

July 27, 1926.

1,593,960

H. E. WHITE

PROCESS AND MACHINE FOR MAKING EXPANDED METAL STRUCTURES

Filed July 2, 1921

5 Sheets-Sheet 1

Fig. 1.

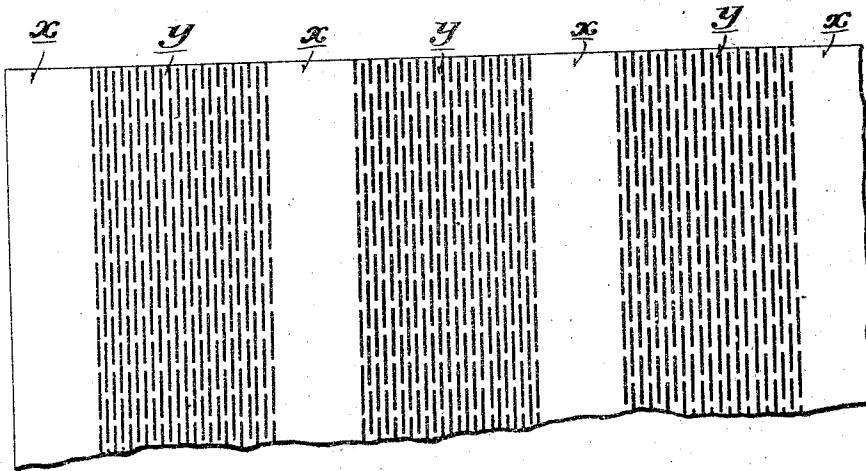


Fig. 2.

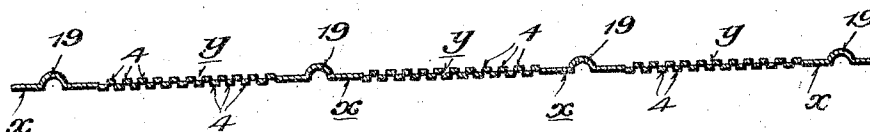
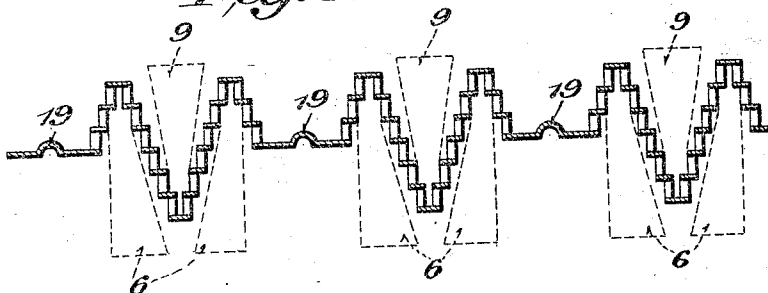


Fig. 3.



Inventor.

Herbert E. White,

WITNESSES:

Chas. L. Griesbauer
Emory L. Croff

By

J. M. McManis

Attorney

July 27, 1926.

1,593,960

H. E. WHITE

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Fig. 4.

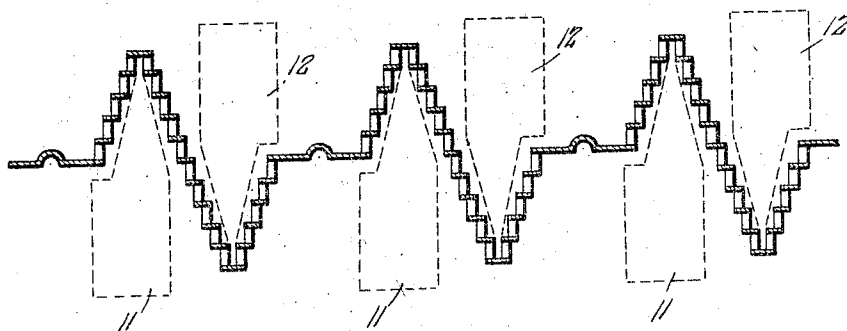


Fig. 5.

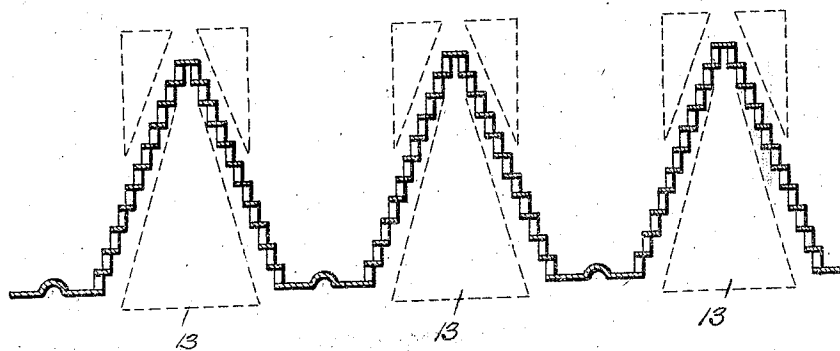
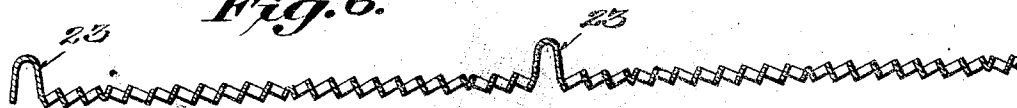


Fig. 6.



Inventor

Herbert E. White.

WITNESSES:

Chas. L. Gigotauer
Emory L. Swift

By

H. E. White

Attorney

July 27, 1926.

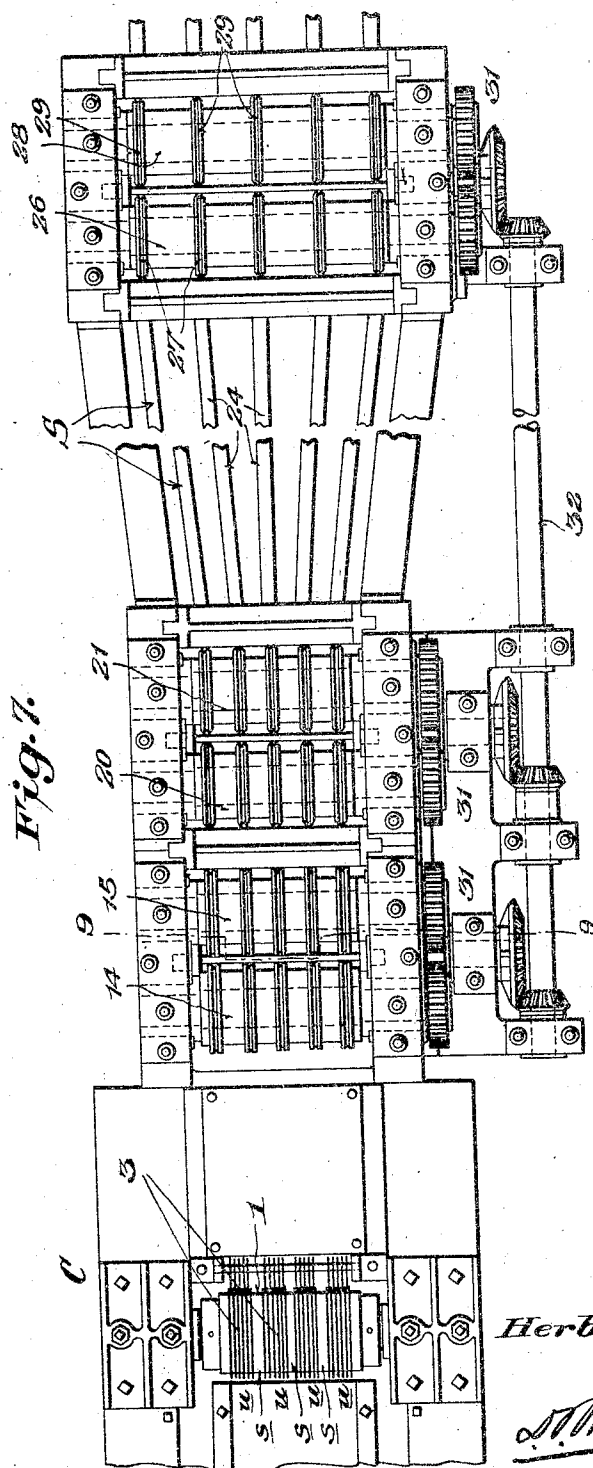
H. E. WHITE

1,593,960

PROCESS AND MACHINE FOR MAKING EXPANDED METAL STRUCTURES

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Inventor

Herbert E. White,

St. Michael

Attorney

July 27, 1926.

H. E. WHITE

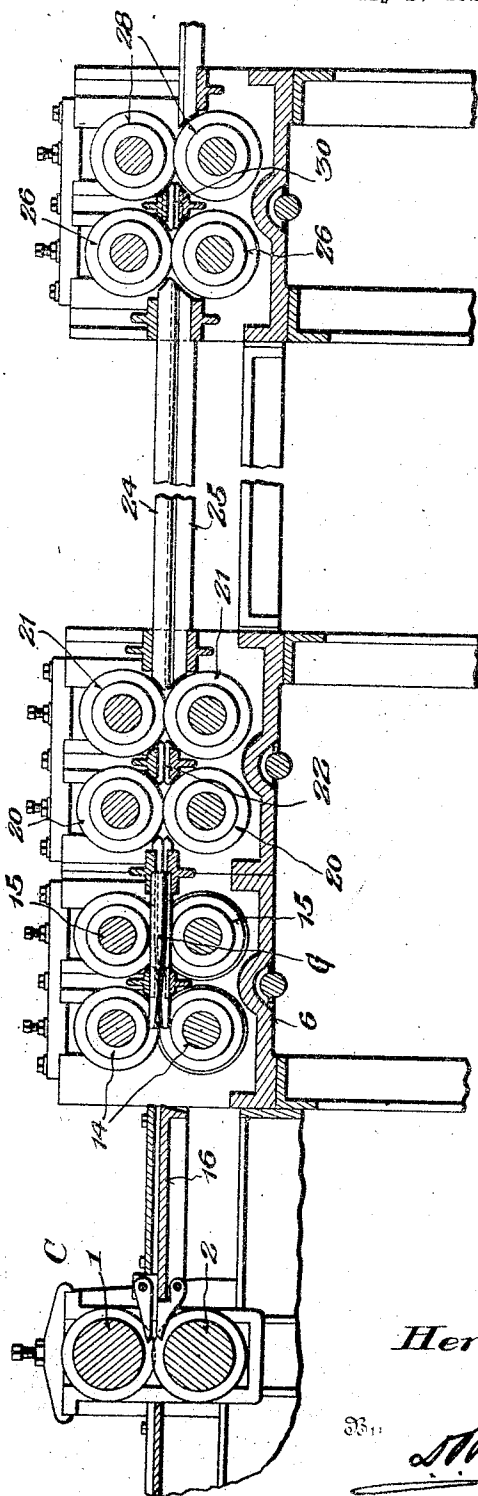
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PROCESS AND MACHINE FOR MAKING EXPANDED METAL STRUCTURES

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Fig. 8.



Inventor
Herbert E. White,

33
W. M. Chas. B.

Attorney

July 27, 1926.

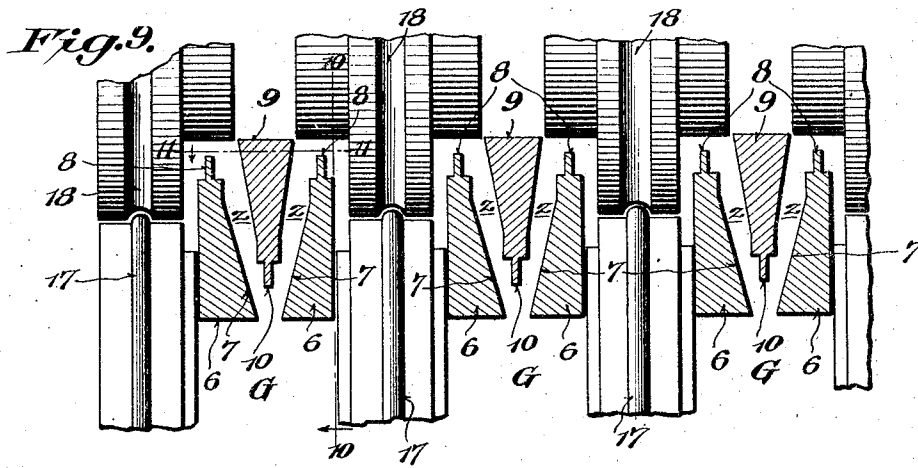
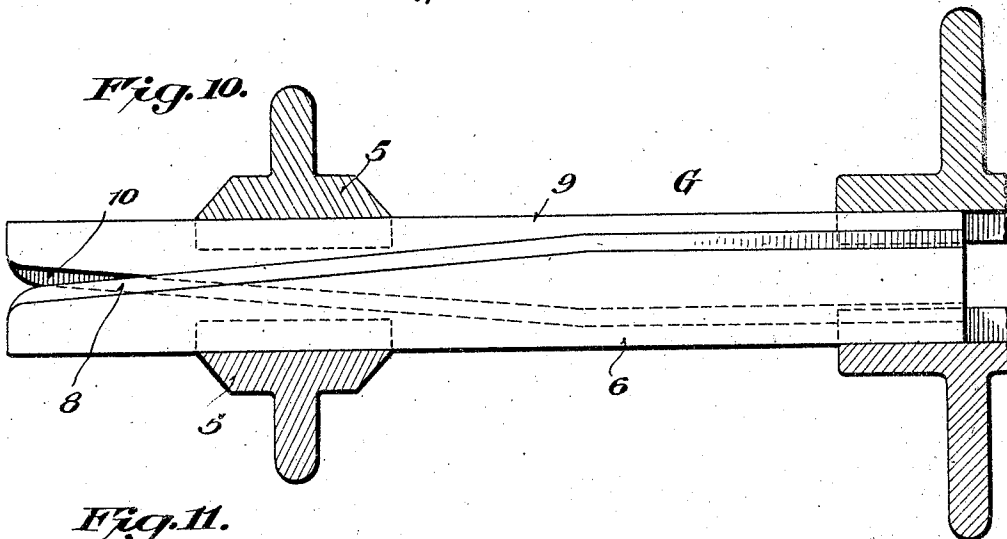
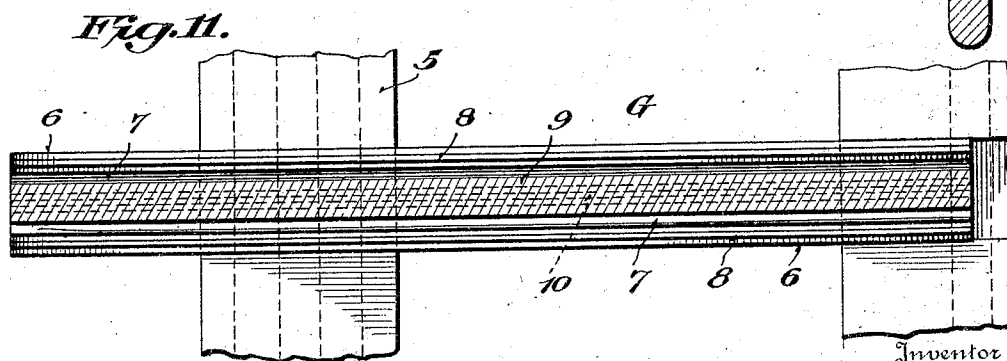
1,593,960

H. E. WHITE

PROCESS AND MACHINE FOR MAKING EXPANDED METAL STRUCTURES

Filed July 2, 1921

5 Sheets-Sheet 5



Inventor

Herbert E. White,

WITNESSES:-

Chas. L. Gierstauer
Conrad L. Shuff

By

[Signature]

Attorney

Patented July 27, 1926.

1,593,960

UNITED STATES PATENT OFFICE.

HERBERT E. WHITE, OF YOUNGSTOWN, OHIO, ASSIGNOR TO TRUSCON STEEL COMPANY, OF YOUNGSTOWN, OHIO, A CORPORATION OF MICHIGAN.

PROCESS AND MACHINE FOR MAKING EXPANDED-METAL STRUCTURES.

Application filed July 2, 1921. Serial No. 482,250.

This invention relates to processes and machines for making expanded metal structures particularly of the type known as metal lathing, and has primarily for its object the practicing of a novel process whereby an expanded metal sheet for lathing and other purposes may be produced economically, accurately, and at much greater speed than heretofore possible, thereby increasing production.

Heretofore, in the making of expanded metal structures a distinctive requirement of the process employed was that of simultaneously slitting and stretching the metal, and to perform that operation in a press or punch equipped with cutting and displacing dies having the functional and structural characteristic of making an orderly arrangement of slits in the metal blank and at the same time stretching the metal in the individual strands with the result of opening the slits into meshes, and thereby expanding the sheet, the final width of the sheet being determined by the extent to which the same may be spread out laterally or narrowed, as may be desired or required. Those processes have not permitted such economies and speed of production as are desirable in the manufacture of expanded metal sheets, particularly for lathing. Therefore, it is the purpose of the present invention to so modify the former processes of making expanded metal structures as to entirely obviate the use of reciprocating presses or punches to provide for slitting and expanding the sheet, and permitting the use of instrumentalities whereby slitting and expanding may be accomplished with very great rapidity and at the same time with all the accuracy necessary, and furthermore without localizing the stretches of the strands or otherwise performing the operation in such a manner as would tend to produce breakage.

In carrying out the improved process suitable instrumentalities or mechanism may be employed which are capable of performing the prescribed steps of the process in a satisfactory manner, but for illustrative purposes there are shown in the drawings certain views intended to illustrate the several steps of the process, as well as a preferred construction of machine which is employed for carrying the same into effect.

Referring to these drawings:—

Figure 1 is a plan view of a portion of a sheet metal blank showing the initial stage of the process, that is, the cutting stage where the blank is formed with regular rows of slits which pierce the metal.

Figure 2 is a sectional view of the cut or slitted metal sheet, also illustrating another step in the process which provides for channelling the uncut and non-contractible areas to produce therein grooves which serve to hold the metal sheet in proper position within the machine, while being operated upon.

Figure 3 is a cross-sectional view of the metal sheet, which represents the metal stretching and expanding step of the process which opens the slits into meshes and stretches the metal in the individual strands, causing the sections thus expanded to take the form of troughs projecting to one or both sides of the flat plane of the sheet.

Figure 4 is a view similar to Figure 3 illustrating another form which may be taken by the slitted sections of the sheet when the strands are stretched and expanded.

Figure 5 is a view similar to Figures 3 and 4 illustrating how the process may be varied to displace the expanded sections to one side only of the flat plane of the sheet.

Figure 6 is a cross-sectional view of the final form of the expanded metal structure, representing the material in Figure 3 laterally spread to bring the expanded sections into the flat plane of the sheet.

Figure 7 is a top plan view of a preferred type and construction of the machine which is used in carrying out the present invention.

Figure 8 is a longitudinal sectional view of the form of machine shown in Figure 7.

Figure 9 is a cross-sectional view on the line 9—9 of Figure 7, illustrating the general form and location of the expanding guides, having an arrangement to produce the stage of Figure 3 of the drawings.

Figure 10 is a detail sectional view on the line 10—10 of Figure 9 showing one of the expanding guide members, illustrating the tapering characteristic of the displacing bars which stretch and expand the slitted part of the sheet.

Figure 11 is a detail sectional view on the line 11—11 of Figure 9, which gives a top plan view of the arched guiding pass through each expanding guide.

Like references designate corresponding parts throughout the several figures of the drawings.

In carrying forward the present invention it is proposed to slit and expand inside areas of the metal sheet, that is, between the ribs or plain uncut portions, without buckling or otherwise producing a contraction or distortion of the ribs or the plain uncut portions during the slitting, and during the combined stretching and expanding operation. However, a distinctive feature of the present process as distinguished from former processes is first to cut inside areas of the blank and thereby produce slits without any stretching of the metal other than the negligible stretching incident to cutting, and this cutting step operates to make a slitted area in the flat plane of the sheet. Subsequently, and by entirely different means or instrumentalities the inside slitted sections of the sheet are operated upon to cause a stretching of the metal in the individual strands and a displacement of said slitted portions to one or both sides of the flat plane of the sheet, resulting in the opening up of the slits into meshes and causing the desired or required degree of expansion in the sheet. After that has been accomplished the deformed expanded sheet is drawn or spread out laterally to bring the stretched and expanded areas into the flat plane, thereby making the finished product.

The above distinctive steps of the present process may well be illustrated by now referring to the preferred construction of the machine employed for carrying the invention into effect. Referring to Figures 7 and 8 of the drawings it will be observed that a machine having the capacity for performing the process of the present invention preferably includes in its organization a rotary cutting device which forms the slitted sections of the blank. This cutting device is designated in the drawings generally by the letter C and comprises a pair of upper and lower superposed cutter rolls 1 and 2 which are equipped with slitting knives 3. As best shown in Figure 7 of the drawings the slitting knives 3 of the cutter rolls 1 and 2 are grouped in spaced knife units, each of which units may be additionally designated by the reference letter *u* and these knife units are separated by blank spaces *s* located in the positions where the metal sheet is left with the plain uncut portions *x*. The group of slitting knives 3 constituting each of the knife units *u* are so arranged in shape to produce slits in the metal sheet having the extent and arrangement shown in Figure 1 of the drawings so that when the metal sheet is passed between the pair of cutting rolls 1 and 2 it will leave said sheet with slitted areas *y* between the uncut areas *x*, which slitted areas *y* are cut with parallel lines of

interrupted slits arranged alternately in adjacent lines so that the slits in each row thereof are disposed in staggered relation to the slits of parallel adjacent rows. This is quite plainly shown in Figure 1 of the drawings and this slitted formation leaves between the slits the uncut strands 4 which may best be seen in Figure 2 of the drawings.

In the cutting or slitting operation performed by the rotary cutter rolls there is no stretching in the metal of the strands 4 other than the slight or negligible stretching incident to cutting, thereby leaving the slitted areas *y* in the flat plane of the sheet represented by the uncut portions *x*, so that it requires a separate and subsequent operation to stretch the metal of the strands 4 to the desired extent to produce the necessary expansion of the metal sheet, and that subsequent step is an important feature of the invention and is carried out in a plurality of expanding-guide units, each of which units is designated by the reference letter G in Figures 9, 10 and 11 of the drawings. The said expanding-guide units G are arranged in spaced relation corresponding to the spaced relation of the slitted areas *y* of the blank and each of said units is intended to function in connection with one of the slitted areas *y* to provide for stretching the metal in the strands and for displacing the slit area out of the flat plane of the sheet in order to obtain the desired amount of expansion. The action of all of the expanding guide units is necessarily the same, and the operation is uniformly carried out at the same time across the entire width of the sheet, so at this point it will be understood that any desired number of slitted and uncut areas may be provided for in the metal sheet, it only being necessary to have a corresponding number of knife units in the cutting device, and a corresponding number of the various other units in the machine, which cooperate respectively with the cut and uncut areas in the metal blank.

Referring further to the expanding-guide members G the same may be mounted in any suitable manner, as for instance by means of supporting bars 5 arranged transversely in the machine frame 6, and each of the said units G consists of a plurality of displacing bars so arranged as to provide a guiding pass *z* between them which gives the desired trough formation to the slitted and expanded section, that is, the form of the troughing shown in either Figures 3, 4, or 5 of the drawings or any modification thereof. However, for illustrative purposes there has been selected in Figures 9, 10 and 11 an expanding-guide unit having a guide pass *z* which produces the trough form of Figure 3 of the drawings, and this expanding-guide unit consists of a pair

of lower spaced displacing bars 6—6 having downwardly convergent inner sides 7 and provided at their upper edges with the guiding ribs 8 which incline upwardly from their receiving ends, as shown in Figure 10 of the drawings. Between the pair of lower displacing bars 6—6 there is arranged a downwardly projecting or depending central displacing bar 9, which is spaced from the downwardly converging inner walls 7—7 of the bars 6—6 to form therewith the arch or trough-like pass $z-z$. The said central displacing bar 9 is provided at its lower edge with a guiding rib 10 which inclines downwardly from its receiving end, as shown in Figure 10 of the drawings. Therefore, it will be apparent that when a slitted section y of the sheet is caused to pass through the pass $z-z$ of one of the expanding-guide units G the upward inclination of the guiding ribs 8 and the downward inclination of the guiding rib 10 has the effect on the material shown in Figure 3 of the drawings, namely, that of forcibly displacing respectively to opposite sides of the flat plane of the sheet the slitted section of the material. And, by reason of the shape of these displacing bars the individual strands 4 are necessarily stretched to provide for the opening of the slits into meshes and for producing the amount of expansion desired.

As indicated in Figure 4 of the drawings the expanding-guide units may be provided with upwardly and downwardly projecting displacing bars 11 and 12 respectively which provide for displacing the slitted material respectively above and below the flat plane of the sheet, or as suggested in Figure 5 of the drawings said guides may be provided with single displacing bars 13 so arranged as to displace all of the slitted material, in each slitted section of the blank, wholly to one side of the flat plane of the sheet.

Preferably there is associated with the expanding-guide units, sets of primary guiding rolls designated respectively by the numbers 14—14 and 15—15. The set of guiding rolls 14—14 is arranged to receive the cut and slitted material from the feed table 16 to which the slitted sheet is delivered from the cutting device C and the said rolls are arranged so as to assist in guiding the slitted sheet into the receiving end of the expanding-guide units. Also, it is preferable in the use of the first set of primary guiding rolls 14—14 to provide said rolls respectively with the interfitting ribs and grooves 17 and 18 respectively, which operate as dies to initiate holding grooves 19 in the uncut areas of the blank, between the slitted areas, as shown in Figure 2 of the drawings. The set of rolls 15—15 are likewise provided with ribs and grooves 17

and 18 which cooperate with the holding grooves 19 of the metal sheet to securely hold the same against lateral displacement or movement while it is being moved through the expanding-guide units G.

Beyond the expanding-guide units G are located sets of ribbing rolls 20—20 and 21—21, between which sets of rolls are arranged suitable guides 22 engaging the grooved portions 19 of the blank sheet to guide it in a straight line through the machine while being operated upon. It is preferable while carrying out the present invention to form the ribbing rolls 20—20 and 21—21 with interfitting ribs and grooves corresponding to the ribs and grooves 17 and 18 of the primary guiding rolls, but of a greater depth than the said ribs and grooves 17 and 18 so as to have the effect of deepening the grooves 19 to thereby produce high-ribs 23 in the uncut portions of the blank, such high-ribs being a desirable structural characteristic of the finished product and being shown in Figure 6 of the drawings. In connection with these ribbing rolls 20—20 and 21—21 the high-ribs may be started by the rolls 20—20 and completed as to depth and width by the rolls 21—21, this operation being provided for by having the ribs and grooves of the rolls 21—21 somewhat deeper than those of the rolls 20—20.

In the form shown in Figure 3 the metal in the slitted areas is stretched and expanded to its fullest extent, and it only remains to stretch the sheet laterally to give the desired width thereto, which operation at the same time brings the expanded sections back into the flat plane of the sheet. That step of the process may be performed by the use of a spreading guide designated generally by the reference letter S and comprising a plurality of divergently arranged guide bars 24 and 25 (Figure 8 of the drawings) so arranged as to provide between them passes corresponding to the high-ribs 23 so that such ribs will take into the passes of the bars 24 and 25 and because of the divergency thereof will cause a pulling or spreading out laterally of the expanded sections of the sheet, causing the same to resume the flat plane as shown in Figure 6. In this final form the product between any two ribs has the strands immediately adjacent the median line between said ribs disposed at opposite inclinations, and also has other sections of strands adjacent the ribs disposed at an opposite inclination to the immediately adjacent strands. This is shown in Figure 6 of the drawings and provides an exceptionally strong expanded section between the high-ribs.

The material is drawn through the spreading guide S by the drawing rolls

26—26 arranged at the delivery end of the said guide S, said drawing rolls being provided with the spaced ribs and grooves 27 engaging the ribbed portions of the blank to provide for positively drawing the latter through the spreading guide, and beyond the said drawing rolls 26—26 is arranged a pair of truing rolls 28—28 having the spaced ribs and grooves 29 also engaging the ribs of the product and serving to true up the finished product quite accurately into the final dimensions.

Between the drawing and truing rolls 26—26 and 28—28 respectively there are preferably arranged a series of sheet guides 30, which cooperate with the ribs of the blank to assist in properly guiding it through the delivery end of the machine.

The various sets of rolls are preferably geared together for unitary operation by means of a system of gears and shafting 31 and 32 as indicated in Figure 7 of the drawings.

From the foregoing it is thought that the improved process and the preferable manner of practicing it will now be apparent to those familiar with this art without further description, and with reference to the machine it will be understood that changes in the form, proportion and minor details of construction, such for instance as the point at which the high-ribs are formed, the detail construction of the expanding-guides, of the spreading guide, et cetera, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

I claim:—

1. A method of making expanded metal structures which consists in slitting the portion of the blank to be expanded, and subsequently elongating the strands thereby formed by stretching longitudinally the metal of the strands and displacing the stretched material from the flat plane of the sheet thereby opening the slits into meshes.

2. The method of making expanded metal structures which consists in initially slitting the portion of the blank to be expanded, subsequently elongating the strands thereby formed by stretching longitudinally the metal of the strands and displacing the stretched material from the plane of the sheet thereby opening the slits into meshes and expanding the material, and then acting on the blank to cause the same to spread laterally in the flat plane bringing the displaced expanded material into a widened plane.

3. The method of making expanded metal structures which consists in slitting the portion of the blank to be expanded, leaving the individual strands substantially in the flat plane of the sheet, subsequently elongating the strands thereby formed by stretching longitudinally the metal of the strands and displacing the stretched material into trough form projecting respectively upon opposite sides of the sheet, and then moving the sheet laterally to thereby spread the expanded sections into a widened plane.

4. The method of making expanded metal structures which consists in moving a metal blank past a rotary cutter to thereby produce slits in a portion of the blank, subsequently elongating the strands thereby formed by stretching longitudinally the metal of the strands and displacing the stretched material beyond the flat plane of the sheet, and then spreading the sheet laterally to thereby bring the expanded section into a widened plane.

5. A machine for making expanded metal structures including a cutter for producing slits in the sheet, and an expanding guide having means for elongating the strands by causing the stretching of the metal of said strands and displacing the same from the flat plane of the sheet.

6. A machine for making expanded metal structures including a rotary cutter for producing slits in the sheet, and an expanding guide having means for elongating the strands by causing the stretching of the metal of said strands and displacing the same from the flat plane of the sheet.

7. A machine for making expanded metal structures including a rotary cutting device having means for slitting a portion of the sheet, and an expanding guide having means for elongating the strands by causing the material of the strands as it passes through it to be stretched and displaced from the flat plane of the sheet thereby opening the meshes and producing an expansion of the sheet.

8. A machine for making expanded metal structures including a rotary cutter for producing slits in the sheet, an expanding guide having means for elongating the strands by causing the stretching of the material of the strands and displacing the same from the flat plane of the sheet.

9. A machine for making expanded metal structures including a rotary cutter for producing slits in the sheet, an expanding guide having means for elongating the strands by causing the stretching of the material of the strands and displacing the same from the flat plane of the sheet.

10. A machine for making expanded metal structures including a rotary cutting device having means for slitting a portion of the sheet, an expanding guide having means for elongating the strands by causing the material of the strands as it passes through it to be stretched and displaced from the flat plane of the sheet thereby opening the

meshes and producing an expansion of the material, and means for spreading laterally the expanded sheet.

11. A machine for making expanded metal structures including a rotary cutting device having means for slitting a portion of the sheet, an expanding guide having means for elongating the strands by causing the material of the strands as it passes through it to be stretched and displaced from the flat plane of the sheet thereby opening the meshes and producing an expansion of the material, and a diverging spreading guide.

12. A machine for making expanded metal structures including a rotary cutter for producing slits in the sheet, an expanding guide having means for elongating the strands by causing the stretching of the material of said strands and displacing the same from the flat plane of the sheet, means for forming ribs in the uncut areas, a spreading guide engaging said ribs, and feeding means.

13. A machine for making expanded metal structures including a rotary cutter for producing slits in inside areas of the sheet, an expanding guide having means for elongating the strands by causing the stretching of the material of the strands and displacing the same from the flat plane of the sheet, means for forming grooves in the uncut portions of the sheet and for engaging said grooves for guiding and holding purposes, and means for spreading laterally the expanded sheet.

14. A machine for making expanded metal structures including a cutter for producing slits in inside areas of the sheet, an expanding guide engaging the slitted areas, means for forming holding and guiding grooves in the uncut portions of the sheet, groove deepening means to produce high ribs, and feeding means.

15. A machine for making expanded metal structures including a cutter for producing slits in inside areas of the sheet, an expanding guide operating upon the slitted areas as the sheet is moved through the same, means for forming holding and guiding grooves in the uncut areas, groove deepening means to produce high ribs, means for spreading laterally the expanded sheet and a feeding unit at the delivery end of the machine having means for drawing and truing the sheet.

16. A machine for making expanded metal structures including a cutter for producing slits in inside areas of the sheet, an expanding guide arranged to receive the slitted sheet from the cutter, means for operating the said guide for producing holding and guiding grooves in uncut portions

of the sheet, a diverging spreading guide having means engaging said grooves to thereby spread laterally the expanded sheet as it moves through the spreading guide, and a delivery unit having means engaging the grooves in the uncut portions of the sheet for drawing the same through the machine and truing the delivered product.

17. A machine for making expanded metal structures including a rotary cutter for producing slits in inside areas of the sheet, an expanding guide operating upon the slitted areas, a diverging spreading guide to cause lateral spreading of the expanded sheet, and a progressively arranged series of rolls having interfitting ribs and grooves, the depth of the ribs and grooves of said rolls being varied respectively to initiate guiding and holding grooves in the uncut areas of the sheet, for deepening said grooves producing high ribs, and for drawing and truing the ribbed expanded product.

18. The method of making expanded metal structures which consists in slitting a portion of a sheet metal blank to be expanded, and subsequently elongating the strands thereby formed by displacing said slitted portion out of the plane of the blank, and stretching the strands of the portion displaced while maintaining substantially the original length of the unslitted portion of the blank.

19. The method of making expanded metal structures which consists in slitting a portion of a sheet metal blank to be expanded, and subsequently elongating the strands thereby formed by displacing said slitted portion out of the plane of the blank and into angular formation, and stretching the strands of the portion displaced while maintaining substantially the original length of the unslitted portion of the blank.

20. The method of making expanded metal structures which consists in slitting a portion of a sheet metal blank to be expanded, and subsequently elongating the strands thereby formed by displacing said slitted portion out of the plane of the blank and into angular formation, and stretching the strands of the portion displaced while maintaining substantially the original length of the unslitted portion of the blank and afterwards laterally expanding the blank and substantially straightening the angular formation back into the flat plane with the remaining portion of the blank.

In testimony whereof I hereunto affix my signature.

HERBERT E. WHITE.