions of the slitted metal, all of the edges of the V-shaped portions extending diagonally with respect to the slits, and means for maintaining unexpanded a portion of the sheet between the expanded portions.

OLIVER E. GIBSON.