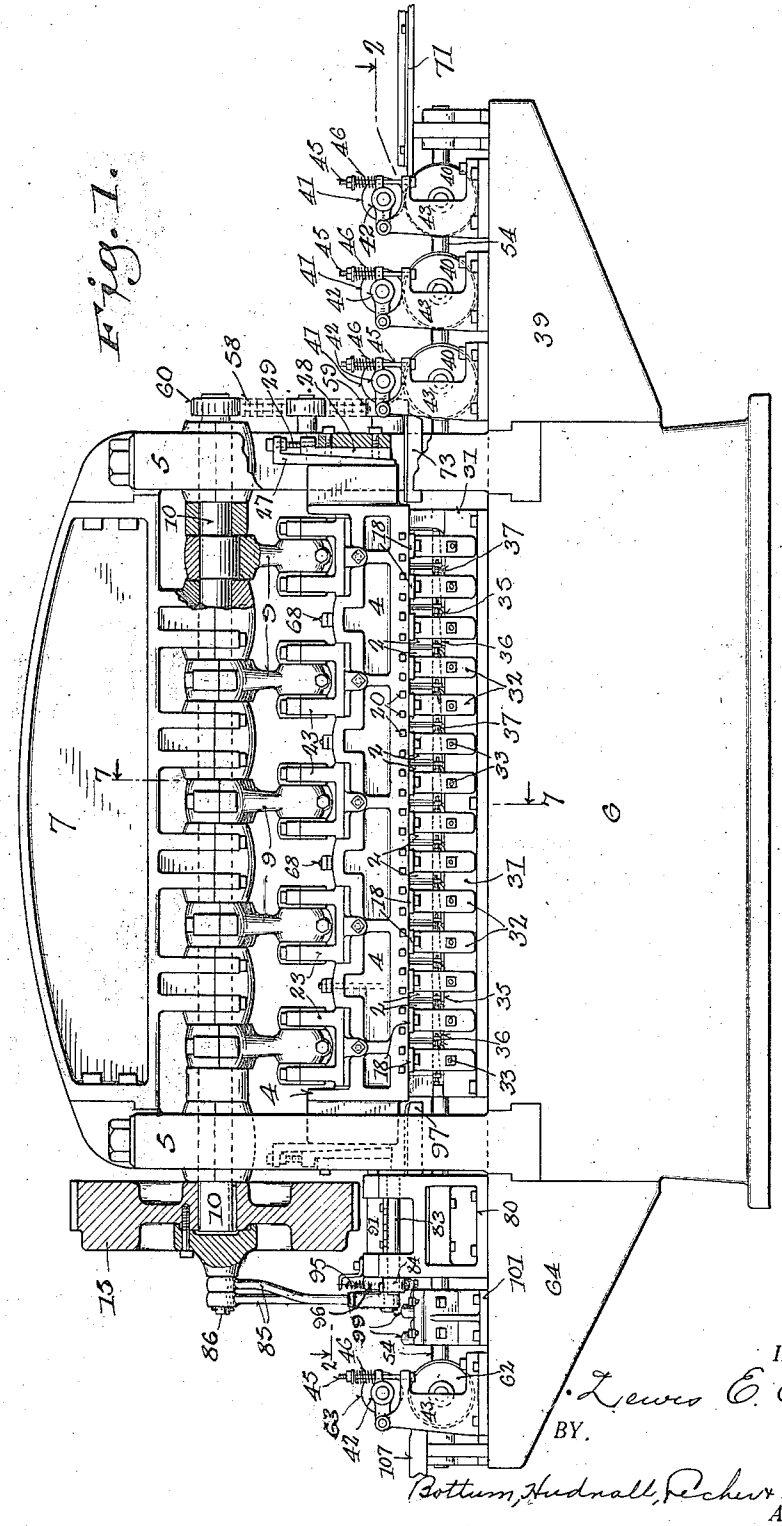
Feb. 5, 1924. 1,482,600

L. E. CURTIS

METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

Filed Sept. 30, 1921 7 Sheets-Sheet 1

Fig. 1.



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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES.

Filed Sept. 30, 1921 7 Sheets-Sheet 2

Fig. 2.

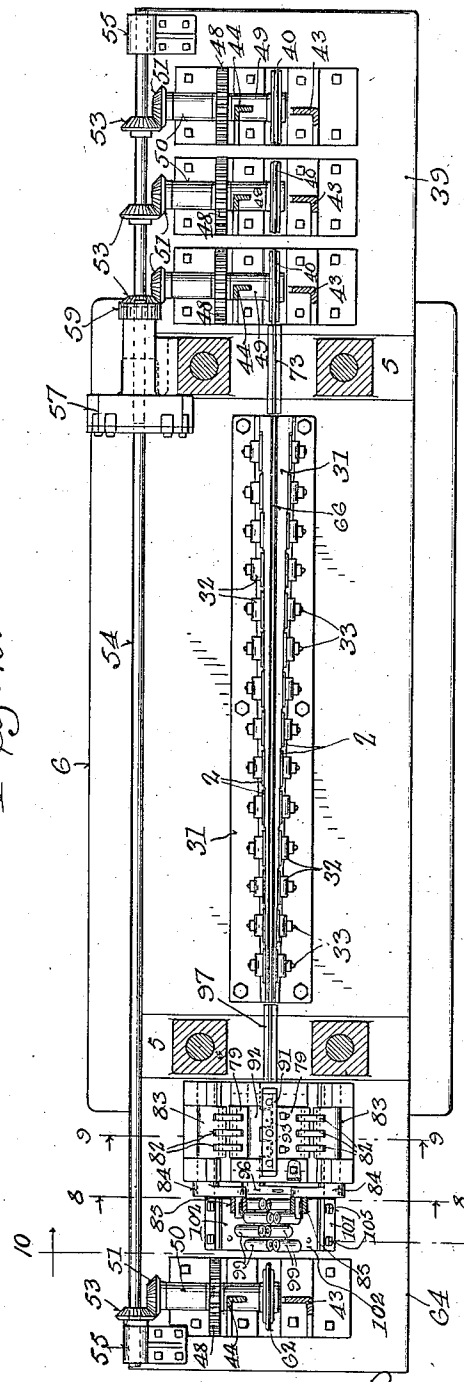


Fig. 4.

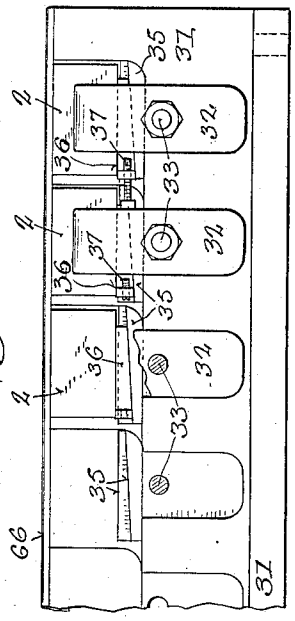
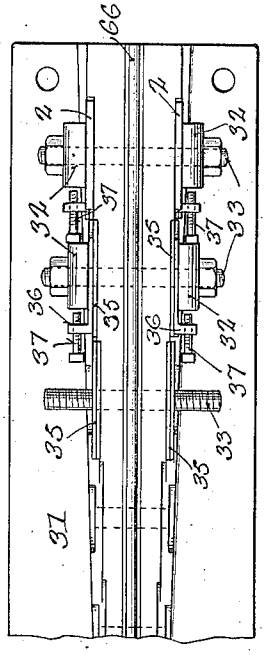


Fig. 3.



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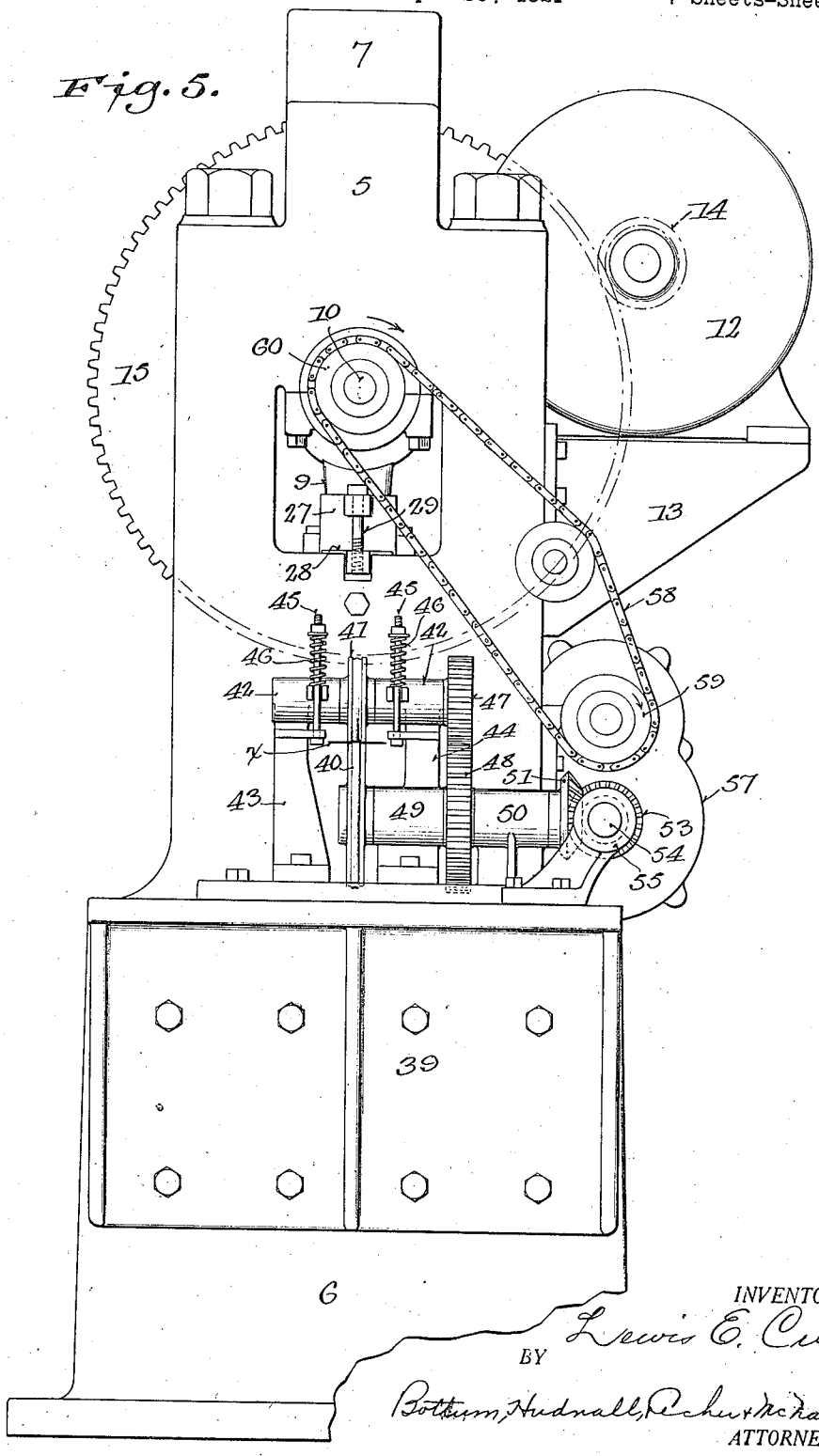
Feb. 5, 1924. 1,482,600

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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

Filed Sept. 30, 1921 7 Sheets-Sheet 3

Fig. 5.



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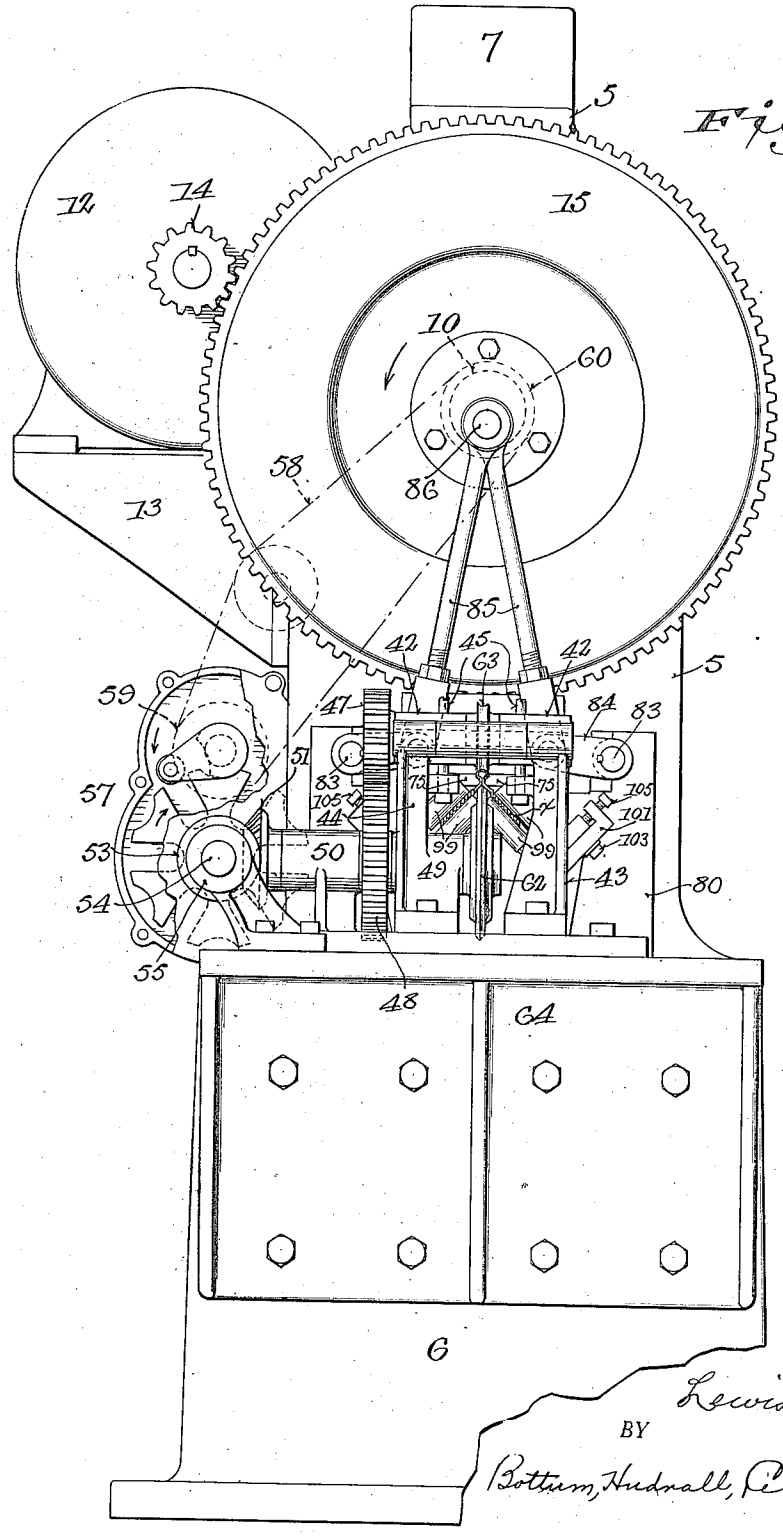
Feb. 5, 1924. 1,482,600

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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

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Fig. 6.



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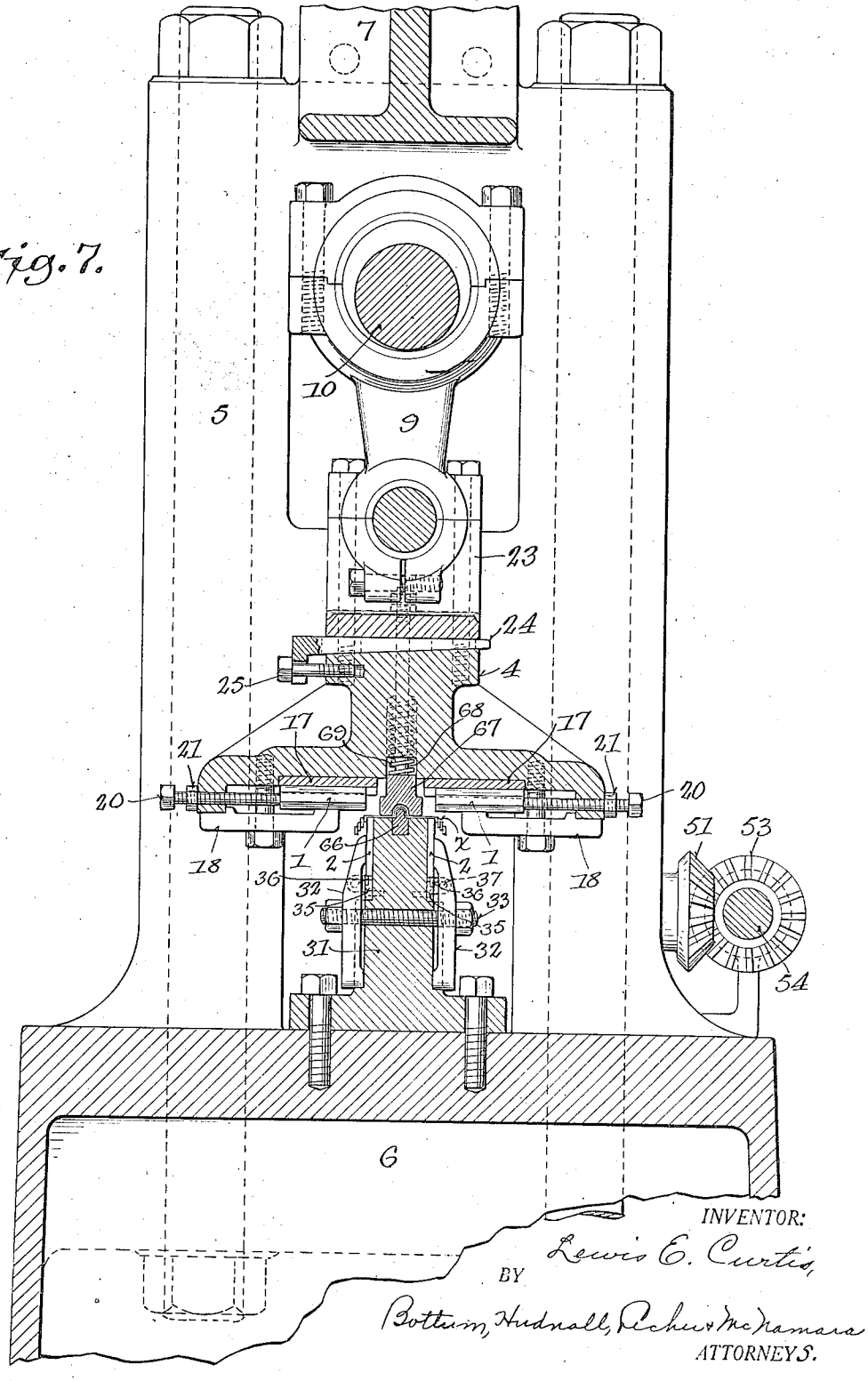
Feb. 5, 1924. 1,482,600

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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

Filed Sept. 30, 1921 7 Sheets-Sheet 5

Fig. 7.



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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

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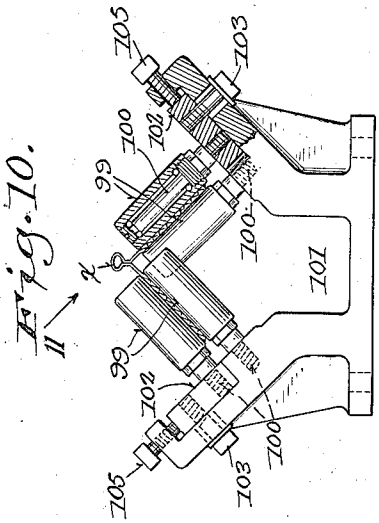


Fig. 10.

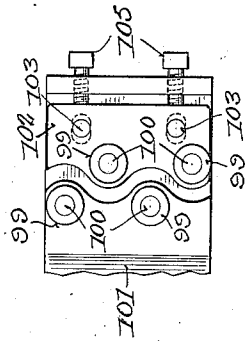


Fig. 11.

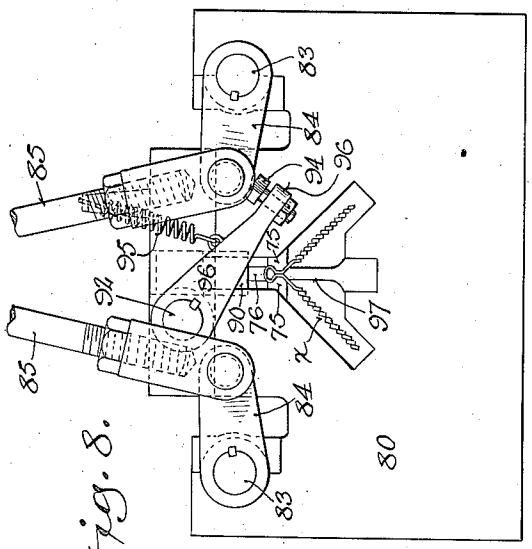


Fig. 8.

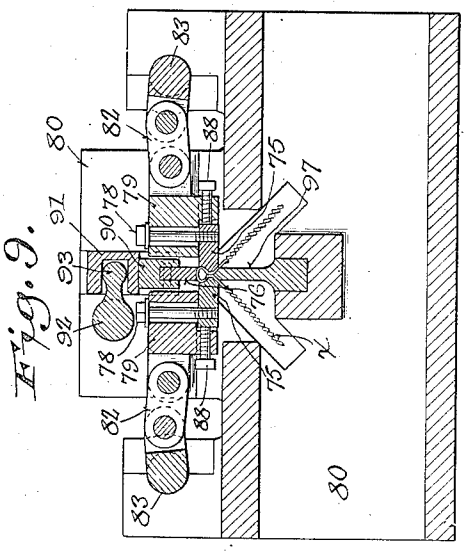


Fig. 9.

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METHOD OF AND MACHINE FOR PRODUCING EXPANDED SHEET METAL ARTICLES

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Fig. 12.

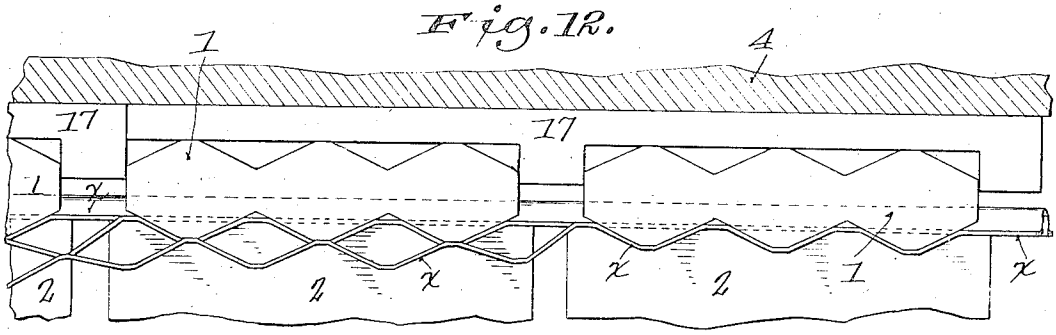


Fig. 13.

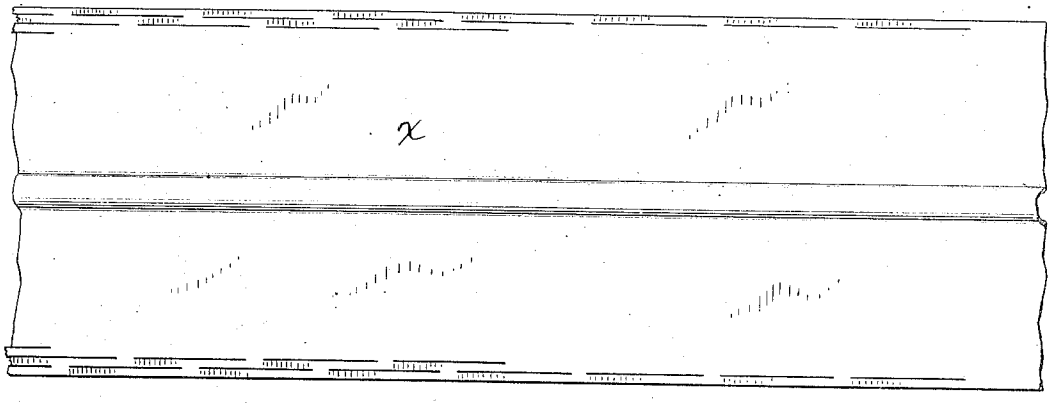
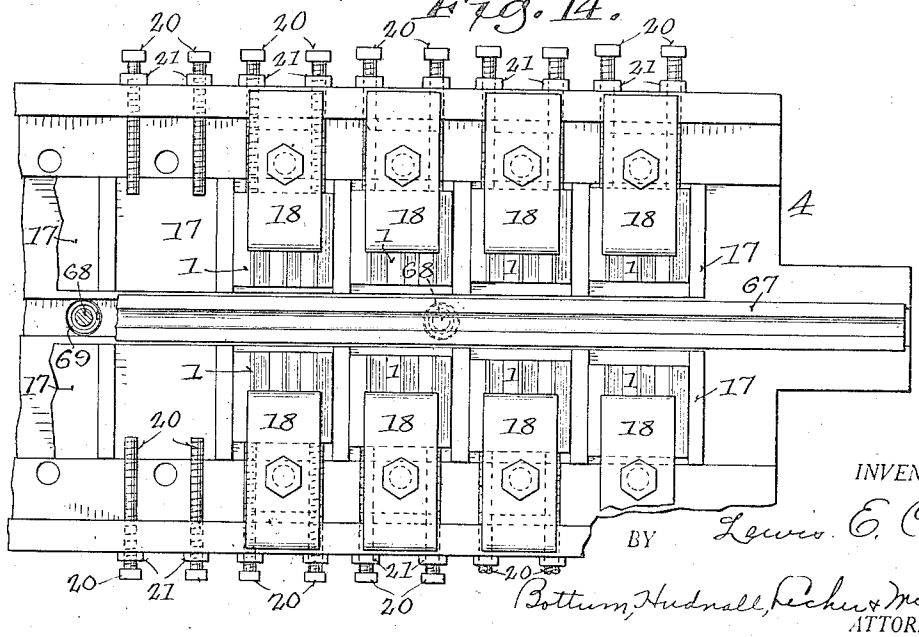


Fig. 14.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND MACHINE FOR PRODUCING EXPANDED-SHEET-METAL ARTICLES.

Application filed September 30, 1921. Serial No. 504,336.

To all whom it may concern:

Be it known that I, LEWIS E. CURTIS, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Methods of and Machines for Producing Expanded-Sheet-Metal Articles, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates more particularly to methods and apparatus by which sheet-metal is simultaneously slit and expanded with reciprocating slitting and expanding cutters, the sheets being fed step by step to the cutters lengthwise thereof parallel with the cutters and the side margins of the sheets.

The main objects of the invention are to increase the output of such processes and apparatus, and generally to simplify and improve the construction and operation of apparatus for the purpose.

It consists in the method or process and in the construction, arrangement and combination of parts of apparatus for performing the method or process as hereinafter particularly described and pointed out in the following claims.

In the accompanying drawing illustrating a machine for carrying out the method or process in accordance with the invention in the manufacture of sheet-metal corner beads or plaster terminals having guiding ribs or beads and expanded wings, like characters designate the same parts in the several figures.

Figure 1 is a side elevation of a corner bead machine embodying a part of the invention; Fig. 2 is a horizontal section on the line 2—2, Fig. 1, showing the arrangement of the lower cutters; Fig. 3 is an enlarged partial plan view of the lower cutter holder; Fig. 4 is an enlarged partial side elevation of the same and associated parts; Fig. 5 is an enlarged front end elevation of the machine; Fig. 6 is an enlarged rear end elevation of the machine; Fig. 7 is an enlarged vertical cross section on the line 7—7, Fig. 1; Figs. 8, 9 and 10 are enlarged detail views in elevation and section taken in planes indicated by the lines 8—8, 9—9 and 10—10 respectively, Fig. 2, showing the bead finishing and wing straightening and truing mechanism at the delivery end of the machine; Fig. 11 is a partial projection viewed in the direction of the arrow 11, Fig. 10, of the wing straightening mechanism, shown in side elevation in Fig. 10; Fig. 12 is a full size side elevation of a number of cutters illustrating in connection with a partially expanded piece of sheet-metal, their operation; Fig. 13 is a plan view of the partially slitted and expanded sheet shown in edge or side elevation in Fig. 12 and Fig. 14 is an enlarged partial inverted plan view of the cross head on which the upper cutters are mounted.

The Golding and Durkee Patent 381,230 of April 17, 1888, and the Golding Patent 381,231 of the same date, are the first so far as I am aware, to disclose machines of the type to which the present invention pertains, having reciprocating slitting and expanding cutters, in which the blank sheets are fed lengthwise of the slits, but in these machines the sheets are advanced the distance of one slit or mesh only at a time, a slit being made and the adjoining strand simultaneously bent to form a single mesh in each longitudinal row of meshes with each advance of the sheet, and one set of cutters is shifted lengthwise alternately in opposite directions after each advance of the sheet, so that the slits in adjacent longitudinal lines will be staggered, and the slits of each line will be opposite the bonds between the slits of the adjacent line or lines.

The Golding Patents 527,242 of October 9, 1894, and 581,713 of March 4, 1897, describe and show a process and machine by which rows of slits are cut one row at a time the full length of a sheet and the resulting strands are simultaneously bent and stretched one row at a time to form the meshes, but with such process and machine the sheets are fed transversely to the slits the width of a single strand at a time, and the sheet is shifted back and forth lengthwise of the cutters the distance of half a slit or mesh alternately with its step by step advance movement.

The Pitkin Patent 619,340 of February 14, 1899 and the Fordyce and Duncan Patent 643,640 of February 20, 1900, each shows and describes a machine for simultaneously slitting and expanding sheet metal, having converging series of rotary cutters.

In these machines the sheets are fed con-

tinuously to the cutters, each or each coacting pair of which, makes one row of slits and simultaneously bends and stretches the strands to form a single row of meshes, and each cutter or coacting pair of cutters, forms a plurality of slits one after another to each revolution. The rotary cutters are thus necessarily of considerable diameter, and consecutive cutters are spaced apart lengthwise of the machine a distance equal to several slits or meshes, thereby unduly lengthening the machines and making them unwieldy and cumbersome.

The Clark Patent 1,146,554 of July 13, 1915, shows and describes a sheet metal slitting machine having reciprocating wedge-shaped cutters arranged to make with each reciprocation two diverging series of aligned slits oblique to the direction of feed and to the side margins of the sheet. With this machine the sheets are advanced step by step the distance between consecutive slits in the direction of feed, thus limiting the feed and correspondingly limiting the output of the machine. This machine contemplates the expansion or opening of the slits into meshes by a subsequent operation in the same or a separate machine independently of the slitting mechanism.

The White Patent 1,049,632 of January 7, 1913, discloses a machine having two sets of cutters arranged in two series diverging in the direction of feed, and adapted to cut and expand a single slit at a time of each row of aligned slits parallel with the side margins of the sheets and in the direction of feed, the slits being cut progressively from the center towards the sides of the areas to be slitted in transverse rows, and the sheets being fed step by step the length of a single slit or mesh at a time. This patent also contemplates preliminarily providing the sheets with stiffening grooves or ribs and subsequently expanding the same in a separate machine independently of the slitting mechanism.

By my improved method and with my improved machine, the sheet is intermittently advanced by intervals, each corresponding with a plurality of aligned slits, and a plurality of aligned slits are cut and the strands thus made are simultaneously expanded into meshes in each of a number of rows parallel with each other and with the advance movement of the sheet, beginning adjacent one longitudinal edge of the sheet and progressing towards the other edge.

In these respects the present method and machine differ from those disclosed in the foregoing patents and are adapted to increase the output of such methods and machines, particularly for certain products such as plaster terminals of various kinds, corner beads, etc., having ribs or beads.

Referring to the drawing, showing for the purpose of illustration, a machine specially designed for making corner beads or plaster terminals in accordance with the invention, the machine is provided with two sets of cutters 1 and 2, one set movable towards and from and adapted to cooperate with the other set, to simultaneously slit and expand sheet-metal. In the present case, for the particular purpose for which the machine is designed, each set of cutters is arranged in two rows converging towards the delivery end of the machine, as shown in Figs. 2 and 14. The slitting and expanding cutters 1 of the upper set, are adjustably mounted on and movable with a vertically reciprocating horizontal cross head 4, which is guided at its ends, as shown in Fig. 1, by ways in uprights or end members 5 of the frame, which comprises a base 6 and an arched tie beam 7, supported at its ends by and connecting the upper ends of the uprights 5.

The cross head 4 is adjustably connected at intervals by links 9 with cranks or eccentrics of a shaft 10, which is supported at intervals by bearings in the uprights 5 and beam 7, above and parallel with the cross head.

The shaft 10 may be driven and a vertical reciprocating movement imparted to the cutters 1, by any suitable power connection, for example, as shown in Figs. 1, 5 and 6, by an electric motor 12, supported by a bracket 13 on one of the frame uprights 5, and provided with a pinion 14, meshing with a gear 15 mounted on one end of said shaft, preferably the rear end, and made heavy, as shown, to serve as a fly or balance wheel.

The cutters 1, shown in Figs. 7, 12 and 14, formed for convenience in transversely corrugated or ribbed and grooved blocks with four interchangeable cutting edges, are fastened with transversely flanged or ribbed backing plates 17 by clamps 18 to the under side of the cross head. The individual cutters, as shown in Fig. 12, have cutting edges of slightly truncated V-shape, and are arranged in a number of parallel series, each consisting of a plurality of cutters having their effective cutting edges longitudinally aligned with and separated from one another in the direction in which the sheets are fed through the machine, as hereinafter explained.

In the present case three cutters are formed integrally with one another in a single block, but the number to each block and in each longitudinally aligned series, as well as the construction of the cutters, may be varied.

In the present case the cutter blocks, each constituting a longitudinally aligned series of cutters, are adjusted transversely to take up wear and to work properly with the lower stationary cutters 2 by means of screws 20, threaded in marginal flanges on

the outer sides of the cross head 4, and fastened in adjusted position therein by lock nuts 21. The cross head 4 is connected with the links 9 by pivot blocks 23, bolted to the upper side thereof with interposed wedges 24, which are connected with the cross head by adjusting screws 25, threaded therein and engaging at their heads with downwardly extending notched ears on the larger ends of the wedges. The wedges 24^a and screws 25 afford means for adjusting the cross head 4 with the cutters 1 vertically, to work properly with the lower stationary cutters 2 and to align the pivot blocks 23 with the pivot pins in the lower ends of the link 9.

The cross head 4 is adjusted longitudinally so that the upper reciprocating cutters 1 will cooperate properly with the lower stationary cutters 2 by means of wedges 27 and 28 and adjusting screws 29, shown in Fig. 1.

The lower cutters 2, which are of flat quadrangular form and have four interchangeable cutting edges, each of somewhat greater length than the total length of a single series of aligned upper cutters 1, as shown in Fig. 12, are mounted as shown in Figs. 1, 2, 3, 4 and 7, on opposite sides of a stepped bar or supporting member 31, which is bolted or rigidly fastened to the base 6 below and parallel with the cross head 4. The cutters 2 are thus arranged parallel with one another in two rows converging towards the delivery end of the machine and corresponding in arrangement with the upper reciprocating cutters 1, with which they are adjusted to cooperate. The several cutters are fastened to the bar 31 by clamps 32 and bolts 33 passing through the clamps and bar and provided at their ends with nuts. The cutters 2 are adjusted vertically on the bar 31 to properly cooperate with the movable cutters 1, and to compensate for wear, by wedges 35 and 36 interposed between the lower edges of the cutters and shoulders at the lower ends of the cutter seats on the bar, and by adjusting screws 37, threaded in outwardly projecting ears on the larger ends of the wedges 36 and engaging adjacent sides of the clamps 32, as shown in Figs. 1 and 4.

On an extension bracket or table 39 of the base 6 at the front end of the machine, are mounted, as shown in Figs. 1, 2 and 5, a longitudinally aligned series of pairs of feed and beading rolls 40, 41. The shafts of the upper rolls 41 are mounted in vertically movable bearings 42, which are pivotally connected with standards 43 and 44, and yieldingly connected therewith by bolts 45 and adjustable springs 46. The shafts of the upper yielding rolls 41 are connected by gears 47 and 48 with the shafts of the lower rolls 40, and the shafts of the rolls 40 which are mounted in bearings 49 and 50, are provided at the ends opposite the rolls with bevel gears 51. The gears 51 mesh with similar gears 53 on a longitudinal shaft 54, mounted in bearings 55 on the machine frame. The shaft 54 is intermittently rotated through the medium of a Geneva gear 57, shown in Fig. 6. The driving member of the Geneva gear is connected by a chain or link belt 58 and chain wheels or pulleys 59 and 60, with the front end of the crank shaft 10, as shown in Figs. 1 and 5.

The feed and beading rolls 40 and 41 are made to progressively form on the sheets to be slit and expanded as they enter the machine, upwardly projecting guiding beads, which are primarily open on the under side of the sheets, as shown in Figs. 5 and 7, and the feeding mechanism is adapted to advance the sheet step by step the length of a single series of longitudinally aligned cutters 1, in the present case three cutters, while said cutters are withdrawn upwardly from the stationary cutters 2. The downward movement of the V-shaped cutters 1 is limited, so that the slits cut by each series of cutters will be separated from one another, leaving bonds, say of about one-eighth of an inch in length, between them, to alternately connect the strands of the successively formed longitudinal rows of meshes, as illustrated in Figs. 12 and 13.

At the delivery end of the machine, one or more pairs of rolls 62 and 63, conforming to the final shape of the corner beads, are mounted like or similarly to the rolls 40 and 41, on an extension bracket or table 64, and are intermittently driven in like manner, by gears 51 and 53 from the shaft 54.

As shown in Figs. 2 and 7, the lower cutter bar or member 31 is provided with a longitudinal guide 66, having an upwardly projecting rib or tongue which fits loosely into the under open sides of the longitudinal guiding beads formed in the sheets by the rolls 40 ond 41. Directly above this guide 66, the cross head 4 is provided with a longitudinal guide and stripper 67, located between the two rows of cutters 1, and fitting a central longitudinal channel in the under side of the cross head, with which it is yieldingly connected by bolts or rods 68 passing loosely upward through the cross head and provided at their upper ends with stop nuts which adjustably limit the downward movement of the guide and stripper relative to the cross head. Springs 69, inserted in sockets in the cross head around the bolts, and bearing against the upper side of the guide and stripper which has a longitudinal groove in the under side, press it yieldingly downward towards the cutter bar or member 31, holding in engagement with the upwardly projecting ribs on the sheets as they pass through the machine, and thereby directing

the sheets parallel with the inner cutting edges or faces of the cutters in proper position to be operated upon thereby.

At the front end of the machine mounted on the bracket 39, is a table 71, upon which the sheets to be fed to the machine are placed and directed in proper position to the feed and beading rolls 40 and 41. Between the feed and beading rolls 40 and 41 and the slitting and expanding cutters 1 and 2, the machine is provided in alignment with the guide 66 with a tongued guide 73, shown in Fig. 1, which is adapted by engagement with the open grooves formed by the beads on the under side of the sheets, to direct the beads into engagement with the guides 66 and 67.

At the rear end of the machine between the adjacent upright 5 and the rolls 62 and 63, bead forming and finishing mechanism is mounted on the bracket 64, as shown in Figs. 1 and 2. This mechanism, as shown in Figs. 8 and 9 in connection with Figs. 1 and 2, comprises two parallel laterally movable bead shaping dies 75, and a vertically movable die 76, located centrally above and parallel with the dies 75. The dies 75 are adjustably fastened by bolts 78 to the under side of slides or heads 79, which are guided at their ends in horizontal ways on a stand or support 80, mounted on the bracket 64. The slides or heads 79 are connected by links 82 with cranks on rocker shafts 83, mounted on the stand or support 80, parallel with and adjacent the outer sides of the slides or heads. The crank shafts 83 are provided at their rear ends with inwardly extending rocker arms 84, which are connected by rods 85 with a crank pin 86 mounted, as shown in Figs. 1 and 6, on the rear end of the shaft 10 or gear 15. The dies 75 are adjusted towards or from each other on the slides or heads 79 by screws 88, the bolts 78 being loosened.

The die 76 is removably fastened in a grooved bar or holder 90, which in turn is fastened to a recessed slide or head 91 and guided therewith in vertical ways on the stand or support 80. The slide or head 91 is moved up and down synchronously with the outward and inward movement of the slides or heads 79 by a rocker shaft 92, mounted in bearings on the stand or support 80, parallel with the crank shafts 83, and provided with rounded crank arms 93 engaging lateral recesses in the slide or head 91. On the rear end of the shaft 92 is mounted an arm 96, which is provided at its free end with an adjustable contact bolt or member held by a spring 95 in engagement with the inner end of one of the rocker arms 84, by which the die 76 is moved downwardly against the top of a bead on a sheet as the dies 75 are moved together against the sides of the bead to give it its final shape.

A guide 97, shown in Figs. 2, 8 and 9, is adapted by engagement with the bead grooves in the under side of the sheets, to direct them to the dies 75 and 76 in proper position for the operation thereon by said dies, to give the beads their final shape. From the rear end of the guide 66 to the bead finishing and shaping dies, the guide 97 is shaped like the rib on the guide 66, to engage with the bead grooves of the sheets, as shown in Fig. 7. Opposite the dies 75 and 76, the upper part of the guide 97 is formed, as shown in Figs. 8 and 9, to permit the dies 75 to close and press the sides of the beads together, the guide conforming to the angle between the wings of the beads and cooperating with the dies to impart the desired final shape to the beads.

Between the bead shaping and finishing dies and the feed or pull-out rolls 62 and 63, the machine is provided with two staggered series of rolls 99, set at an angle to one another, as shown in Figs. 2 and 10, and adapted to straighten or true the expanded wings of the corner beads as they pass between them from the bead shaping and finishing dies.

The inner and lower rolls 99 of each series are mounted on stationary studs 100, fastened at their lower ends in the branches of a Y-shaped stand or support 101, as shown in Figs. 10 and 11, while the upper and outer rolls of each series are mounted on and adjustable with like studs parallel but alternating with the studs of the associated inner and lower rolls and fastened at their lower ends in plates or slides 102, adjustably fastened by bolts 103 to the upwardly diverging branches of the stand or support 101. The plates or slides 102, with the rolls mounted thereon, are adjusted towards or from the opposing stationarily mounted inner and lower rolls by screws 105.

At the delivery end of the machine, as shown in Fig. 1, a guide or support 107, is provided for receiving the finished corner beads from the rolls 62 and 63.

In the drawing, a sheet metal blank shown in certain figures in different stages of its formation into a corner bead, having slitted and expanded wings, is designated *x*.

In the operation of the machine, to produce corner beads according to the method constituting a part of the present invention, the blank sheets are placed on the table 71 and advanced one at a time to the feed and bead forming rolls 40 and 41, by which longitudinal guiding beads are formed thereon, and they are simultaneously fed step by step between the slitting and expanding cutters 1 and 2, the distance of a single series, in the present case three, of longitudinally aligned cutters, at a time or to each step. After each step in the advance movement of the sheet, the cross head

4 with the several series of cutters 1, descends, and in the first operation on a sheet, cuts two parallel series of longitudinally aligned slits adjacent to and parallel with the side margins of the sheet as shown at the right in Fig. 13. Simultaneously with the slitting of the sheet, the V-shaped cutters 1, cooperating with the straight edged cutters 2, expand the strands thus formed into meshes or half meshes, as shown in Fig. 12.

In the second operation, two additional series of slits are cut and the strands formed thereby simultaneously expanded in longitudinal alignment with the first formed series and at the same time two more series of longitudinally aligned slits alternating with the bonds of the first formed series, are cut, and the strands thus formed expanded into half meshes, completing the previously formed half meshes of the first series.

With each succeeding operation, additional series of slits and strands are cut and expanded in alignment with the previously formed slits and strands, thus progressing step by step longitudinally the distance of a plurality of longitudinally aligned slits and transversely the width of a single strand on each side of and towards the central guiding bead with each step, additional series of slits and strands being simultaneously cut and expanded at each step until both wings of the corner bead are completely expanded. With the expansion of successive rows of strands the wings of the corner bead are gradually bent downward in diverging planes, as shown in Figs. 6, 7, 8, 9 and 12.

In their passage through the machine, the sheets are directed in the proper course and held in the proper position for the operation of the slitting and expanding cutters 1 and 2, by engagement of the guides 66 and 67 with the longitudinal guiding beads formed by the rolls 40 and 41. The upper yielding guide 67, serving as a stripper, holds the sheets in engagement with the lower guide and prevents their being lifted away from the lower cutters 2 by the upward movement of the reciprocating upper cutters 1.

As the sheets pass from the slitting and expanding cutters between the dies 75 and 76, the sides of the beads are pressed together and the desired shape is given to the beads, as shown in Figs. 8 and 9.

Passing from the bead shaping and finishing dies between the straightening or truing rolls 99, the expanded wings of the corner beads which leave the slitting and expanding cutters more or less winding or warped, are straightened and trued to the proper angle with each other.

When the sheets clear the last pair of beading and feeding rolls 40 and 41, they are engaged by the rolls 62 and 63, which continue to draw them intermittently through the machine, and finally deliver them therefrom upon the guide or support 107, from which they may be removed by an operator or otherwise.

The construction and arrangement of the slitting and expanding cutters, the feed and beading rolls, the bead shaping and finishing dies and other parts of the machine, may be modified in various ways to adapt the machine to the production of different kinds of expanded sheet-metal products such as lathing and plaster terminals of various designs, without departure from the principle and scope of the invention, as defined in the following claims.

I claim:

1. The method of producing expanded sheet-metal articles which consists in advancing a sheet step by step lengthwise of slits aligned to be cut therein a distance of a plurality of slits to each step, and simultaneously after each successive advance movement of the sheet cutting a series of longitudinally aligned slits in each of a number of parallel series, the slits in each series alternating with those of adjacent series.

2. The method of producing expanded sheet-metal articles which consists in advancing a sheet step by step lengthwise of the slits to be cut therein a distance of a plurality of slits to each step, and simultaneously after each successive advance movement of the sheet cutting a series of longitudinally aligned slits in each of a number of parallel series, beginning at one side and progressing transversely towards the other side of an area to be expanded as the sheet is intermittently advanced longitudinally, the slits in each series alternating with those of adjacent series.

3. The method of producing expanded sheet-metal articles which consists in advancing a sheet step by step lengthwise of slits to be cut therein a distance of a plurality of slits to each step, after each successive advance movement of the sheet simultaneously cutting a series of longitudinally aligned slits and bending and stretching into open meshes the strands thus formed in each of a number of parallel series, the slits of each series alternating with those of adjacent series.

4. The method of producing expanded sheet-metal articles which consists in intermittently advancing a sheet step by step lengthwise of slits to be cut therein a distance of a plurality of slits to each step, after each advance movement of the sheet simultaneously cutting a series of longitudinally aligned slits in each of a number of parallel series, the slits in the several series alternating with those of adjacent series, and simultaneously bending into open meshes the strands thus formed, beginning

adjacent one end and one side of an area to be expanded and progressing transversely to the slits towards the other side of such area with the intermittent advance movement of the sheet lengthwise of the slits.

5. The method of producing expanded sheet-metal articles which consists in first forming a sheet with a longitudinal guiding bead, advancing the sheet lengthwise of and directed by the bead step by step a distance at each step of a plurality of slits to be cut and simultaneously cutting a series of longitudinally aligned slits in each of a number of series parallel with each other and with the bead after each successive advance movement of the sheet, the slits in each series alternating with those of adjacent series.

6. The method of producing expanded sheet-metal articles which consists in forming a sheet with a preliminary longtudinal guiding bead, advancing the sheet lengthwise of and directed by the bead step by step a distance of a number of longitudinally aligned slits to each step, simultaneously cutting a series of such slits and expanding the strands thus formed into open meshes in each of an increasing number of series parallel with each other and with the bead after each successive advance movement of the sheet, the slits in each series alternating with those of adjacent series, and finally forming the bead into the shape it is to have in the finished product.

7. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters, one movable towards and from and adapted to cooperate with the other set to simultaneously cut a series of longitudinally aligned slits in each of a number of parallel series, means for reciprocating one set of cutters towards and from the other set, and means for intermittently advancing a sheet between the opposing cutters lengthwise thereof a distance corresponding with the length of a single series of aligned cutters to each step.

8. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters one of which is movable towards and from and adapted to cooperate with the other, one set comprising a number of parallel series each consisting of a plurality of longitudinally spaced and aligned cutters, the parallel series being spaced longitudinally from one another a distance corresponding with half the length of a single cutter, means for reciprocating one set of cutters towards and from the other set, and means for intermittently advancing a sheet between the opposing cutters lengthwise thereof the length of a single series of aligned cutters at a time, whereby the slits in adjacent series are staggered.

9. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters one of which is movable towards and from the other and adapted to cooperate therewith, one set comprising a number of longitudinally spaced parallel series each consisting of a plurality of longitudinally spaced and aligned cutters adapted to simultaneously cut a series of longitudinally aligned slits and expand the strands thus made into meshes, means for reciprocating the movable cutters, rolls for intermittently advancing sheets between the opposing cutters lengthwise thereof the length of a single series of aligned cutters at a time and for simultaneously forming longitudinal guiding beads on the sheets as they are fed to the cutters, and a guide adapted by engagement with the beads on the sheets to direct them through the machine parallel with the working edges of the cutters.

10. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters, one set being movable towards and from the other, each set comprising two rows converging towards the delivery end of the machine, and the two converging rows of one set each comprising a number of longitudinally spaced parallel series each consisting of a plurality of longitudinally aligned and spaced cutters adapted to simultaneously cut a plurality of aligned slits and expand the strands thus formed, means for reciprocating the movable cutters, and means for intermittently advancing sheets between the opposing and cooperating cutters the length of a single series of cutters at a time.

11. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters one movable towards and from and adapted to cooperate with the other and one set comprising a number of longitudinally spaced parallel series each consisting of a plurality of longitudinally aligned and spaced slitting and expanding cutters, rolls adapted to intermittently feed sheets between the opposing and cooperating cutters parallel with their cutting edges the length of a single series of cutters at a time and to form guiding beads on the sheets, a guide adapted by engagement with the beads to direct the sheets through the machine with the beads parallel with the working edges of the cutters, and dies adapted to shape the beads to final form.

12. In a machine for producing expanded sheet-metal products, the combination of two sets of slitting and expanding cutters, one set movable towards and from and adapted to cooperate with the other, each set comprising two rows converging towards the delivery end of the machine, and the two converging rows of one set each comprising a number of longitudinally spaced par-

allel series each consisting of a plurality of longitudinally aligned and spaced cutters, rolls adapted to intermittently feed sheets between the opposing cutters parallel with their working edges the length of a single series of cutters at a time and to form longitudinal guiding beads on the sheets, a guide adapted by engagement with the beads to direct the sheets through the machine with the beads parallel with the cutting edges of the cutters, and truing rolls arranged adjacent the delivery end of the machine transversely to and on opposite sides of the line of the guide, and on opposite sides of the paths of the expanded portions of the sheets through the machine.

13. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters, one set movable towards and from the other, means for simultaneously reciprocating the movable cutters, one set comprising a number of longitudinally spaced parallel series arranged in a row oblique to the working edges of the cutters, and each series consisting of a plurality of longitudinally aligned and spaced slitting and expanding cutters, and means for intermittently advancing sheets between the opposing cutters parallel with the several series of aligned cutters the length of a single series at a time.

14. In a machine for producing expanded sheet-metal articles, the combination of two sets of cutters, one set movable towards and from the other, means for simultaneously reciprocating the movable cutters, one set comprising a number of parallel series spaced from one another longitudinally half the length of a single mesh and transversely the width of a single strand, and arranged in a row oblique to the several parallel series and to the direction of feed of the work through the machine, and each series consisting of a plurality of longitudinally spaced and aligned V-shaped cutters, and means for intermittently advancing sheets between the opposing cutters parallel with the several series of longitudinally aligned cutters the length of a single series at a time.

15. In a machine for producing expanded sheet-metal articles, the combination of rolls adapted to form preliminary guiding beads on sheets to be slit and expanded as they are fed to the machine, means for intermittently turning said rolls to advance the sheets the length of a plurality of longitudinally aligned cutters at a time, two sets of cutters, one set movable towards and from the other and adapted to cooperate therewith to simultaneously slit and expand the sheets, means for reciprocating the movable cutters, one set of cutters comprising a number of longitudinally spaced parallel series arranged in a row oblique to the working edges of the cutters and to the direction of feed of the sheets through the machine, and each series consisting of a plurality of longitudinally spaced and aligned slitting and expanding cutters, a longitudinal guiding rib and an upwardly yielding longitudinally grooved stripper arranged to cooperate with the guiding rib to direct the sheets in their proper course through the machine by engagement with the guiding beads of the sheets.

In witness whereof I hereto affix my signature.

LEWIS E. CURTIS.