N. E. CLARK.

METAL WORKING.

APPLICATION FILED JAN. 14, 1909.

1,166,888.

Patented Jan. 4, 1916.

2 SHEETS—SHEET 1.

Fig. 1.

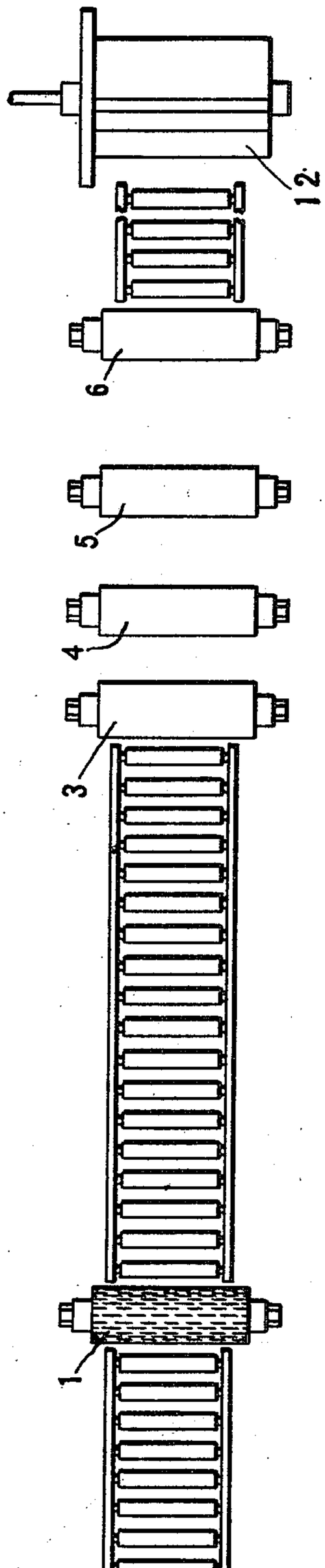
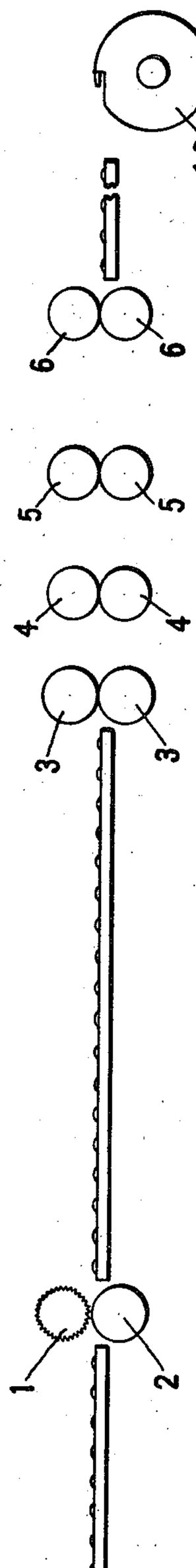


Fig. 2.



WITNESSES

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2 SHEETS—SHEET 2.

Fig. 3.

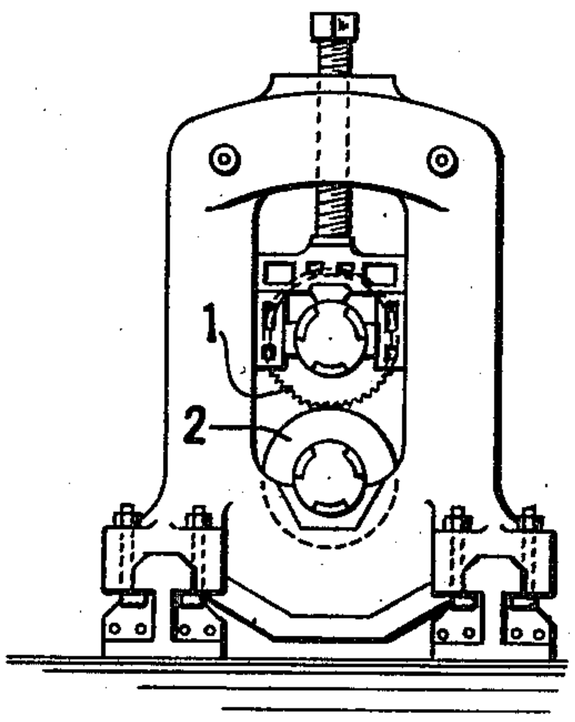


Fig. 4.

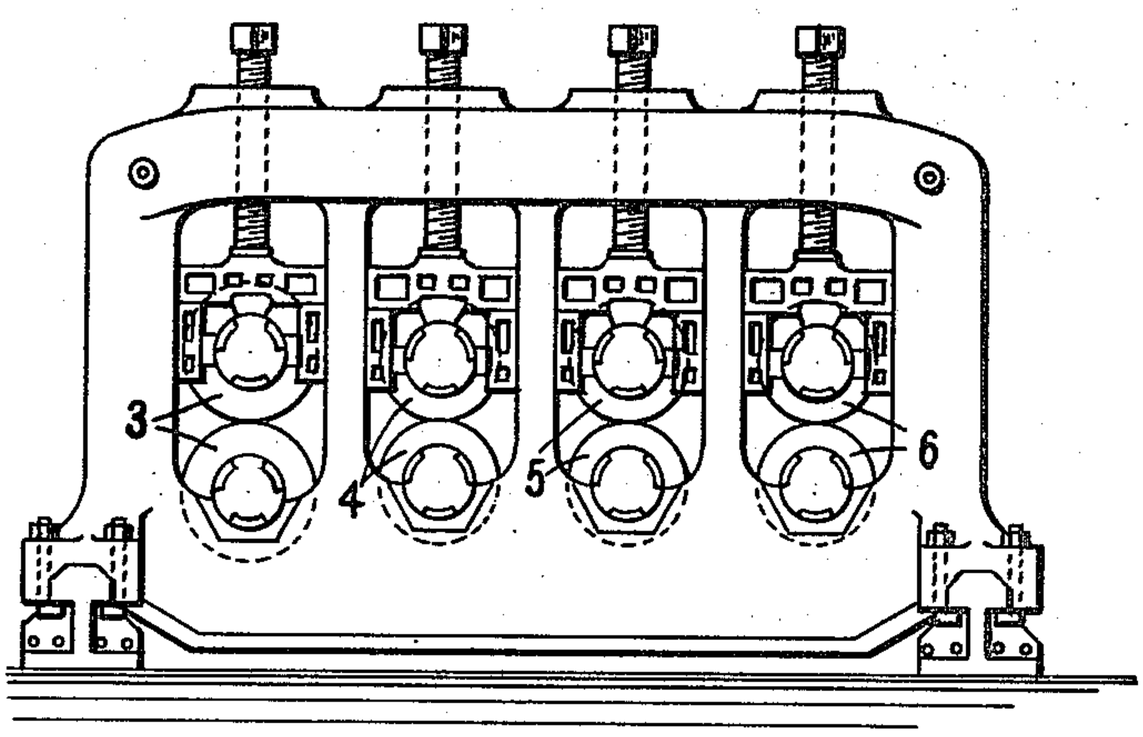


Fig. 6.

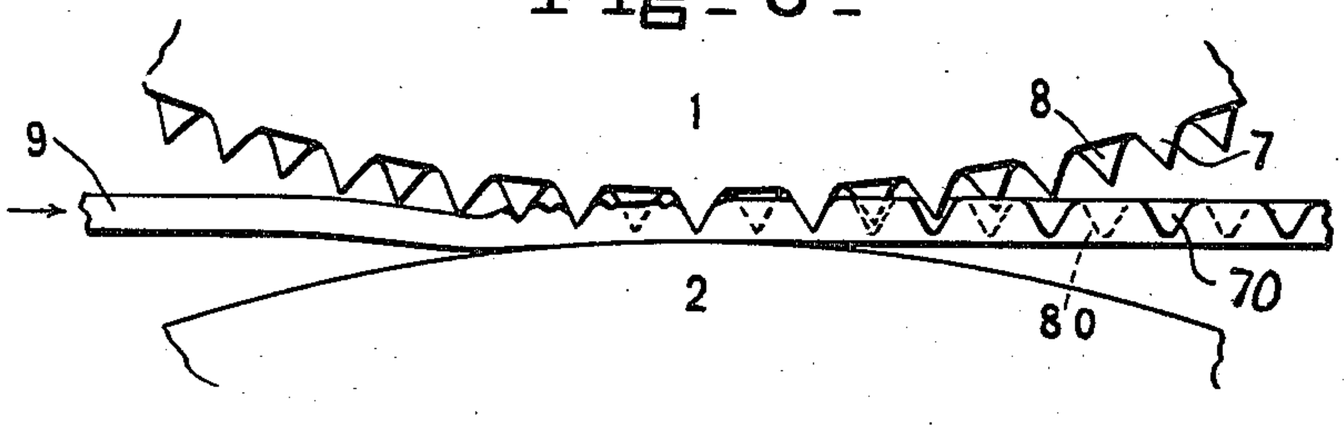


Fig. 5.

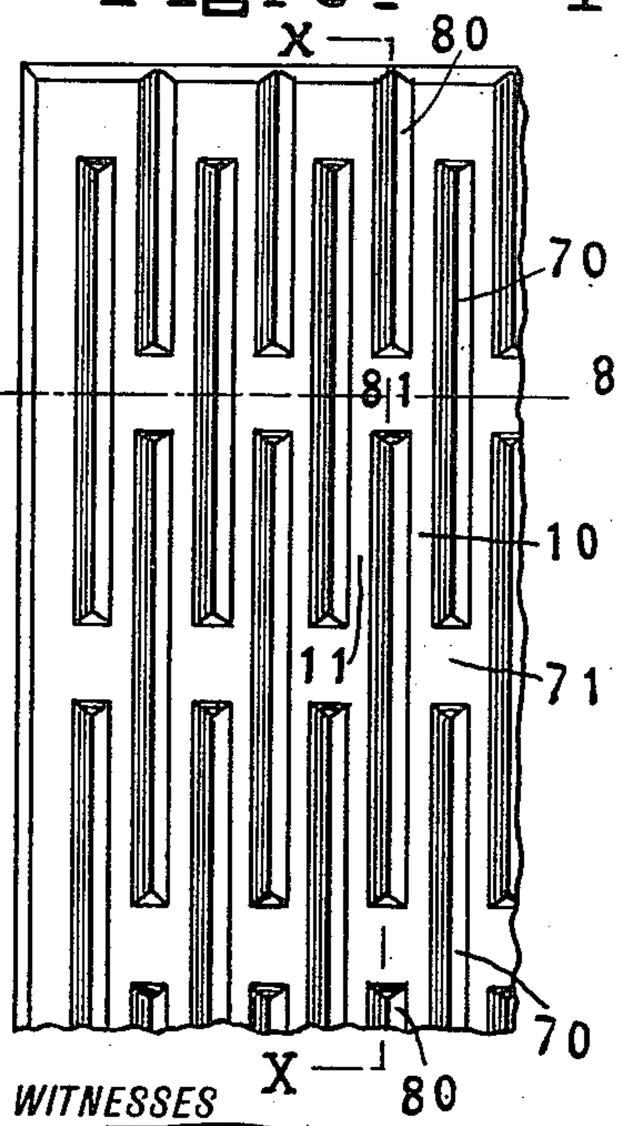


Fig. 7.

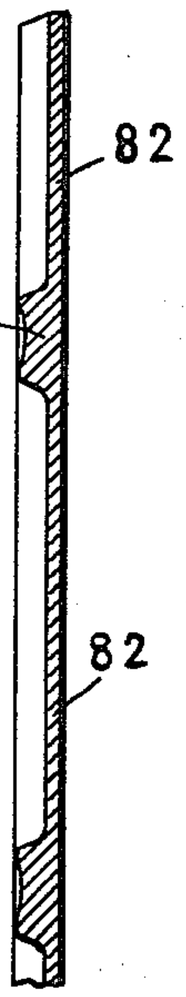


Fig. 8.

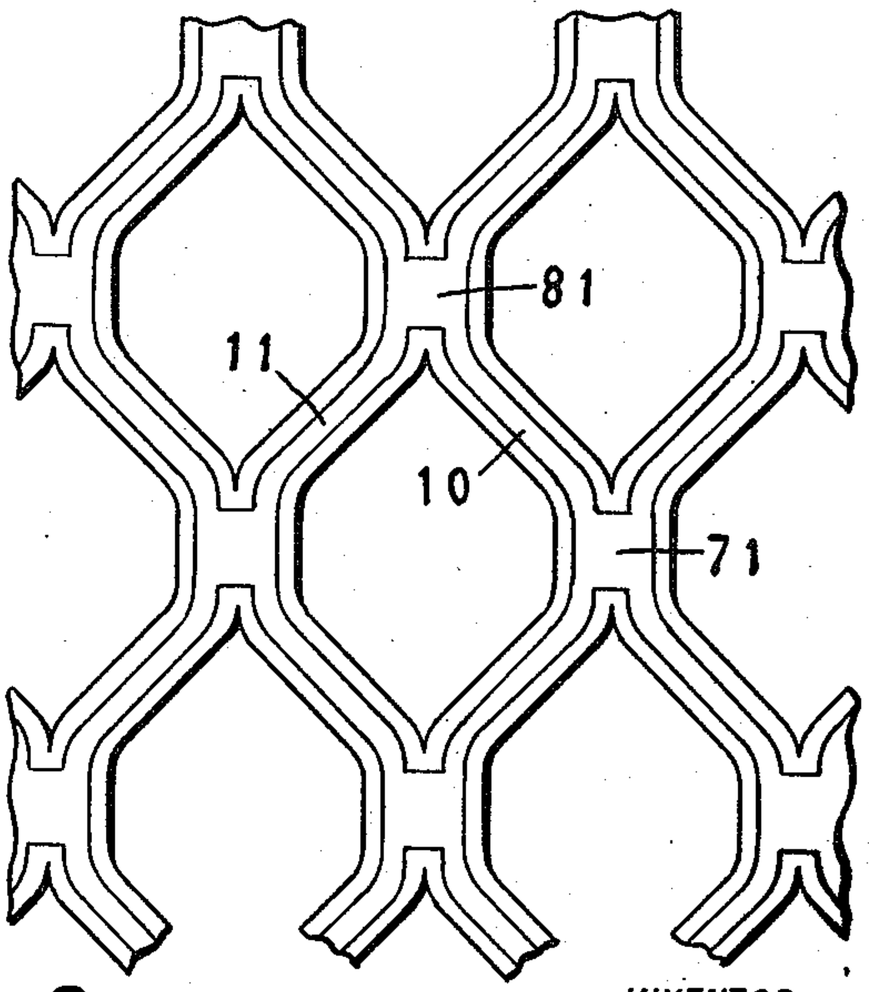
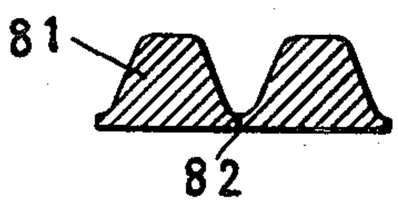


Fig. 9.



WITNESSES

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UNITED STATES PATENT OFFICE.

NORRIS ELMORE CLARK, OF PLAINVILLE, CONNECTICUT.

METAL-WORKING.

1,166,888. Specification of Letters Patent. Patented Jan. 4, 1916.

Application field January 14, 1909. Serial No. 472,260.

To all whom it may concern:

Be it known that I, NORRIS ELMORE CLARK, a citizen of the United States, residing at Plainville, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Metal-Working, of which the following is a specification.

This invention relates particularly to the art or method of making reticulated metal plates or sheets commonly termed expanded metal.

My main object is to decrease the cost of manufacture and also to improve the product.

The machine and method of operation are such that the finished product may be made in a continuous operation starting with a hot plate. This enables me to run plates direct from the plate forming rolls into my improved mill without loss of heat. The process is particularly concerned with hot rolling at least at the start as will be understood from the following specification. The plates are first indented preferably while hot by means of rolls having teeth arranged in staggered relation which nearly perforate the plate. The metal of the webs at the bottom of the indentations thus formed is readily severed or broken and the indented material may be stretched or expanded by suitable mechanism. I prefer to indent the plates so that the thin webs extend transversely across the plate and then I fracture or sever the webs and expand the plates longitudinally by means of a set of stretching rolls, each succeeding pair of which has a greater peripheral speed than the preceding pair. In some cases the indenting rolls will substantially sever the metal so that it can be stretched or expanded immediately. In other cases the pressure of the first pair of expanding rolls may be sufficient to reduce the gage of the stock and break the thin webs. The fracture may be aided by locally chilling the webs or bending the plate. In some cases it may be desirable to allow the metal to partially cool before expansion. As the thin webs cool more rapidly than the strands, the webs will be relatively chilled and will fracture more readily. It is also possible to cut or punch the thin webs and this may be desirable in some cases.

Figure 1, is a diagrammatic plan view showing the arrangement of a mill for carrying out the invention. Fig. 2, is a diagrammatic side view of the rolls for the system. Fig. 3, is a side view showing the indenting rolls of a mill of my invention. Fig. 4, is a side view of the expanding rolls. Fig. 5, is a plan view showing a fragment of the product of one form of the indenting rolls. Fig. 6, is a view on the same scale as Fig. 5 showing portions of the peripheries of the indenting rolls with the material being operated upon. Fig. 7 is a section on the plane of the line X—X of Fig. 5. Fig. 8, is a fragment of the completed product of the process. Fig. 9, is a section as on line Y of Fig. 5 of the drawing showing a more pronounced web.

In the preferred form of mill the rolls 1 and 2 indent the plate in staggered arrangement and the plate is then expanded by the pairs of rolls 3, 3—4, 4—5, 5 and 6, 6. Although the indented plate may be stretched directly from the rolls 1, 2, I prefer to locate and arrange the expanding rolls so that the rolls 1, 2, will be subject to the indenting strains only. The succeeding pairs of expanding rolls may be rotated at say 25, 50, 100 and 200 feet per minute respectively.

The lower roll 2 is preferably smooth and the length of the teeth on roll 1 is parallel with the axis of the roll, the cross section of each tooth being as shown in end view at 7 and 8 in Fig. 6. The stock 9 is dented as at 70, 70 by teeth in the row of tooth 7 and as at 80, 80 by teeth in the row of tooth 8. The teeth in row 7 are spaced apart so as to leave bonds such as 71 between the grooves 70, 70 and the teeth in row 8 are arranged so as to leave bonds such as 81 between the grooves 80, 80. The bonds 71 come opposite the center of the grooves 80 and the bonds 81 come opposite the center of grooves 70. At the bottom of each groove is a web 82 relatively very thin and easily fractured or severed. The width of this web will depend upon the shape of the indenting tooth.

In the process of indenting a plate the metal between the teeth is compressed at the bonds and also at the strands 10 and 11 which connect the bonds. This greatly improves the quality of the metal. The teeth 7 and 8 may be formed in any suitable way as by nurling or milling. Nurling produces harder and tougher teeth.

Any suitable expanding mechanism may be employed but my complete process con-

templates a set of stretching rolls. When the rolls 3, 3 are relied upon to reduce the gage of the stock materially they may be made heavier than the other expanding rolls. The product of the indenting rolls is likely to be somewhat thicker than the raw sheet before indentation and more or less rounded upon the upper surface of the strands and the rolling down by rolls 3, 3 flattens and broadens the tops of the strands and bonds, the plate having a less tendency to flow at the lower side which is practically continuous as it comes in between the rolls. As the plate passes between the succeeding pairs of stretching rolls it is gradually expanded to the form shown in Fig. 8 and may be at the same time rolled down in thickness.

Obviously it is possible to obtain some of the advantages herein set forth by using rolls having their teeth arranged so as to groove or indent the stock longitudinally. After indentation, the expansion may be accomplished laterally of the line of feed or in a vertical plane. The method herein illustrated however, is preferred.

The material from the expanding rolls may be run onto a cooling table or coiled on a drum 12. By giving the drum a greater peripheral speed than the rolls 6, 6 the material may be expanded and coiled under tension and insures a uniform action and product. The plates may be taken from a reheating furnace and a single indenting machine with transfer tables may supply a plurality of expanding machines.

I reserve the right to claim the entire mill for carrying out the complete process of indenting plates and expanding the same and the product thereof and also specifically the indenting rolls and the product thereof in separate applications.

What I claim is:

1. The method of forming reticulated metal which includes indenting a sheet in staggered arrangement while hot, fracturing the webs at the bottom of the indentations and expanding the sheet.

2. The method of forming reticulated metal which includes indenting and fracturing a sheet in staggered arrangement and expanding it while hot by stretching.

3. The method of forming reticulated metal which includes indenting a sheet in staggered arrangement, rolling it down and thereby fracturing the webs at the base of the indentations and then expanding the sheet.

4. The method of producing expanded metal, comprising rolling indentations in a metal sheet while hot and by further rolling, reducing and expanding said indented sheet.

5. The method of forming reticulated metal which comprises indenting a sheet and thereby forming strands between the indentations thicker than the original sheet, fracturing the web of metal at the bottom of the indentations and separating the thickened strands.

6. The method of forming a reticulated fabric which consists in forming a plurality of indentations in staggered arrangement to outline strands and at the same time holding the metal between the indentations, fracturing the metal at the bases of the indentations and bending the strands to form openings.

7. The method of forming a reticulated fabric which consists in indenting the sheet in staggered arrangement to form strands and simultaneously compressing the metal between the indentations and afterward opening out the sheet.

8. A continuous method of forming reticulated metal from hot metal sheets which consists in rolling staggered indentations into the face of a hot metal sheet transversely of the line of feed thereof and thereby displacing the metal away from such indentations to form transverse strands between the indentations and then stretching the indented sheet forwardly in the direction of feed thereof to thereby form an expanded fabric.

NORRIS ELMORE CLARK.