

N. E. CLARK.
MANUFACTURE OF EXPANDED METAL.
APPLICATION FILED APR. 7, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

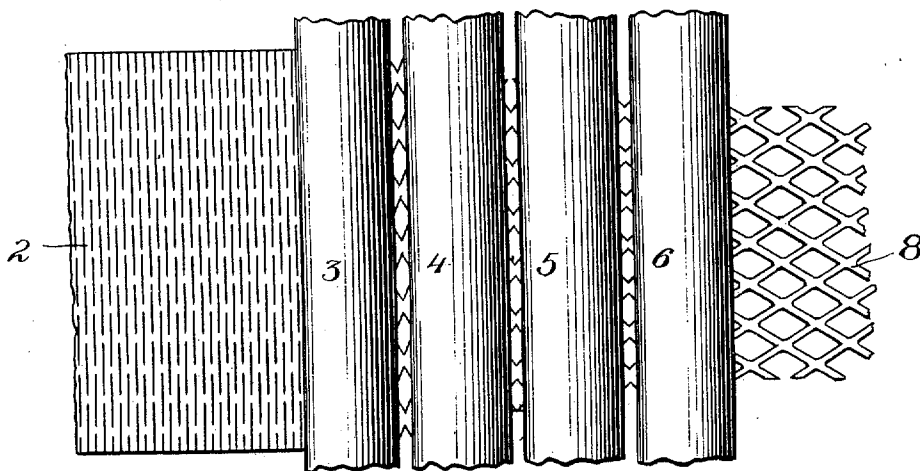
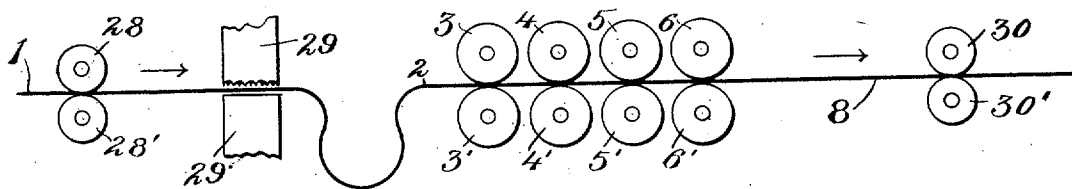


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

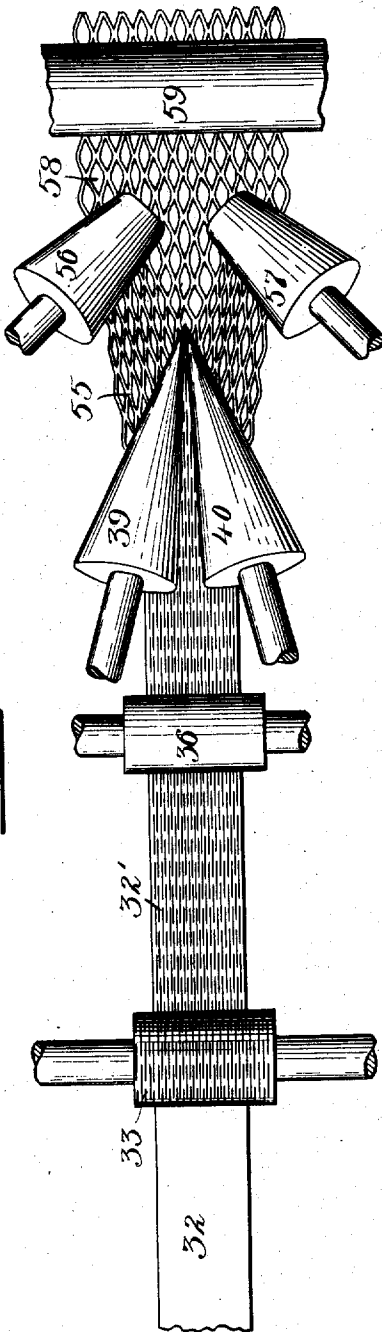
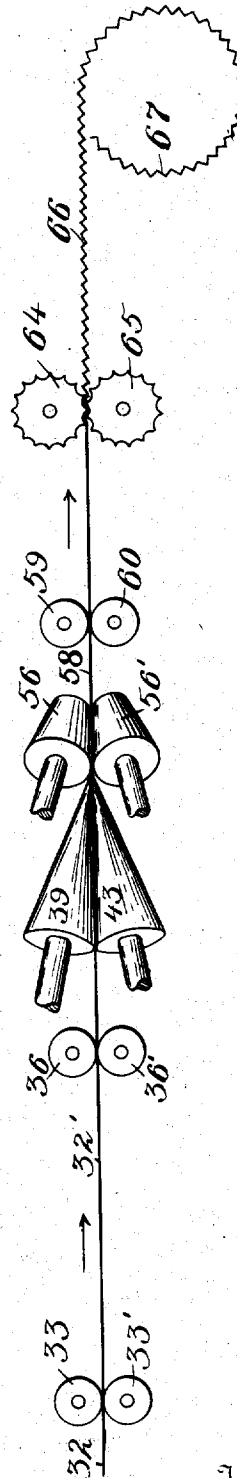


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

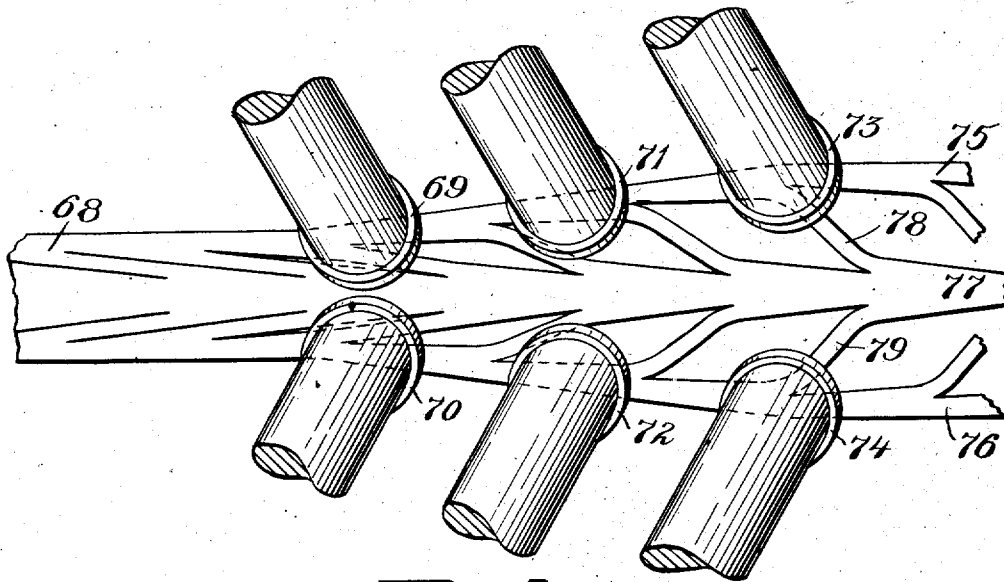


Fig. 6.

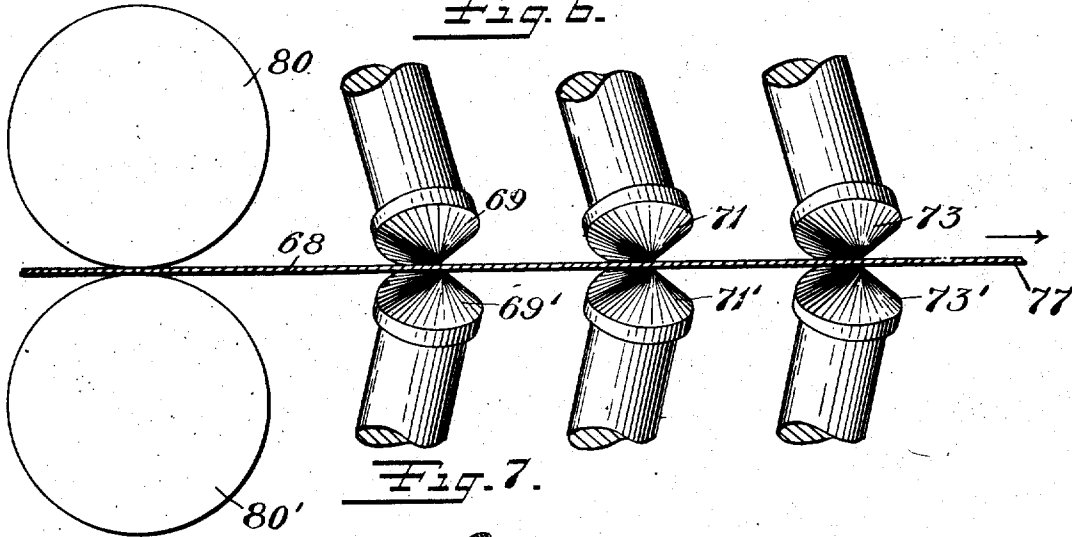
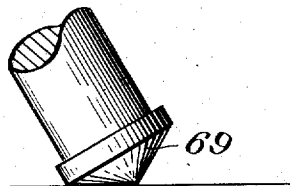


Fig. 7.



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UNITED STATES PATENT OFFICE.

NORRIS ELMORE CLARK, OF PLAINVILLE, CONNECTICUT, ASSIGNOR TO THE NATIONAL METAL FABRIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

MANUFACTURE OF EXPANDED METAL.

No. 884,714.

Specification of Letters Patent.

Patented April 14, 1908.

Original application filed January 12, 1906, Serial No. 295,810. Divided and this application filed April 7, 1906.

Serial No. 310,522.

To all whom it may concern:

Be it known that I, NORRIS ELMORE CLARK a citizen of the United States, residing at Plainville, Connecticut, (P. O. address the same,) have invented certain new and useful Improvements in Manufacture of Expanded Metal, of which the following is a full, clear, and exact description.

My invention relates to the method or process of manufacturing expanded metal and particularly metal of the type set forth in my Patent 767,798, of August 16, 1904. The present invention contemplates the embodiment of the principles of my former patent 767,798, referred to, and 788,093, of April 25, 1905, and comprises subject matter divided from my application 295,810, filed January 12, 1906. That application contains a fuller disclosure of and claims for the mechanism employed for carrying out this method.

The method consists in slitting the sheets or strips of metal by suitable mechanism, and then drawing out the strips or sheets by means of friction rolls so as to open the slits and form reticulations, and accomplishing simultaneously with the drawing action a smoothing or finishing of the product. This drawing action of the rolls is preferably accomplished gradually from the slitted material to the full open mesh, so that the expansion may take place with greater uniformity and without undue strain upon the strands of the material.

I have illustrated the invention adapted to expansion of three classes of slitted material, first, material slitted transversely of the direction of feed or line of travel in a machine, second, material slitted longitudinally of the direction of feed in the machine, and third, material slitted obliquely to the line of travel in the machine. Each of these classes of slitted material require, preferably, special mechanism for producing the expansion. The expansion of transversely slitted stock is preferably accomplished by cylindrical rolls. The expansion of the longitudinally slitted stock is preferably accomplished by the use of conical rolls for simultaneously acting upon the strands adjacent a diagonal row of slits, the angle of the cones being acute. The obliquely slitted strip is illustrated narrow in width and particularly adapted for fencing. This is pref-

erably produced by the use of a number of conical rolls, one for each bond between the strands, the angle of the cones being obtuse.

The drawings are largely diagrammatic, but sufficiently illustrative of the invention to enable one acquainted with expanded metal working to comprehend perfectly.

Figure 1 is a plan view of a machine for expanding metal slitted transversely of the line of feed. Fig. 2 is a diagrammatic view showing the continuous operation of slitting transversely, expanding and rolling. Fig. 3 is a plan view of a machine for expanding metal slitted longitudinally of the line of feed. Fig. 4 is a diagrammatic view showing the continuous operation of slitting longitudinally, expanding by conical rolls, corrugating, and the formation of a roll of corrugated expanded metal. Fig. 5 is a plan view illustrating a series of conical rolls operating upon a strip of obliquely slitted metal. Fig. 6 is a longitudinal view showing the strip of metal in section. Fig. 7 is a detail view of one of the obtuse conical rolls.

In Figs. 1 and 2 is illustrated the expansion from transversely slitted stock. 2 is the slitted stock. 3-4-5- and 6 are cylindrical rolls having differential peripheral speeds. 8 is the expanded material. Beneath rolls 3, 4, 5 and 6 are preferably arranged rolls 3', 4', 5', and 6' having corresponding surface speeds. These rolls are driven by suitable gearing. The stock is fed between the rolls 3-3', where it is gripped tightly. As it passes along, the front edge is caught by the rolls 4-4', which are traveling at a slightly greater peripheral speed. This frictional engagement draws out the stock and opens up the slits to form openings. The rolls 5-5' operate in the same way, but rotating at a greater speed than the rolls 4-4' to draw out the stock still further. The drawing and expansion is continued by rolls 6-6' and may be continued indefinitely up to the limits of the size of mesh of the product desired. At the same time the expansion is taking place the stock is being constantly rolled so as to present a comparatively finished surface which is flat and lies in the original plane of the stock. In the diagram in Fig. 2, 28-28' indicate suitable feed rolls for the blank stock. 29-29' are suitable slitting punches, and 30-30' are suitable delivery and finishing rolls. This illus-

trates that the invention may be carried out by a continuous process. It is preferred, however, that there shall be a loop of considerable size formed in the slitted stock between the punch 29 and the rolls 3—3', so that the rolling process may be continuous while the punch operation is intermittent, the punch being of the reciprocating type.

In Fig. 3 and the diagram of Fig. 4 is illustrated the expansion of longitudinally slitted stock. 32 is the blank stock. 33—33' are slitting rolls. 32' is the slitted stock. 36—36' are rolls for smoothing the slitted stock and controlling its feed. 39 and 40 are conical rolls arranged above the stock. A similar pair of rolls are arranged beneath the stock of which roll 43 is one. The elements of these cones which contact with the surfaces of the slitted stock are arranged at acute angles to each other and to the line of feed of the stock. All these rolls may be driven by suitable gearing. As the cones are rotated the strands of the stock are gripped between the surfaces of the upper and lower cones and drawn outwardly so as to form the expanded stock 55. 56 and 57 indicate a pair of rolls shaped like the frustums of cones, which may be employed for giving a further expansion to the stock, as shown at 58. A similar pair of rolls is mounted beneath 56 and 57 of which 56' is one. These cones bear only on the outer edges of the stock and their conjoint action is sufficient to expand the central portion of the stock. 59 and 60 are the delivery rolls which continually smooth the metal as it comes from the draw rolls and keep it under sufficient tension, so that the operation of the draw rolls is uniform. It is not necessary to show the details of gearing, as they will be readily understood.

In the diagram of Fig. 4, the stock is slitted by the rolls 33—33', is passed between the rolls 36—36', expanded by the rolls 39—43, 56—56', and smoothed by the rolls 59 and 60. 64 and 65 are two rollers adapted to corrugate the expanded strip transversely to form the stock illustrated diagrammatically at 66. This may be rolled up in a coil, as 67, for convenience in handling. Of course the corrugating rolls 64 and 65 may be omitted if desired, but by their use it is possible to construct expanded metal having any shape or character desired by simply properly designing the rolls 64 and 65. The stock as delivered from the rolls 30—30' in Fig. 9, may also be coiled continuously if desired. It is a convenient form of handling the stock when it is manufactured in long strips. It is possible to coil the completely expanded metal formed in this way with rapidity. The peripheral speed of the conical rolls 39 and 40 and their corresponding lower rolls 43 and 44, of course changes gradually from the apices of the cones toward their bases. The

result is that the outer portion of the slitted strip is acted upon at a greater rate of speed, and the expansion along the outer edge is more rapid. This action is transmitted through the material being acted upon toward the center, however, so that the central portion is acted upon not only by the tips of the cones directly but indirectly through the tension in the stock. The same general operation is true of cones 56 and 57. The taper of the cones and the angles which their axes make relative to the line of feed of the stock, will depend upon the proportion of expansion which it is desired to effect in the material, upon the speed of travel of the strip, and upon the length of the slits in the strip.

Figs. 5 and 6 illustrate the mechanism for expanding an obliquely slitted strip and the method of expansion. 68 indicates the strip which has previously been slitted in lines oblique to the length of the strip, the slits overlapping or alternating relative to one another. 69, 70, 71, 72, 73 and 74 indicate a series of cones, the angle of the taper of which is obtuse, as shown particularly in Fig. 7. Below the line of travel of the strip is located a series of corresponding cones. Three of these are shown in Fig. 6 and are indicated at 69', 71', and 73'. A strip of material may be said to be made up of two outer continuous strands 75 and 76, and the central strand 77, connected to the outer strands by the strands 78 and 79. It is preferred to accomplish the expanding action gradually. A series of cones are therefore provided, and their frictional or gripping surfaces are located so as to cooperate with the strip as it moves along. The peripheral speed of the cones is graduated so as to correspond with the relative movement of the outer edges of the material. The rolls 80 and 80' may be provided to cooperate with the action of the conical rolls so as to produce a uniform expanding action.

The gripping surfaces of the rolls in all three types of my invention may be perfectly smooth if desired, so as to produce a smooth product. This will, of course, require the application of considerable pressure in order to produce the friction necessary for the expanding action. The surfaces of the rolls may, however, be roughened or provided with teeth, grooves, corrugations, or projections for assisting in the drawing action. The particular character of surface employed will depend upon the finish required in the product. The method or art of manufacture and the mechanism employed are of such character as to permit of a wide range of variations in the product. The product, as a consequence of the process of manufacture, is particularly adapted for transportation and handling, since it may be readily coiled up. I do not wish it understood, however, that I consider the invention

as limited to the operation on long strips, since for certain classes of work the invention is peculiarly applicable to the production of large plates.

5 The frictional engagement herein referred to is such engagement as results from the use of smooth or substantially smooth surfaces whereby slippage of the material between the surfaces is possible.

10 What I claim is:

1. The new and improved method of manufacturing expanded metal which comprises first, slitting the metal to form strands and then frictionally engaging the outer surfaces 15 of the strands to open the slits and maintain the strands in a single plane.

2. The method of manufacturing expanded metal sheets which comprises slitting the metal sheet and then continuously feeding and expanding the slitted metal in the plane of the original sheet to form a flat sheet with alternately arranged openings.

3. The method of manufacturing expanded metal which comprises feeding a slitted sheet continuously at right angles to the direction of the slits, opening the slits in the direction of the line of feed and preserving the strands in a single plane.

4. The method of manufacturing expanded metal which includes the continuous frictional engagement of the surfaces of a slitted sheet along the lines of the bonds and entirely across the sheet for opening the slits.

5. The method of manufacturing expanded metal which includes the continuous frictional engagement of the surfaces of a slitted sheet along the lines of the bonds and straight across the sheet for opening the 40 slits.

6. The method of manufacturing expanded metal which includes the frictional engagement of the surfaces of a slitted sheet at right angles to the direction of feed.

7. The method of manufacturing expanded metal which includes the continuous feed and engagement of a slitted sheet to open the slits in the plane of the original stock and form a flat sheet.

8. The method of manufacturing expanded metal which comprises continuously feeding and expanding a slitted sheet in a single plane to form a flat sheet.

9. A method of forming expanded metal sheets or strips, which comprises slitting the metal to form strands connected at intervals, and continuously rolling the strands to open the slits in the direction of the original plane of the metal to form a flat sheet.

10. A method of forming expanded sheet metal material, which comprises slitting the

metal, rolling it down flat, and continuously opening the slits in a single plane.

11. A method of forming expanded metal material, which comprises slitting a strip of metal and gradually and continuously opening the slits and retaining the bonds and strands in the plane of the original metal.

12. A method of forming expanded sheet metal material which comprises slitting the entire width of the stock, and continuously feeding and rolling the slitted stock to open the slits and form a flat sheet.

13. The method of manufacturing expanded sheet metal, which consists in forming alternating slits in the metal, feeding the metal in a direction at right angles to the slits and frictionally engaging the metal at a plurality of lines substantially at right angles to the direction of feed of the metal to open the slits.

14. The method of expanding a slitted sheet which includes feeding the sheet at a certain speed, applying a stretching force at a speed to produce the desired total expansion and applying an intermediate stretching force whereby the total effective stretching action is divided into definite gradual steps.

15. The method of expanding a slitted sheet which includes stretching and flattening the sheet and again further stretching and flattening the sheet to form a flat product.

16. The method of expanding a slitted sheet composed of strands and bonds, which includes stretching the sheet to open the slits and rolling the sheet transversely to the bonds to set the bonds and strands into a flat plane.

17. The method of expanding a slitted sheet which consists in stretching and rolling the sheet flat and again stretching the partially expanded sheet and rolling it flat.

18. The method of expanding a slitted sheet which includes subjecting limited portions of the sheet successively to a plurality of gradual stretching and flattening operations.

19. The method of forming an expanded metal fabric which consists in slitting a sheet, then flattening the slitted sheet, then expanding the flat slitted sheet and then rolling the expanded sheet.

20. The method of forming an expanded metal fabric which includes slitting a sheet, then rolling the slitted sheet flat, then expanding the slitted sheet and then flattening the expanded sheet.

NORRIS ELMORE CLARK.

Witnesses:

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D. G. CLARK.

It is hereby certified that in Letters Patent No. 884,714, granted April 14, 1908, upon the application of Norris Elmore Clark, of Plainville, Connecticut, for an improvement in "the Manufacture of Expanded Metal," an error appears in the printed specification requiring correction, as follows: In line 56, page 2, abbreviation and numeral "Fig. 9" should read *Fig. 2*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of April, A. D., 1908.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.