No. 845,617. PATENTED FEB. 26, 1907.

N. E. CLARK.

EXPANDED METAL MANUFACTURE.

APPLICATION FILED JUNE 5, 1906.

2 SHEETS—SHEET 1.

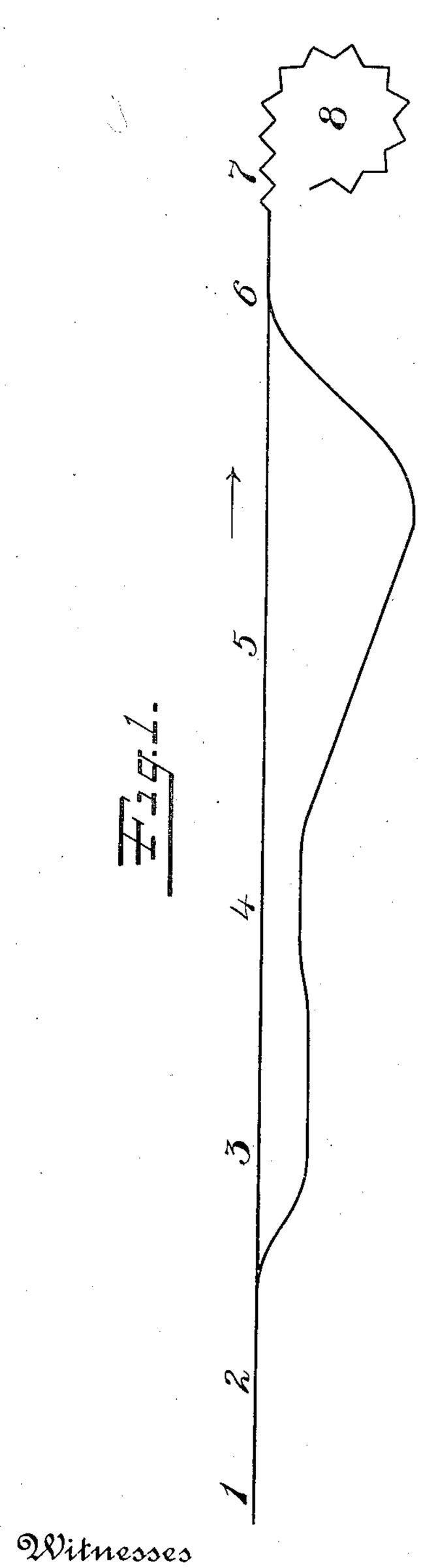

Fig. 1.

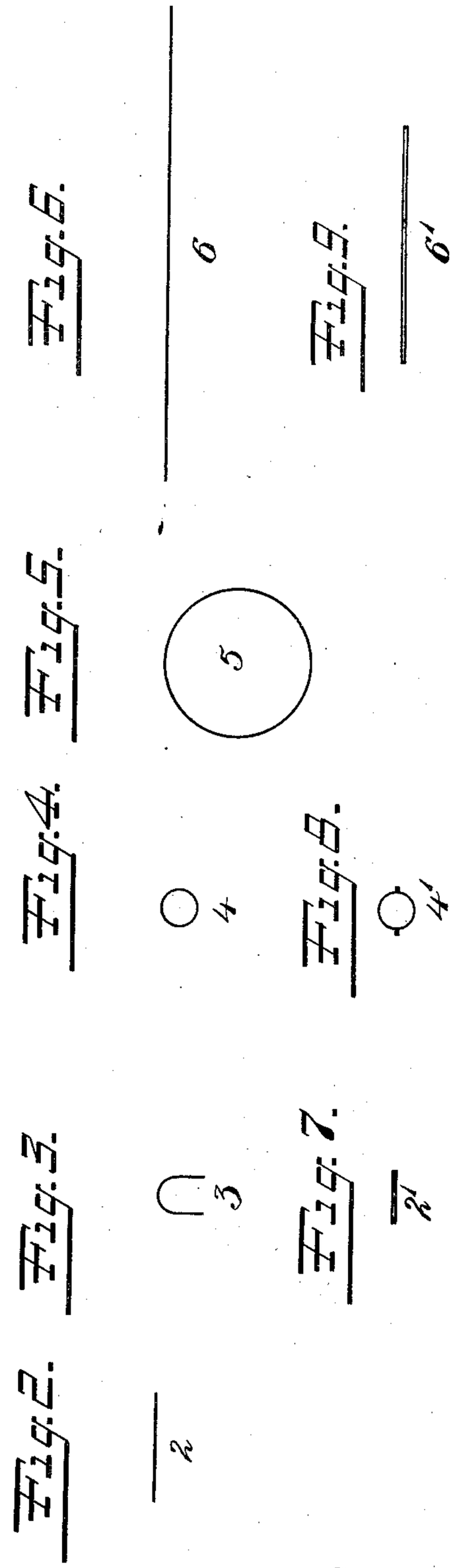

Fig. 2.

Witnesses

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By his Attorneys

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2 SHEETS—SHEET 2.

Fig. 10.

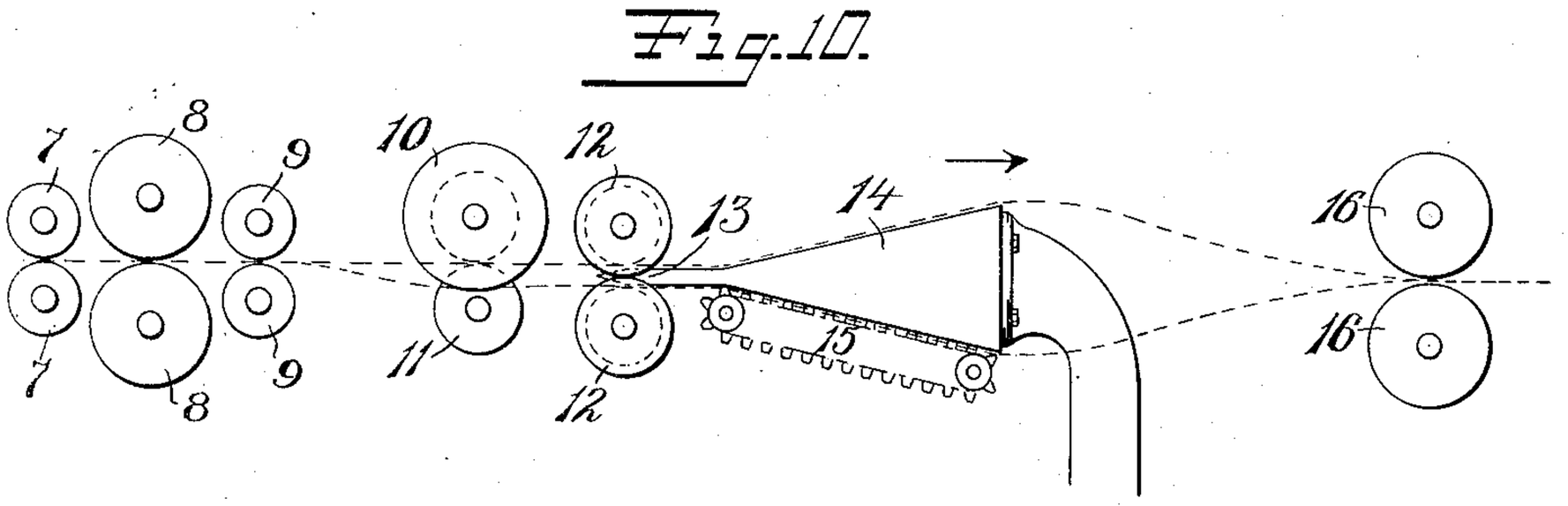


Fig. 11.

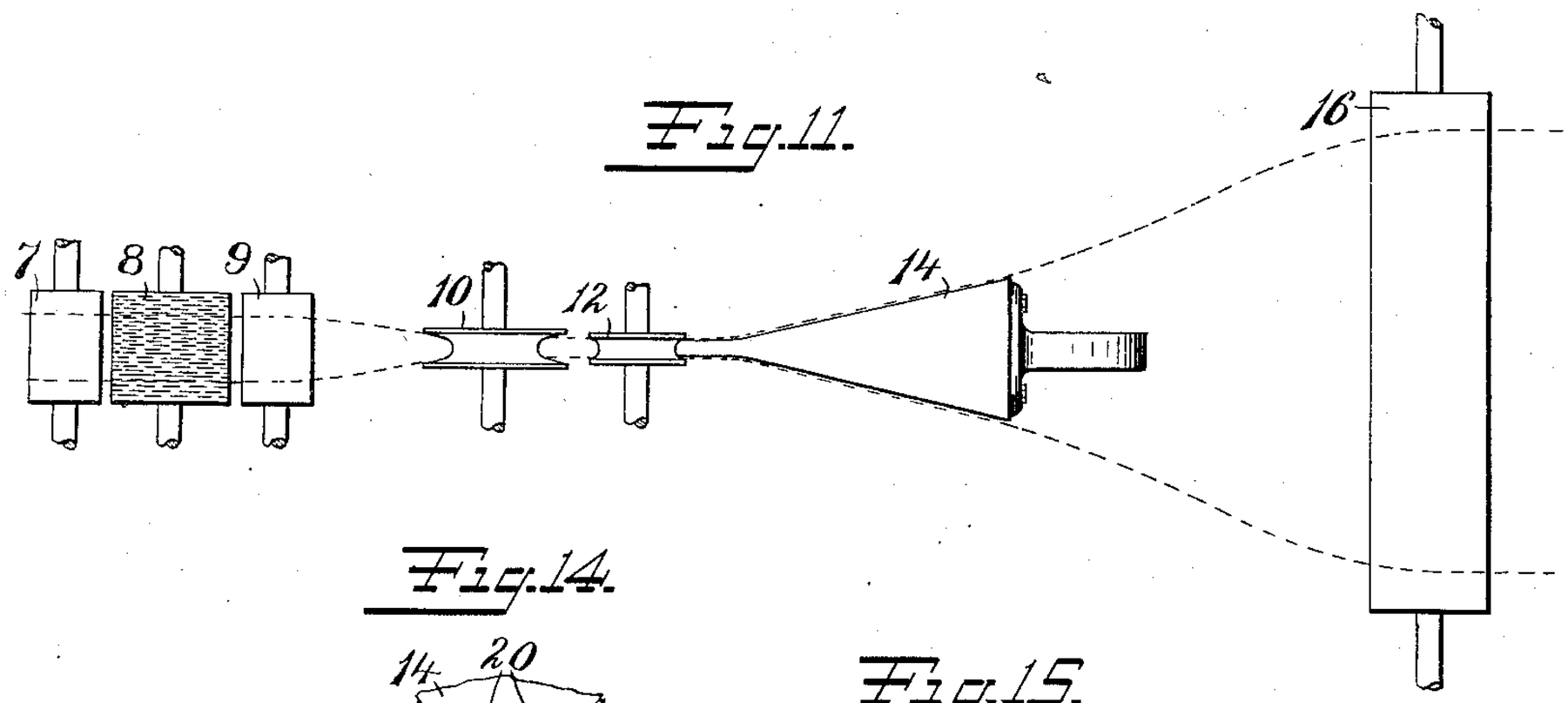


Fig. 14.

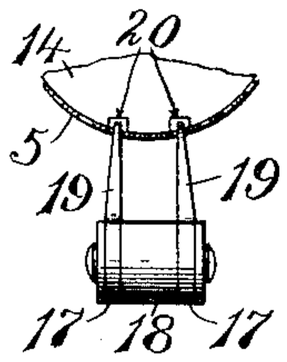


Fig. 15.

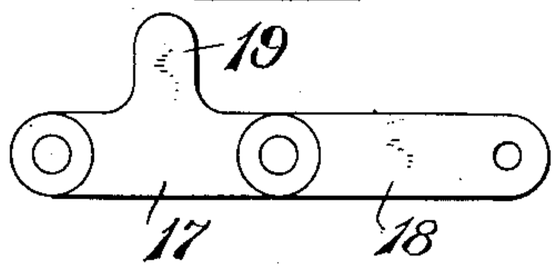


Fig. 12.

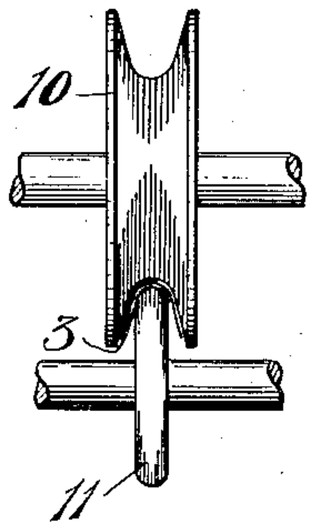
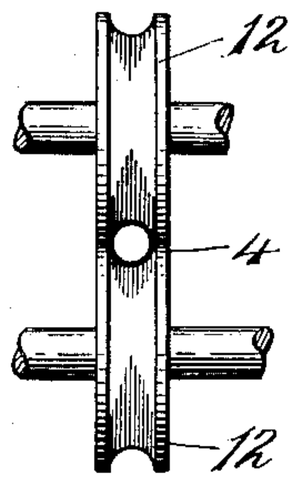


Fig. 13.



Witnesses

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UNITED STATES PATENT OFFICE.

NORRIS ELMORE CLARK, OF PLAINVILLE, CONNECTICUT.

EXPANDED-METAL MANUFACTURE.

No. 845,617. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed June 5, 1906. Serial No. 320,254.

To all whom it may concern:

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

My invention relates to improvements in metal-working, and particularly the manufacture of expanded metal.

One object of my invention is to produce a tube of expanded metal.

Another object of my invention is to manufacture flat expanded metal of the character set forth in United States Letters Patent No. 767,798, granted me August 16, 1904, with great rapidity and at low cost.

Another object is to produce economically a material suitable for concrete reinforcements, lathing, &c., having great strength, uniformity, and retaining power.

The invention contemplates the expansion by internal pressure of a tube of sheet metal having slits alternating with each other and arranged longitudinally of the tube, so as to separate the strands and form an expanded tube having openings. When a flat sheet as distinguished from a cylindrical sheet is desired, the tube is opened out. When a roughened product is desired, the flat sheet may be subjected to a corrugating or roughening action for bending the bonds and strands. By "tube" I do not necessarily mean one having a circular cross-section. The tube may be formed from a single sheet of metal having its edges brought together, and it may be flattened on the sides, if desired. The tube may also be formed by uniting two or more sheets of metal. The metal may be slitted before or after the formation of the tube, according to the machinery employed and the results desired. When the slitted tube is formed, it is subjected to internal pressure—for instance, by drawing it over a mandrel—which causes the strands to separate from each other and form openings. The shape of the mandrel may be varied; but a circular cross-section or one approaching the circular and having a smooth surface is preferred, since this produces a more uniform product. The tubular product resulting from the expansive action is suitable for various kinds of work. A greater scope of utility is, however, found in the flat product of my former patent. The tube is readily converted into this product by the action of suitable rolls. Since for certain classes of work a material having pockets or recesses as distinguished from mere perforations is desired, I subject the sheet of expanded metal to a corrugating action.

The method set forth is illustrated diagrammatically on Sheet 1 of the drawings, while Sheet 2 shows one form of mechanism for carrying the invention into effect. In this present application I claim the method of manufacture, but wish it understood that I reserve the right to claim in another application the mechanism herein described.

Figure 1 is a diagram showing the outline of a sheet of metal passing through the various steps of my improved method. Fig. 2 indicates the shape of the original flat slitted sheet or strip. Fig. 3 shows the slitted sheet arched. Fig. 4 shows it formed into a tube. Fig. 5 shows the tube expanded. Fig. 6 shows the expanded tube flattened out. The relative sizes of Figs. 2 and 6 show the lateral expansion, while the relative sizes of Figs. 4 and 5 show the relative tubular expansion. Fig. 7 is a view similar to Fig. 2, but showing a double thickness of metal forming a flat tube. Fig. 8 is similar to Fig. 4, but shows the flat tube formed into a round tube, the edges being united and forming flanges convenient for feed engagement. Fig. 9 is a view similar to Fig. 6, showing the double expanded sheet flattened out. Fig. 10 is a diagrammatic side elevation of one form of mechanism for carrying out the steps of my invention to produce a flat product. The outline of the metal being operated upon is shown in dotted lines. Fig. 11 is a plan view of the same. Fig. 12 is an enlarged detail of folding-rolls. Fig. 13 is a similar detail of tube-forming rolls. Fig. 14 is a detail showing a fragment of a mandrel and means for feeding and holding the expanding sheet. Fig. 15 is a detail side view of two of the feed-chain links.

The relative positions and sequence of steps is shown in Fig. 1, in which 1 indicates the flat stock. 2 indicates the stock after slitting longitudinally. 3 indicates the stock folded or formed into an arch. 4 indicates the tubular formation. 5 indicates the tubular expansion by mandrel action. 6 indicates the flattened product. 7 indicates the corrugated product, and 8 indicates the coil

formed for convenience in handling and shipping. All these steps may be carried out in one machine, if desired, or in separate machines. The steps are, however, of such a nature that great economy of operation results from their operation in a continuous machine requiring only one handling of the material.

2′ indicates a double sheet or flat tube. 4′ indicates a round tube formed therefrom, and 6′ indicates the double expanded sheet. The double sheet may be formed from a single sheet folded in the center, or it may be formed from two narrow sheets. The edges may be secured together by any suitable means—for instance, by clamps, by clips, or by welding. The double sheet is, in effect, already a flat tube. In operating on a double sheet, such as 2′, the arching and tubing rolls are unnecessary, since the sheet is simply drawn over the mandrel after inserting the tip of the mandrel between the upper and lower parts of the sheet. After the double expanded sheet is formed the edges may be separated or left connected, according to how the material is to be used. The flat double sheet is useful for many purposes in the condition shown in Fig. 9.

Sheet 2 shows diagrammatically details of one form of mechanism for carrying out the expanding and flattening steps of my invention. 7 7 are feed-rolls. 8 8 are slitting or lancing rolls for forming slits in the stock, extending longitudinally of the direction of travel and arranged alternately in any suitable way, so that the slits may be opened laterally of their length. 9 9 indicate a second pair of feed-rolls, which serve to flatten the slitted product, so that the subsequent expanding action may be more uniform. 10 and 11 indicate two rolls coöperating to form the flat slitted sheet into an arch. 12 12 indicate two rolls shaped to form the arched slitted sheet into a tube. In order that the tube formation may be more perfect, I prefer to employ a central core 13, extending into the space between the tubing-rolls 12 12. 14 indicates the expanding-mandrel, which in this instance is shown as carrying the central core 13. The core may, however, be formed separately. 15 indicates a continuously-driven chain for feeding or drawing the tubular sheet over the surface of the mandrel. When the surface of the expanding-mandrel is smooth and unbroken, the expansion of the sheet is uniform at every point on any section. When the mandrel is tapered, the expansion is gradual from the beginning to the end and proportional to the increase in mandrel-surface.

16 16 indicate rolls for flattening the product. The mechanism illustrated is particularly intended for forming the tube from a flat strip, expanding the tube, and then opening it and flattening the expanded sheet. The edges of the original strip when it is brought into tubular form need, therefore, be only temporarily connected. This may be accomplished in any suitable manner—for instance, by a chain having links 17 and 18. Each link 17 has a projecting tooth 19, adapted to pass through an opening in the tube and travel along in a groove 20 in the mandrel-surface. The two corresponding teeth 19 19, as shown in Fig. 14, thus serve to hold the edges of the sheet 5 together and in contact with the mandrel. When the chain lets go of the expanded tube, the edges of the tubular sheet spring away from the mandrel, and the sheet may be then passed between the rolls 16 16 for flattening and setting the bonds and strands in the same plane, as set forth in my Patent No. 788,093, of April 25, 1905. After the product has been smoothed by the rolls 16 16 it may be again rolled to elongate the strands, if desired, or the same action may be obtained by suitably adjusting the pressure between the rolls 16 16. The expanded product may be subjected to further action, such as corrugation, for producing a material having projections lying in different planes and forming pockets, as described and claimed in another application, Serial No. 323,451, filed June 26, 1906.

When it is desired to use the product in tubular form, it is unnecessary to open the tube after expansion. It is therefore a simple matter either to permanently unite the edges of a flat strip before expansion—for instance, by welding—or to slit a tube previously formed by drawing or welding. While it is preferred to expand the tube while feeding it forward, the expansion may be accomplished by internal pressure while stationary.

While I have shown a chain for feeding the tubular sheet during the expansive action, it should be understood that I contemplate the use of clamps, rolls, traveling blocks fed by screws, &c., and hence claim, broadly, the method set forth irrespective of the form or character of feeding device.

What I claim is—

1. A method of expanding metal, which includes slitting a strip, forming it into a tube, and expanding it while in tubular form.

2. A method of expanding metal, which includes drawing a tube of slitted metal over an expanding-mandrel having a continuous bearing-surface.

3. A method of forming expanded metal, which includes expanding a slitted tube, opening the tube, and corrugating the product.

4. A method of forming expanded metal, which includes expanding a slitted tube of metal, opening the tube, and flattening the product.

5. A method of expanding metal, which includes expanding a slitted tube, opening the tube, flattening the expanded sheet, and corrugating the flattened sheet.

6. A method of expanding metal, which includes forming a double thickness of slitted metal, expanding both thicknesses of metal simultaneously, and separating the two thicknesses.

7. A method of expanding metal, including forming a tube of slitted metal and drawing the tube over a curved continuous expanding-surface.

8. A method of expanding metal, which comprises subjecting a tube of longitudinally-slitted metal to gradually-increasing internal pressure to separate the strands and form openings.

9. A method of expanding metal, including slitting the metal longitudinally, flattening it, forming it into a tube, and expanding the tube.

10. A method of expanding metal, including slitting the metal longitudinally, flattening it, forming it into a tube, expanding the tube, and flattening the expanded product.

11. A method of expanding metal, including slitting the metal longitudinally, flattening it, forming it into a tube, expanding the tube, and flattening and corrugating the expanded product.

12. A method of expanding metal, which includes fastening together a plurality of slitted strips of metal superimposed upon one another, simultaneously expanding the strips, and then separating the expanded sheets.

13. A method of expanding metal, including temporarily fastening together the edges of a sheet or sheets of slitted material, expanding the sheet or sheets, and then separating the edges.

14. A method of expanding sheet metal, which includes drawing a tubular slitted sheet of metal over a gradually-tapered mandrel.

15. A method of expanding metal, which comprises drawing a sheet of slitted stock over a smooth substantially continuous bearing-surface increasing in area in proportion to the expansion of the metal.

16. A method of expanding metal, which comprises subjecting the entire area of a sheet of slitted stock to the same ultimate pressure and substantially at right angles to its surface.

17. A method of expanding sheet metal which comprises slitting the stock, flattening the slitted stock, forming it into a tube and then expanding the slitted tube.

18. A method of expanding sheet metal, which comprises slitting the stock, flattening the slitted stock, tubing it, expanding the slitted tube and then flattening the expanded sheet.

19. A method of expanding sheet metal, which comprises slitting the stock, flattening the slitted stock, tubing it, expanding the tube and then corrugating the expanded sheet.

20. A method of expanding sheet metal which comprises slitting the stock, flattening the slitted stock, forming it into a tube, expanding the tube, flattening the expanded sheet, and corrugating the flattened sheet.

21. A method of expanding sheet metal, including drawing a tube of slitted metal over a mandrel having a gradually-increasing surface area.

22. A method of expanding metal which includes forming a tube of slitted metal drawing the tube over an expanding-mandrel and opening the expanded tube.

23. A method of forming expanded metal which includes forming a tube of slitted metal, expanding the tube, opening the expanded tube and flattening the product.

24. A method of expanding metal which includes forming a tube of metal with longitudinally-arranged slits, subjecting the tube to internal pressure to separate the strands and form openings and then opening the tube.

25. A method of expanding metal, which includes slitting a strip of metal, forming it into a tube, expanding the tube and flattening the product.

26. A method of expanding sheet metal, which includes slitting a strip of metal, arching the slitted strip, then forming it into a tube, and then expanding the tube.

27. A method of expanding metal, which includes slitting a strip, then arching it, then tubing it, expanding the tube and opening the expanded tube.

28. A method of expanding metal, which includes slitting a strip, then rolling it, then tubing it, expanding the tube, opening the expanded tube and flattening the product.

29. A method of expanding metal, which includes slitting a strip of metal, forming it into a tube and drawing the tube over an expanding-mandrel.

30. A method of forming expanded metal, which includes slitting a strip of metal, forming it into a tube, expanding the tube, opening the expanded tube and flattening the product.

NORRIS ELMORE CLARK.

Witnesses:
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WM. A. BENTON.