Feb. 8, 1938. H. K. BAKER 2,107,278

METHOD OF FORMING EXPANDED METAL

Filed Dec. 23, 1935 3 Sheets-Sheet 1

FIG.1.

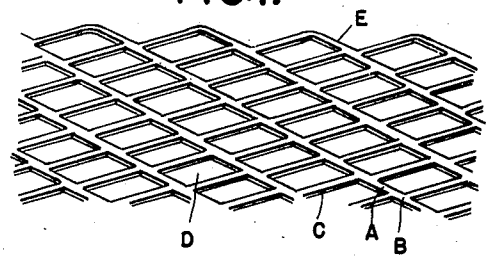


FIG.2.

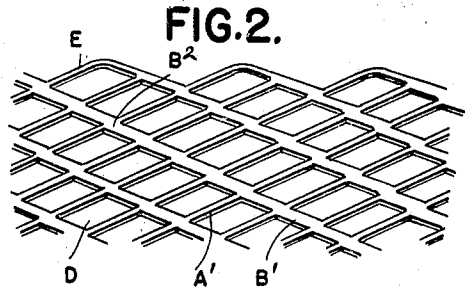


FIG.3.

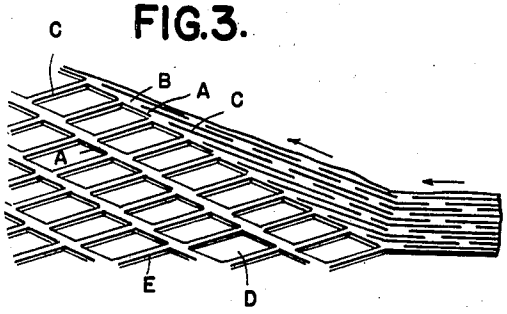


FIG.8.

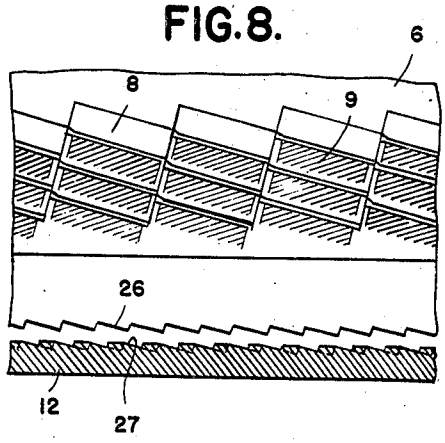


FIG.10.

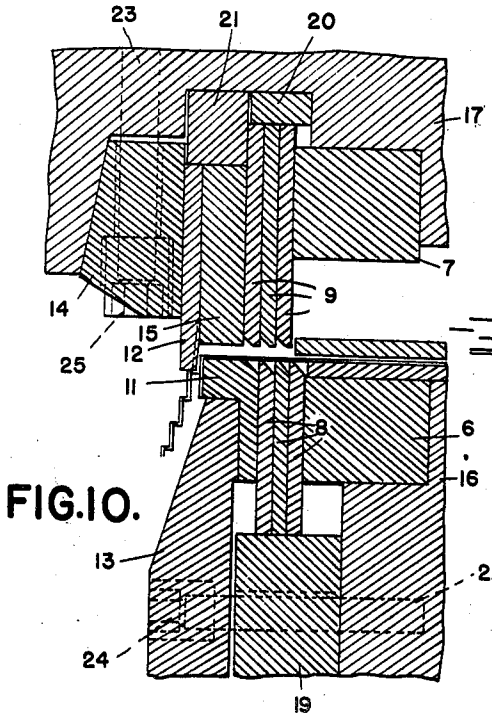
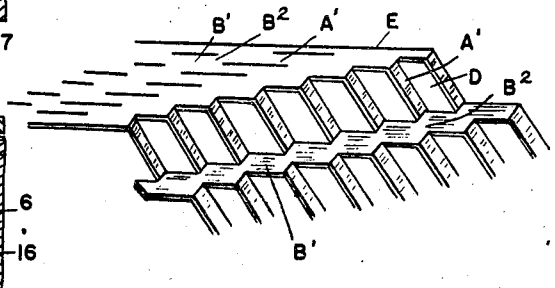


FIG.11.



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Feb. 8, 1938. H. K. BAKER 2,107,278

METHOD OF FORMING EXPANDED METAL

Filed Dec. 23, 1935 3 Sheets-Sheet 2

FIG.4.

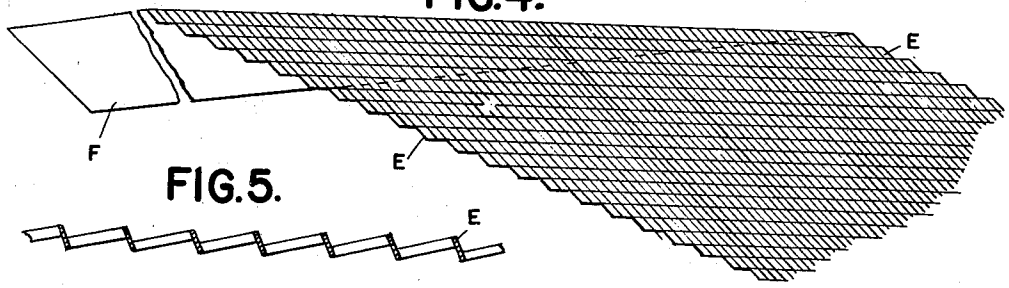


FIG.5.

FIG.6.

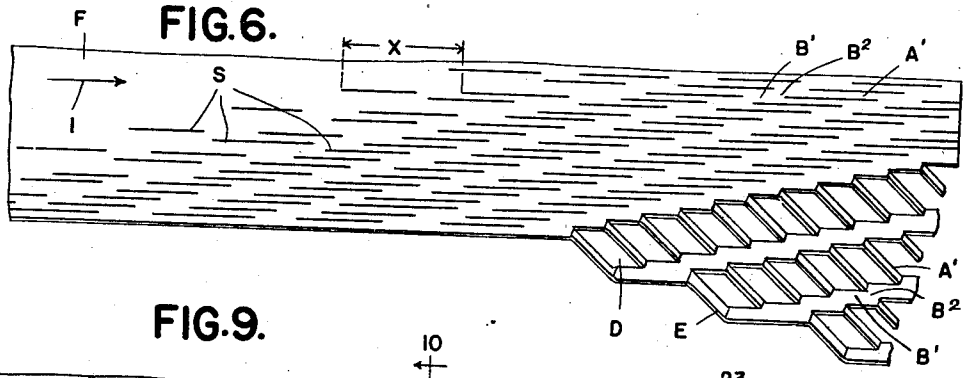
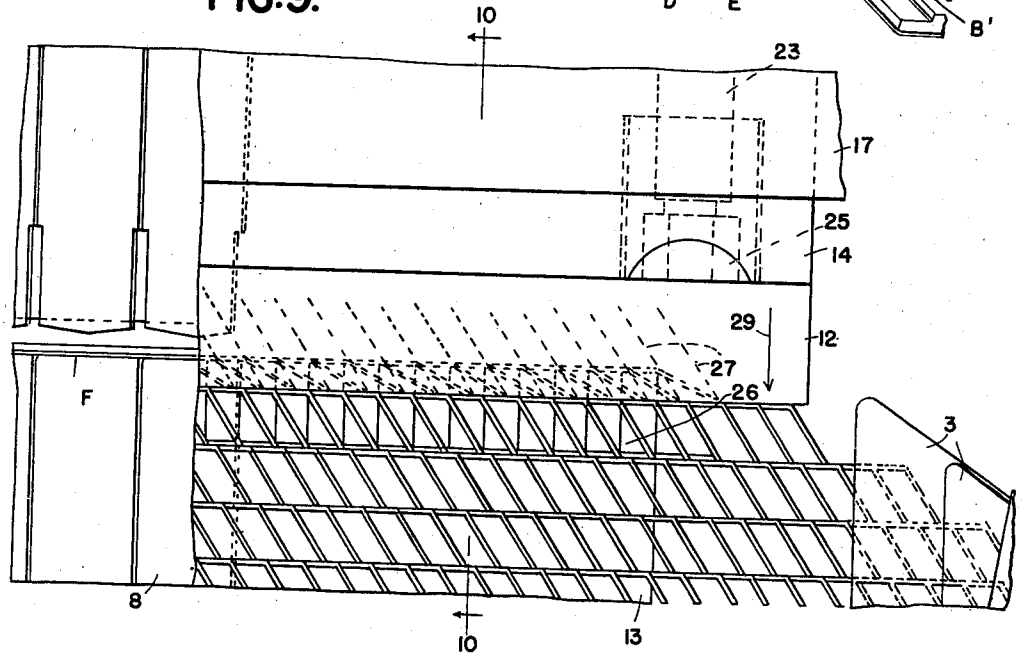


FIG.9.



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Feb. 8, 1938. H. K. BAKER 2,107,278

METHOD OF FORMING EXPANDED METAL

Filed Dec. 23, 1935 3 Sheets-Sheet 3

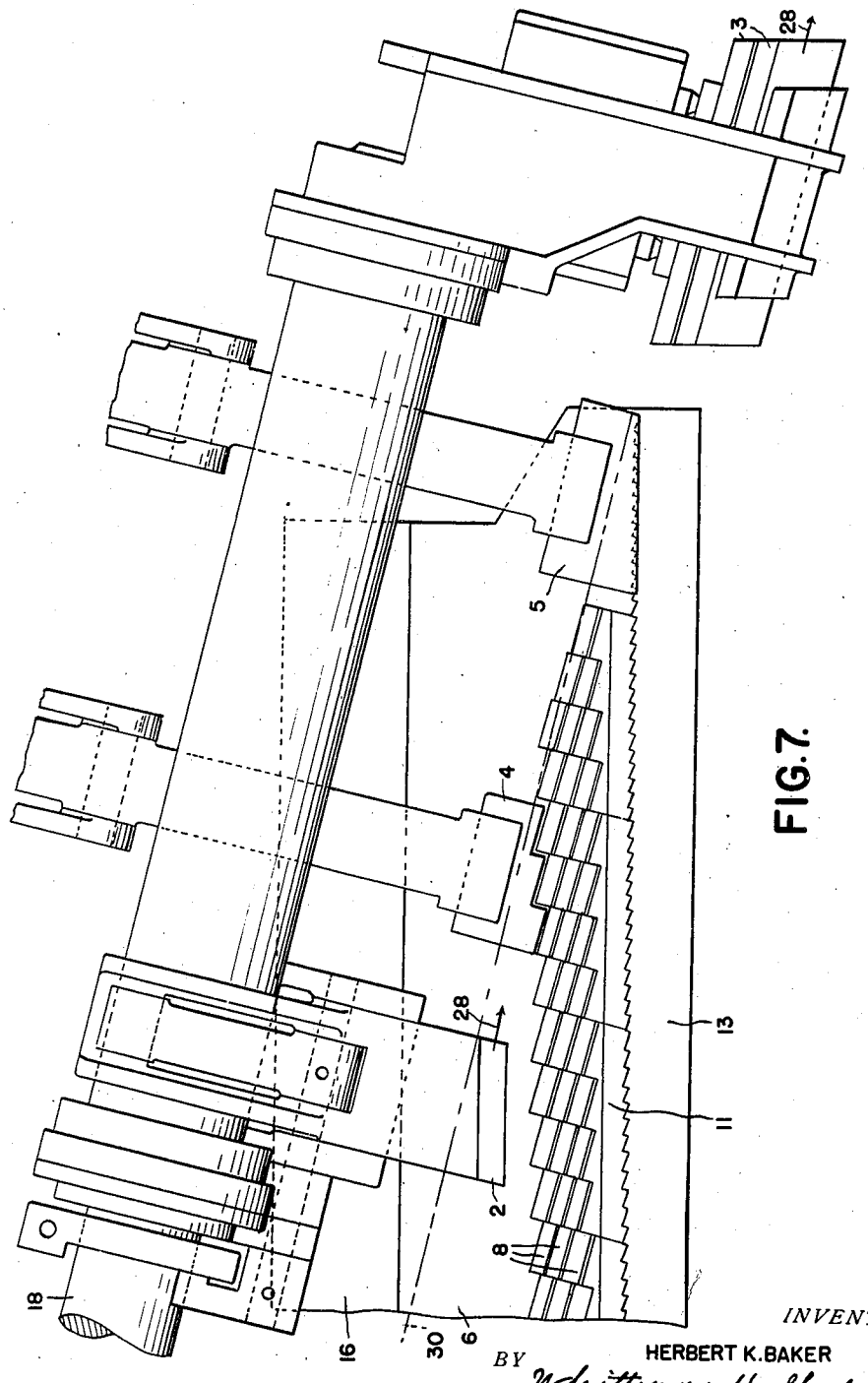


FIG.7.

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METHOD OF FORMING EXPANDED METAL

Herbert K. Baker, Kokomo, Ind.

Application December 23, 1935, Serial No. 55,884

11 Claims. (Cl. 164—6.5)

The invention relates to the manufacture of expanded metal and has for its object the production of sheets of expanded meshwork of improved strength and rigidity and having a high degree of uniformity. This product forms the subject matter of my co-pending application for patent, Serial No. 562,580, filed September 12, 1931, and the present application has for its subject matter the method and apparatus for forming such product.

In manufacturing one form of the product disclosed herein, the blanks are slitted parallel to their side edges to form relatively long and short bonded strands and to expand the slitted blank into meshwork, rows of long strands are deflected transversely from the plane of the blank to dispose successive series of short strands including the bonds in edgewise alignments parallel to each other while the opposite longitudinal margins of the expanded portion of the sheet are extended from the blank a distance apart at least equal to the width of the finished sheet as the strands are being deployed from the blank, in this way the meshwork is kept flat or in a single plane throughout, expansion thereby eliminating any unnatural twisting of the strands which would tend to weaken the meshwork sheet.

The bonds connecting the slitted strands, by reason of their greater width than the strands when disposed in substantially edgewise relation to the plane of the sheet, are the main factors imparting rigidity to the meshwork and the closer these bonds are coupled together in a series of bonds the more rigidity the finished sheets of meshwork will possess. To further enhance the rigidity of the meshwork sheets, another form of the product is manufactured following the same procedure as described above and embodied in this invention with certain modifications, in that the blank is slitted by an arrangement to form series of strands, and bonds between strands continuous with each other; these continuities of bonds become relatively wide stiffening members upon being disposed transversely to the strands in the meshwork sheets.

In carrying out the objects of my present invention, the blanks may be slitted in any suitable apparatus and subsequently expanded in another. The preferred arrangement, as embodied in this invention, contemplates the employment of separate slitting punches and expanding elements spaced apart but in close relation to each other. These slitting punches and expanding elements are mounted in a pair of cooperating press mechanisms arranged for the intermittent feed of blanks therethrough in a direction parallel to the slits formed, but diagonal to the mounting of series of slitting punches lengthwise of the apparatus.

Heretofore, there has been certain disadvantages encountered in the use of reciprocating press mechanisms designed for combining the slitting and expanding operations. The principal disadvantage was occasioned by the arrangement of the slitting punches to cut and expand a single series of strands lengthwise of the blank, requiring a slide for the mounting of these punches of considerable length for the area of work to be performed, therefore, of a size and weight too cumbersome to reciprocate at a high rate of speed. The slide being the main reciprocating part, its size and weight together with the length of travel or stroke determines the speed at which the apparatus may be operated.

Another disadvantage for obtaining high operating speeds from apparatus of former art of this character was that the slitting punches were required first to enter the blank to sever strands and continuing their movement until the strands were fully deflected which necessarily caused the moment of impact or load to occur a considerable distance up from the bottom of the stroke of the slide equal to the depth of expansion of a row of meshes thereby requiring a proportionate additional length of the slide travel or stroke in order to obtain smooth operation and prevent severe shocks and strains to the mechanism. These disadvantages materially held back development of this type of apparatus for high speed operation so necessary for efficient and economical production of light weight expanded metal, such as used for metal lathing.

To overcome the disadvantages encountered in former apparatus as mentioned above, the present invention employs the novel arrangement as disclosed herein of mounting the slitting punches apart from the expanding elements and said punches are disposed in groups of a plurality of slitting punches transversely of the apparatus in each group and with series of similar groups of punches extending lengthwise of the apparatus so that a multiple of series of slits are formed at each reciprocation of the press to produce rows of strands diagonally across the blank. By this arrangement the distance required for the mounting of the slitting punches is materially shortened in direct proportion to the multiple of transverse series of punches employed, so therefore, the slide carrying the upper set of punches is made more compact and lighter in

weight consistent with the stresses occurring to operate the apparatus at a high rate of speed without overstraining the mechanism.

In further considering the novel features of my invention it should be noted that the power required to deflect a row of slitted strands previously formed independent of the slitting operation is very small indeed, in fact of such little consequence that the deflection may be started at any point in the downward movement of the slide carrying the upper set of expanding elements without in any way straining the mechanism actuating the slide.

With the foregoing in mind, the apparatus embodied in this invention employs sets of slitting punches, expanding punches and dies mounted in two cooperating press mechanisms; one of these press mechanisms being carried by a reciprocating slide. These slitting punches are so arranged that in the step-by-step feeding, a blank first encounters the action of the slitting punches, and during further advancement of the blank in a direction lengthwise of the slits formed, a slitted area of the blank comes under the action of the expanding punches and dies. The expanding punches project down beyond the level of the cutting edges of the slitting punches disposed in the upper press mechanism and deflect a row of previously slitted strands in their downward movement before the slitting punches engage the blank. In this way, the slitting punches engage the blank substantially at the bottom of the stroke of the slide, consequently the main load or shock occurs at a point in the reciprocation of the slide least likely to strain the actuating mechanism, thereby permitting the slide to reciprocate with a short travel or stroke which further enhances the operating speed of the apparatus.

The specific advantages obtained from my invention will be readily understood by an examination of the accompanying drawings and specification.

In the drawings:

Figure 1 is a face view of a fragment of one form of the product manufactured to show the meshwork structure comprising relatively long and short bonded strands;

Figure 2 is a face view of a fragment of another form of the product manufactured to show the meshwork structure comprising strands and bonds with the bonds continuous with each other to form relatively wide stiffening members;

Figure 3 is a view of a portion of the slitted blank being progressively expanded by deflecting relatively long strands transversely from the blank to form the meshwork structure shown in Figure 1, the arrows indicating the direction of movement of the slitted blank as said blank is being progressively expanded;

Figure 4 shows a blank as may be taken from the apparatus in progress of manufacture including a portion of the blank expanded;

Figure 5 is an end view of the expanded portion of the sheet shown in Figure 4;

Figure 6 is a view of a fragment of a blank to show the progressive steps in manufacturing sheets of meshwork of the strand structure shown in Figure 2 as accomplished by the apparatus embodied in this invention;

Figure 7 is a partial plan view of the apparatus showing the relative positions of the lower slitting punches, expanding dies and the grip feed mechanism employed with the attendant hold-downs for holding the sheet stationary while the grippers are open and returning to their feeding position;

Figure 8 is an enlarged partial plan view of slitting punches, expanding punches and dies with the upper slitting and expanding punches shown in section as indicated by the shading lines;

Figure 9 is a partial view of the apparatus expanding a sheet with part of the mechanism broken away to show another view of the slitting punches;

Figure 10 is a sectional view of the apparatus at reduced scale taken as indicated by line 10—10 of Figure 9;

Figure 11 is a perspective view showing a small portion of the slitted sheet and a portion of the open mesh fabric expanded therefrom.

The reference character E indicates the longitudinal margins of the expanded sheet. In Figure 4, both the opposite longitudinal margins E are shown extended from the blank. Figure 5 shows the plane of the sheet throughout expansion.

The relatively long and short strands are indicated by C and A respectively and bonds by B; their relative positions before and after expansion are shown in Figure 3.

In the meshwork structure shown in Figure 2 series of bonds B^1 overlap each other and the overlap is indicated by B^2, the strands extending transversely from these continuities of bonds are indicated by A^1, and their relative positions before and after expansion are shown in Figure 6. The openings of the meshwork are indicated by D, and F is the blank for forming the meshwork. The arrow I in Figure 6 indicates the direction of the feed travel of the blank.

The numerals 2 and 3 indicate the grippers of the feed mechanism, gripper 2 engages the blank while gripper 3 engages the expanded portion of the sheet and continues the feed of the sheet after the blank has advanced beyond the sphere of operation of gripper 2. The hold-downs 4 and 5 engage the blank to hold it stationary while the grippers reverse their feeding movement (with their jaws open) to their feed starting position. At this point, the gripper jaws then close gripping the blank to advance the sheet; the feeding direction of the grippers is indicated by arrows 28 in Figure 7. The longitudinal movement of the grippers is actuated by the shaft 18. The dotted line 30 in Figure 7 indicates the position of a longitudinal edge of the blank.

The lower slitting punches 8 are positioned by centering blocks 6 and both these slitting punches and expanding dies 11 are held in place by clamps 13. The upper slitting punches 9 are positioned by centering blocks 7 and expanding punches 12 are spaced from the slitting punches by a spacer 15. These parts are held in position by a wedge 14. To securely hold the lower slitting punches and expanding dies in their proper position the clamps are tightened by drawing up a nut 24 on a threaded stud 22. The upper slitting and expanding punches are held securely by drawing up the wedge tight with a nut 25 on a threaded stud 23.

The lower slitting punches are backed up by a plate 19 and the upper slitting punches by blocks 26. The upper expanding punches and spacer are backed up by blocks 21. The lower backing-up plate for the slitting punches can be made adjustable up or down to compensate for

the changing height of the slitting punches through resharpening to keep the punches at a constant level, and this is accomplished by a pair of saw tooth wedges (not shown) under the full length of the backing-up plate, and these wedges are adjustable longitudinally by set screws (not shown).

The parts comprising the lower mechanism are held by a press member 16 and the upper mechanism by the grooved press member 17.

The arrow 29 in Figure 9 indicates the direction of the downward movement of the expanding punch necessary to deflect a row of strands. The stepped shoulders of the expanding dies are indicated by 26 and the stepped shoulders of the expanding punches by 27. These stepped shoulders may be eliminated if so desired, and the edges made plain in either of both of the expanding punches and dies.

In the construction of the apparatus of my present invention, a slitting punch having a single cutting edge and beveled back therefrom for clearance is of a thickness equal to a multiple of strand widths. By this construction, the punches themselves act as their own spacers for proper positioning of the cutting edges to produce strands. Pluralities of these punches are arranged transversely of the apparatus in groups with their ends in alignment in each group, the parallel cutting edges of a group of punches are offset from alignment the width of a strand from the cutting edges of an adjacent group of punches. Upon actuation of the press a multiple of series of parallel slits are formed diagonally across the blank, these parallel slits formed at each actuation of the press are spaced in a series of slits a distance apart equal to a multiple of strand widths, but the individual slits of one series are offset from alignment the width of a single strand from the slits in an adjacent series, so upon continued actuation of the press and the step-by-step feeding the metal between the widely spaced parallel slits is successively slitted until strands of the proper width are produced ready for expansion.

This offset arrangement of slits is indicated by S in Figure 6 and the length of a feed step by X. The continued step-by-step feeding of the blank in a direction parallel to the slits formed subsequently brings previously slitted rows of parallel strands diagonally across the blank under the action of the expanding punches and dies, the working surface or lower edge of the expanding punch engages and presses downward a series of bonds between strands while an adjacent portion of the blank is restrained from such action by the expanding dies. In this way, a row of strands is deflected at each reciprocation of the press, while at the same time disposing successive series of bonds in edgewise alignments diagonally of the sheet and parallel with each other throughout expansion of the blank. By this arrangement, continuous uniformity is secured in respect to the meshwork which is a very advantageous feature for the marketing of the product.

My present arrangement of the slitting and expanding operations not only enhances the operating speed to obtain efficient and economical production of the meshwork sheets, but permits compact and rugged construction of the mechanism to prolong the life of the apparatus.

What I claim as my invention is:

1. The method of forming expanded metal comprising slitting a sheet substantially parallel to the longitudinal edges thereof to form diagonally across said sheet adjacent to an unslitted portion thereof a series of overlapping strands and simultaneously expanding all of the strands of said diagonal series in a plane transverse to that of the slitted sheet.

2. The method of forming expanded metal comprising, slitting a sheet substantially parallel to the longitudinal edges thereof to simultaneously form diagonally across said sheet a series of overlapping strands, expanding all of the strands of said diagonal series in a plane transverse to that of the slitted sheet and simultaneously therewith again slitting said sheet to form another adjacent diagonal series of strands.

3. The method of forming expanded metal comprising, slitting a sheet substantially parallel to the longitudinal edges thereof to form diagonally across the sheet adjacent to an unslitted portion thereof successive series of overlapping strands with unslitted diagonally extending bars between adjacent series and successively laterally deflecting said bars in a plane transverse to that of the slitted sheet to form an expanded open meshwork.

4. The method of forming expanded metal comprising periodically slitting a sheet substantially parallel to the longitudinal edges thereof to form diagonally across said sheet successive series of overlapping strands, advancing the sheet between successive slitting operations a distance greater than the length of the slits to leave between successive series a diagonally extending unslitted bar and during each period laterally deflecting one of said bars in a plane transverse to that of the slitted sheet to expand the strands between said bar and the succeeding bar into an open meshwork.

5. The method of forming expanded metal comprising periodically slitting the sheet substantially parallel to the longitudinal edges thereof to form diagonally across the sheet successive series of overlapping strands, advancing the sheet in the direction of the slits between successive slitting operations a distance greater than the length of the slits to leave between successive series diagonally extending unslitted bars and in successively deflecting said bars laterally in a plane transverse to that of the slitted sheet to expand the strands between successive bars into an open meshwork with all portions of the expanded sheet extending in a common plane.

6. In the method of forming expanded metal, the steps of slitting a metallic sheet to produce series of relatively long and short bonded strands, expanding the slitted sheet by deflecting the long strands transversely from the plane of said sheet thereby separating said strands into an open meshwork and disposing successive series of short strands, including the bonds in edgewise alignment therewith, parallel to each other, while maintaining the meshwork in a single plane throughout expansion of the sheet.

7. In the method of manufacturing expanded metal, the steps of slitting a metallic blank to produce series of relatively long and short bonded strands, expanding the slitted blank by deflecting long strands transversely from the plane of said blank and disposing successive series of short strands, including the bonds in edgewise alignment, parallel to each other while maintaining the meshwork in a single plane throughout expansion of the sheet.

8. In the method of manufacturing expanded metal, the steps of slitting a metallic blank to produce series of relatively long and short bonded

strands, expanding the slitted blank by deflecting long strands from the plane of said blank thereby disposing successive series of short strands, including the bonds in edgewise alignment, while the longitudinal margins of the sheet are extended from the blank a distance apart at least equal to the width of the finished sheet throughout expansion.

9. The method of forming expanded metal, the steps of slitting a metallic blank to produce relatively long and short bonded strands, expanding the slitted blank to form meshwork by disposing diagonally of the sheet series of short strands including the bonds transversely from the long strands to widen the sheet while maintaining the meshwork in a single plane throughout expansion.

10. The method of forming stranded meshwork from metallic blanks comprising the steps of simultaneously forming a multiple series of parallel slits diagonally across the blank, the individual slits of one series being offset from alignment the width of a single strand from the slits in an adjacent series, advancing the blank in the direction of the slits to successively form similar series of slits and thereby produce overlapping strands, and deflecting said strands from the plane of the blank into an open meshwork.

11. The method of forming expanded metal comprising slitting the sheet substantially parallel to the longitudinal edges thereof to form overlapping bonded strands in an arrangement to leave diagonally across the sheet uninterrupted continuities of bonds between series of said strands, and deflecting the strands out of the plane of the slitted sheet to dispose continuities of bonds in edgewise arrangements during expansion into an open meshwork.

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