

July 17, 1928.

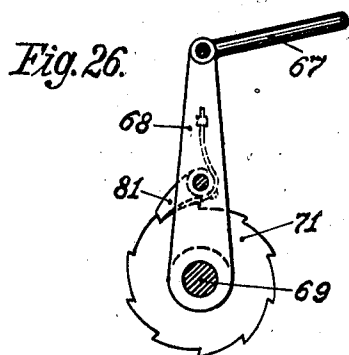
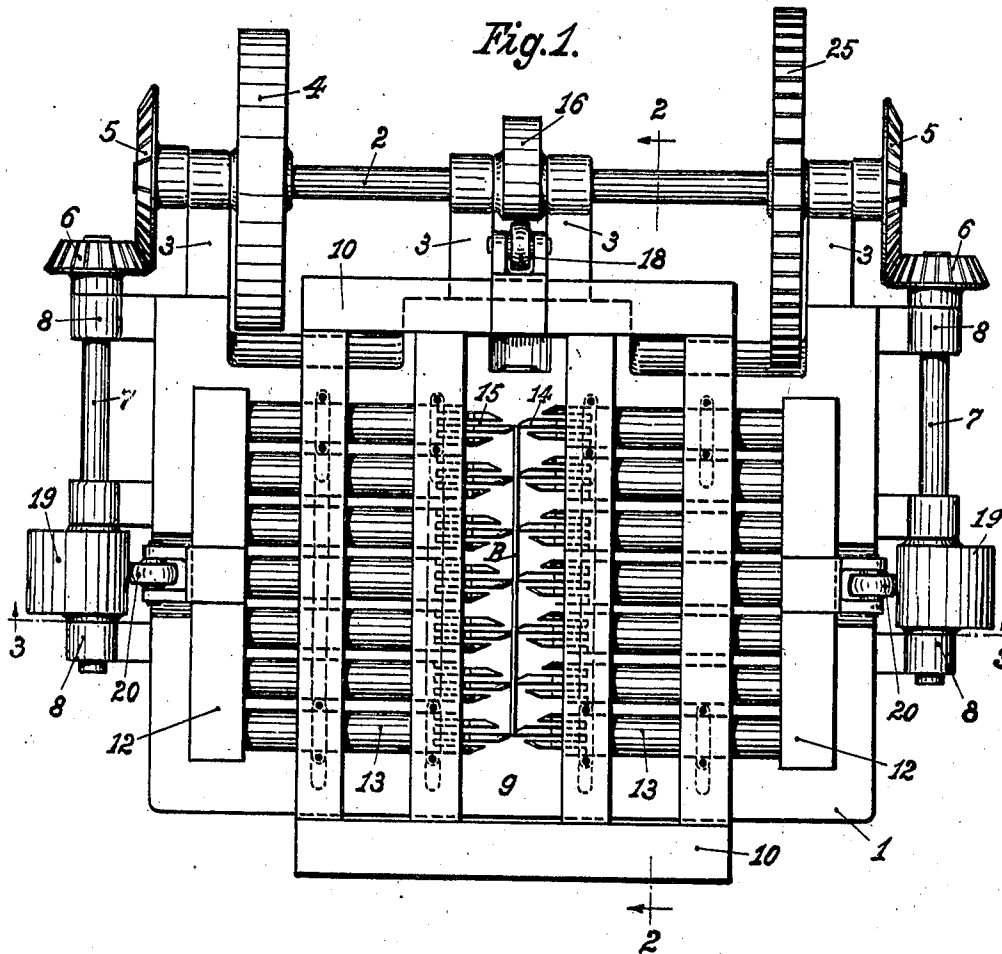
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1,677,438

APPARATUS FOR PRODUCING MESHED SHEET METAL, FLAT BARS, AND HOOP IRON

Filed Nov. 10, 1924

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

Fig. 2.

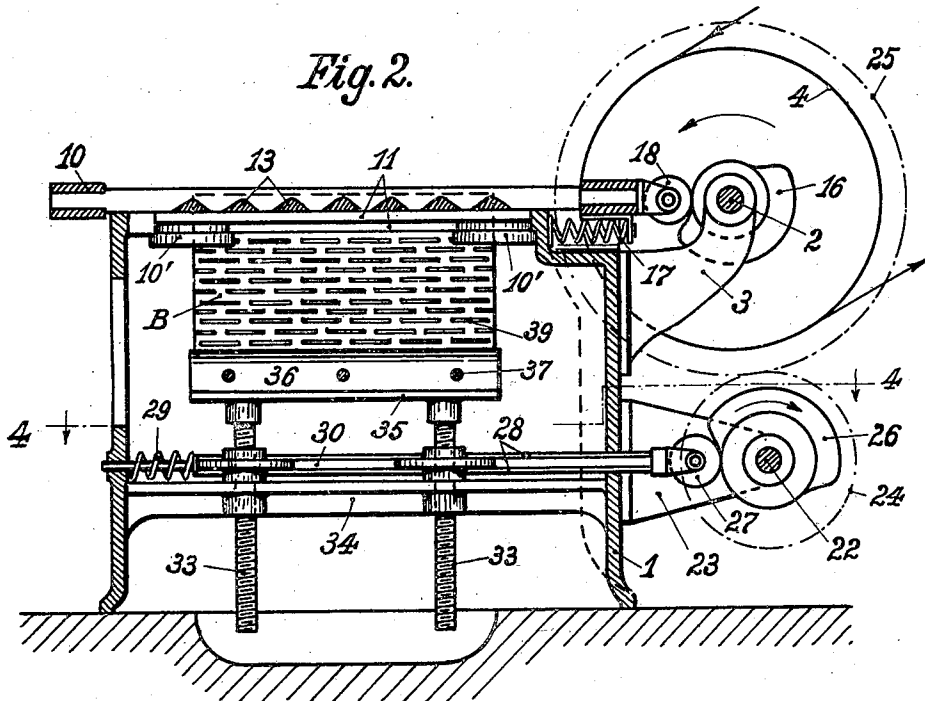
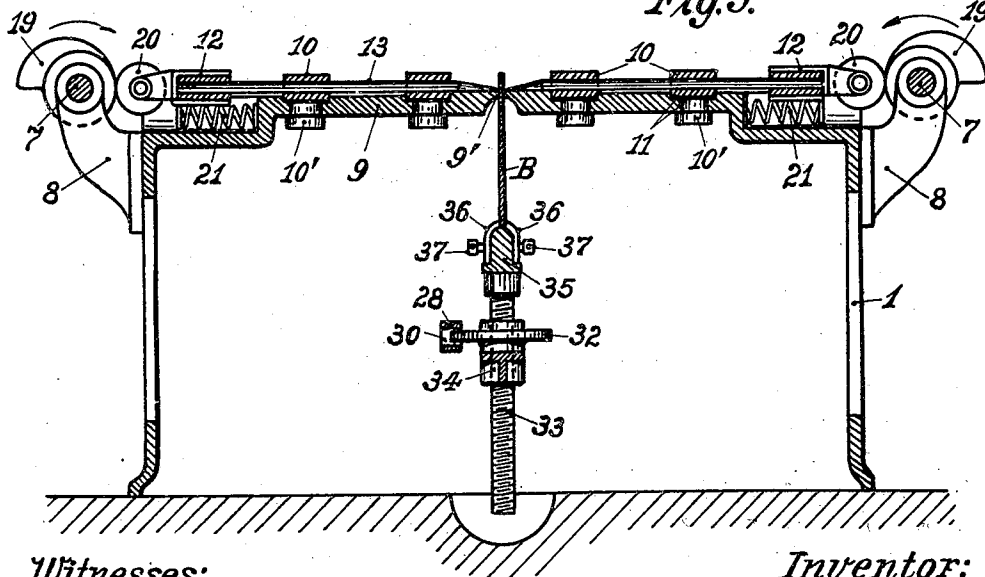


Fig. 3.



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5 Sheets-Sheet 3

Fig. 4.

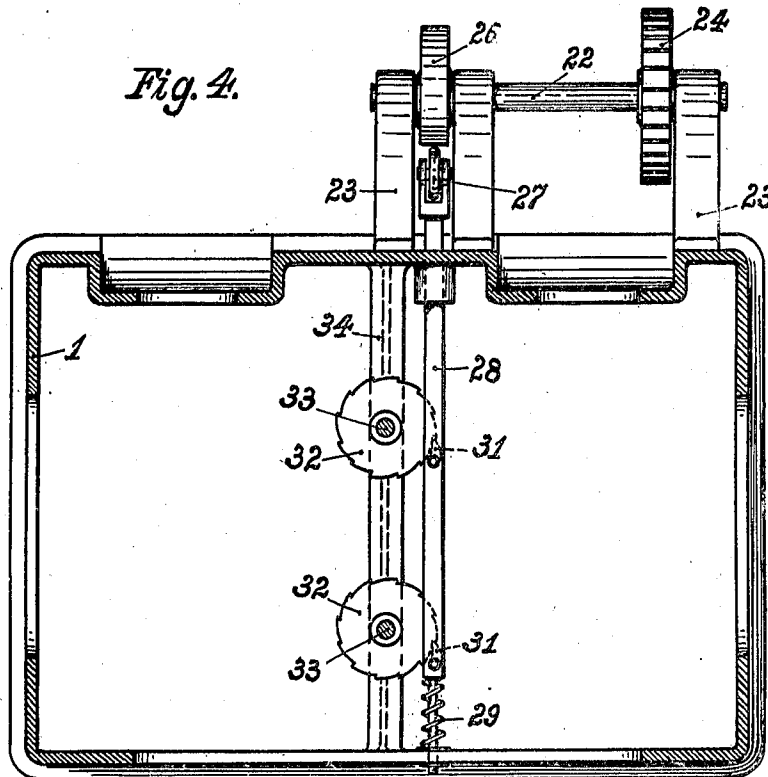


Fig. 19.

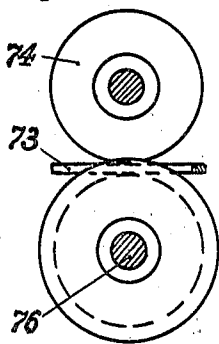


Fig. 20.

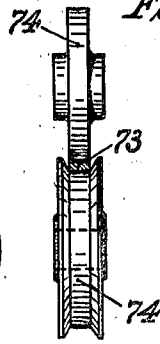


Fig. 21.

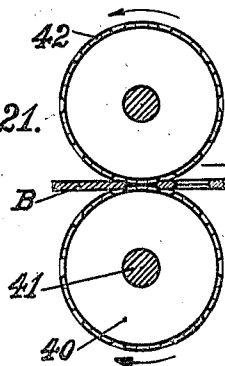
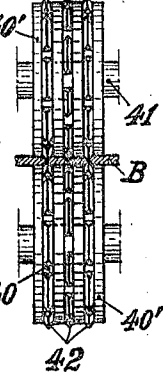


Fig. 22.



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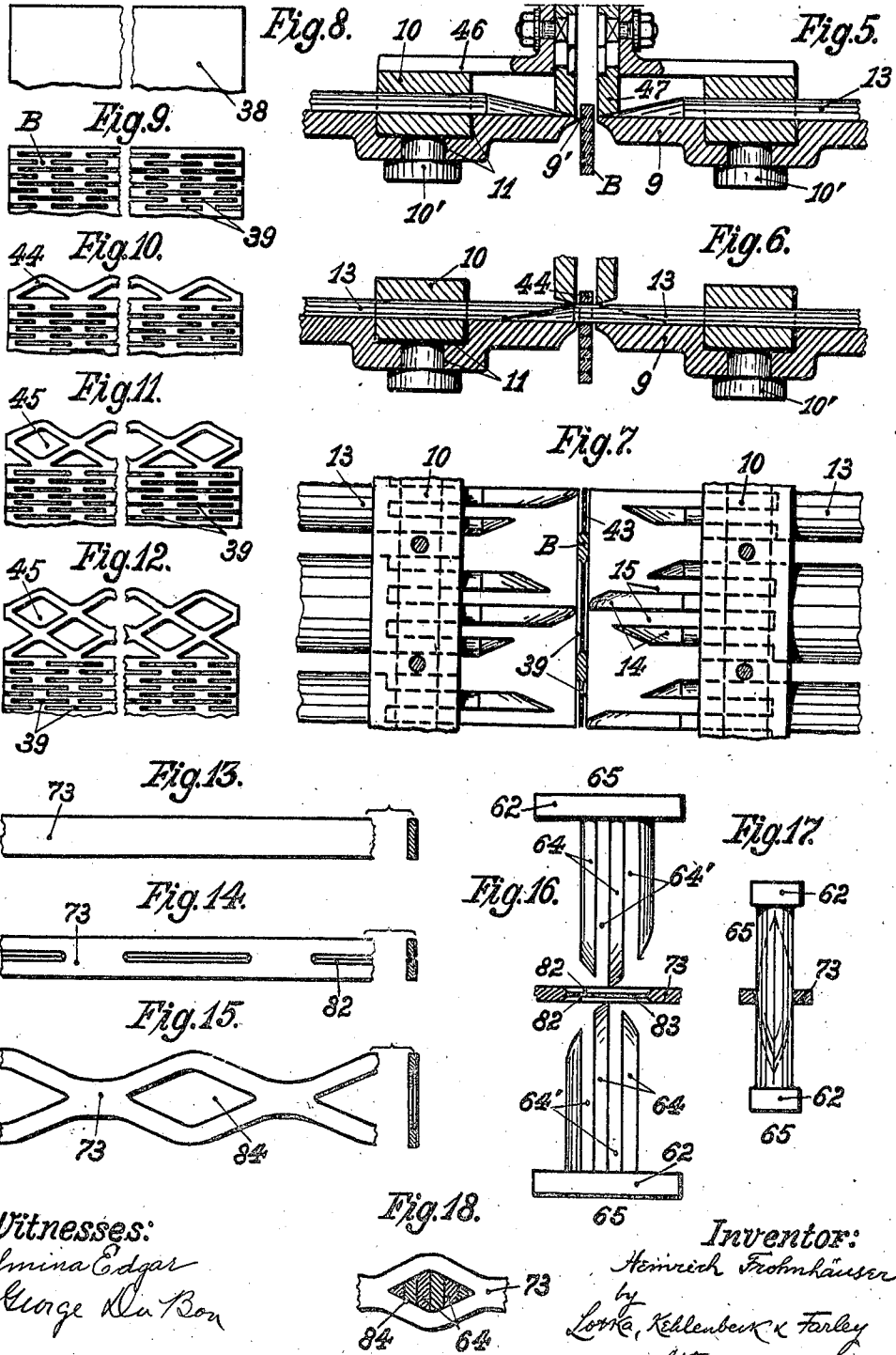
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APPARATUS FOR PRODUCING MESHEd SHEET METAL, FLAT BARS, AND HOOP IRON

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5 Sheets-Sheet 4



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APPARATUS FOR PRODUCING MESHEd SHEET METAL, FLAT BARS, AND HOOP IRON.

Filed Nov. 10, 1924

5 Sheets-Sheet 5

Fig. 23.

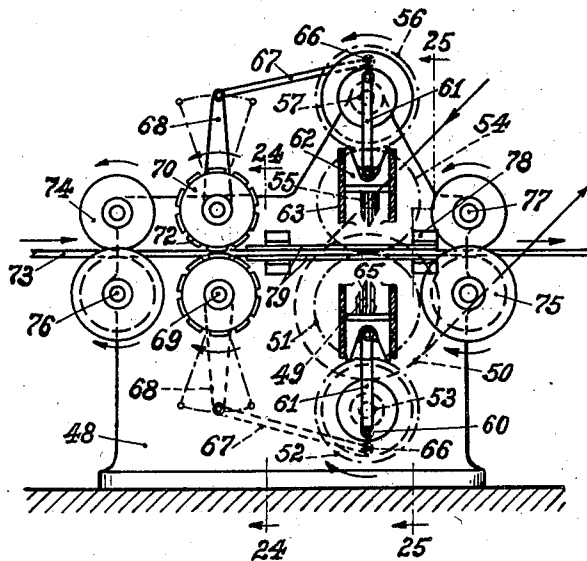


Fig. 24.

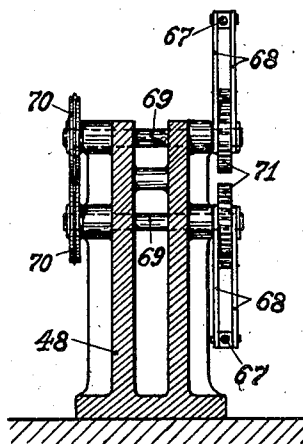
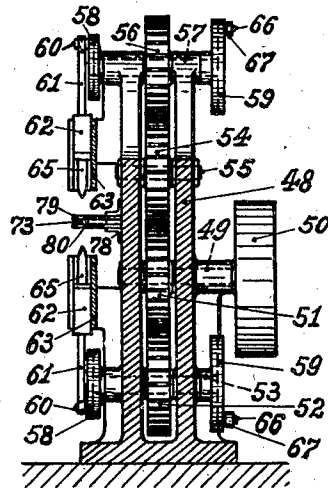


Fig. 25.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR PRODUCING MESHED SHEET METAL, FLAT BARS, AND HOOP IRON.

Application filed November 10, 1924, Serial No. 748,877, and in Germany February 26, 1924.

The meshed or foraminated sheet metal, flat bars and hoop-iron produced according to my present invention remain, in comparison with the well known expanded metal, perfectly flat and even, they lose nothing of their original strength, since their cross-sections are simply split, and there is no loss of material whatever.

In consequence of these properties the meshed sheet metal may be trimmed, cut, rolled, bent, corrugated or otherwise shaped just like other plain sheet. This peculiarity makes the meshed sheet metal particularly adapted for its employment in reinforced concrete-work for the construction of columns, frame-work, walls, ceilings and so forth. Aside from this the meshed sheet metal can be pressed, drawn and punched in the same manner as an ordinary plain sheet, for which reason it may be used for the production of a variety of hollow wares, which need not be watertight, as for instance boxes, baskets and the like. Meshed sheet metal of greater thickness thus produced may be utilized for gang-ways on cranes and in connection with other machines, or as a covering for stair-landings and stair-steps, or as a filling of balustrades, or as partition walls and the like.

The meshed flat bars and hoop-iron produced in the same manner are primarily intended to take up the tensional strain in brick-work and concrete-work, to which end they are placed either in the joints of the brick-work or at suitable points in the concrete-work. They may also be embedded with advantage in the foundations of buildings to uniformly distribute the weight of the latter over the foundation-ground and thus prevent an uneven settling of the buildings and prevent subsequent cracks or fissures therein.

In comparison with the round iron bars hitherto employed to strengthen architectural work—more particularly concrete-work—these meshed flat bars or hoop iron possess the great advantage that the mortar, cement or concrete enters the meshes of said bars and thus acts like rivets or bolts, for which reason such portions of the mortar or the like must be shorn off before said bars can lose their hold on the building-material.

This event is, however, prevented not only by the well-known adhesion of the binding material to the surface of said bars but also by that part of the binding material which enters into the lateral indentations formed by the outlines of two consecutive meshes and the intermediate portion of the bar.

The most important feature of the apparatus employed for producing meshes in sheet metal, flat bars and hoop-iron is embodied in the cooperating pairs of expanders always operating simultaneously in opposite directions to each other and each provided with individual fingers arranged like the prongs of a fork in such a manner that the fingers of one expander will enter into the interstices of the cooperating expander, and vice versa. The plate of sheet metal to be provided with meshes according to my present invention must previously to its engagement with the individual fingers of said expanders be provided with linear notches arranged in rows in such a manner that the notches arranged in the one row are offset against the notches of the adjacent row or rows to a length equal to one half the interval between two adjacent notches. These notches are preferably produced simultaneously on both sides of the sheet metal and driven to a depth to keep them separated by a very thin web. By the simultaneous insertion of the knife-edged fingers of said expanders from opposite directions this web is slit and the strip of metal bordering the top-side of each notch will assume bow-shape in conformity with the joint cross-section of the cooperating fingers of said expanders. The approximately triangular hole thus formed will be transformed into an approximately diamond-shaped mesh, when in the next row of notches the two adjacent notches have been slit and expanded, whereas the meshes, perforations or eyes of flat bars and hoop-iron will attain their approximately diamond-shaped form during one and the same operation. In both instances the simultaneous action of the individual fingers from opposite sides upon the severed material compels the latter to remain in the original plane of the sheet metal or bar, so that the resulting product leaves the apparatus as smooth and

even as the material employed for its manufacture.

The difference between the expanders employed in the production of meshes in sheet metal and the expanders utilized for providing flat bars or hoop-iron with similar meshes chiefly consists in their different joint cross-sectional area, which in the first instance has the approximate shape of a parabolic-segment, whereas in the second instance it has the appearance of a lens. The number of simultaneously employed expanders provided with individual fingers is for the production of meshed sheet metal determined by the width of the sheet and by the length or pitch of the meshes, whereas for the production of meshed flat bars and hoop-iron one pair of cooperating expanders will be sufficient, but a plurality of pairs may be employed if deemed advisable.

In the accompanying drawings:—

Figure 1 is a plan view of my improved apparatus for producing meshed sheet metal from previously notched blanks.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Figure 3 is a similar view taken on line 3—3 of Figure 1.

Figure 4 is a horizontal sectional view taken on line 4—4 of Figure 2.

Figure 5 is a sectional view of the expanders ready for introducing their individual fingers simultaneously from opposite sides into the notched sheet metal blank.

Figure 6 is a sectional view similar to Figure 5 showing the individual fingers just after the formation of the upper half of the top row of meshes.

Figure 7 is a plan view of the different expanders in their retracted position.

Figure 8 is a plan view of a piece of commercial sheet metal.

Figure 9 is a similar view of the notched blank.

Figures 10 to 12 inclusive show the blank at various stages of manufacture.

Figures 13 to 15 inclusive show plan views and the corresponding sectional views of a flat bar at different stages of manufacture.

Figure 16 is a plan view of a pair of expanders showing their individual fingers ready for entering into the notches of a flat bar from opposite sides.

Figure 17 is an elevation of the expanders still in engagement after finishing the mesh.

Figure 18 is a cross-sectional view of cooperating individual fingers in their interlaced position in the finished mesh.

Figure 19 is a side elevation and

Figure 20 is an end view of guide rollers for a flat bar or hoop-iron.

Figure 21 is a side elevation and

Figure 22 a front elevation of a plurality of notching discs employed for notching sheet metal blanks.

Figure 23 is a diagrammatical elevation of a notching apparatus for notching and meshing flat bars and hoop-iron.

Figure 24 is a sectional view taken on line 24—24 of Figure 23.

Figure 25 is a similar sectional view taken on line 25—25 of the Figure 23.

Figure 26 is an elevation of a running ratchet gearing adapted to cause an intermittent advance of a flat bar or a hoop-iron to obtain the temporary rest necessary for expanding the notches into meshes.

In the stationary frame 1 of the machine a driving shaft 2 is journaled in brackets 3 and rotated by means of a pulley 4. The driving shaft transmits its rotary motion by means of conical gear wheels 5 and 6 to lateral shafts 7 journaled in side brackets 8. In the top plate 9 of the frame 1 a sliding frame 10 is guided in T-shaped slots 11 at right angles to the driving shaft 2 by the aid of guide heads 10', as indicated in Figures 2 and 3. In this frame two auxiliary frames 12 are slidably mounted to move in directions parallel to the shaft 2, each of said frames 12 carrying a plurality of expanders 13 composed of a number of individual fingers 14 separated by interstices 15 of the same width as the fingers 14. The two groups of expanders thus formed are arranged on opposite sides of a transverse slot 9' of the top-plate 9, so that cooperating pairs of expanders are formed, in which the individual thorns 14 of the one expander can enter into the interstices 15 of the cooperating expander, and vice versa, as shown more particularly in Figures 1 and 7. The simultaneous motion of the frame 10 and the two auxiliary frames 12 at right angles to the driving-shaft 2 is accomplished by means of a cam 16 seated on said driving shaft, whereby a helical spring 17 is compressed, which returns said frames to their starting point, as soon as the roller 18 is cleared by said cam and comes into contact with the hub of the latter, as shown in Figure 2. In a similar manner the auxiliary frames 12 are moved simultaneously inward, i. e. at right angles to said transverse slot 9', by means of the cams 19 seated upon the lateral shaft 7, said cams acting upon the rollers 20 of said auxiliary frames 12, which are returned to their starting point by helical springs 21, as indicated in Figure 3. During the movements of the auxiliary frames 12, the sliding frame 10 which carries them is at rest, as will be more fully explained later on.

Below the driving shaft 2 another shaft 22 is journaled parallel therewith in brackets 23 and receives its motion by means of a spur wheel 24 in mesh with a spur wheel 25 seated upon the driving shaft 2. The shaft 22 carries a cam 26, which acts upon a roller 27 of a longitudinally slotted bar 28 slidingly

arranged in the frame 1 and steadily pressed against the cam 26 by a helical spring 29. Within the slot 30 of the bar 28 are seated two pawls 31 adapted to cooperate with ratchet wheels 32 seated upon screw-spindles 33 as shown in Fig. 4. The lower ends of the latter pass through apertures of a beam 34 either forming an integral part of the frame 1 or rigidly connected therewith, whereas the upper ends of said screw-spindles are secured to the under face of a blank carrier 35. The latter is provided with clamps 36 adapted to effectively take hold of the lower edge of a notched blank B preparatory to its transformation into a meshed article of manufacture. The gripping power of said clamps is attained by the aid of a plurality of laterally projecting screws 37, as indicated in Figure 3.

To prepare a plate of sheet metal for the reception of the meshes the commercial plate 38, or any suitable part thereof, shown in Figure 8, must be provided with registering linear notches 39. This is accomplished by a convenient number of notching discs 40 seated upon power-driven arbors 41. These discs are preferably punched out of sheet-steel and after their teeth 42 have been ground they are hardened. The desired pitch or spacing of the rows of notches is secured by placing between the notching discs 40 annular distance pieces 40', as shown in Figure 22. To obtain the alternate positions of the linear notches in the different rows of notches the teeth of every second notching disc must show an angular advance of half the pitch of the teeth, as indicated in Figure 22. It is evident that in order to obtain registering linear notches the teeth of the cooperating notching discs 40 must in all positions correspond in every particular. The depth to which the teeth penetrate from both sides simultaneously into the blank depends on the distance from centre to centre of said arbors, whereby incidentally the thickness of the intervening web 43 is also determined, as shown on a larger scale in Figures 5, 6 and 7. To be in a position to alter the distance from centre to centre of said arbors at will the latter are preferably mounted in adjustable bearings (not shown). A device for notching a blank in accordance with Figure 9 may be of any convenient design, provided it fulfils the conditions enumerated above. Such a device might be combined with, or attached to the stationary frame 1, or it may be built as a separate device, which solution should have the preference when blanks of considerable dimensions are to be prepared.

A blank B thus prepared is fastened to the blank carrier 35, as shown in Figure 3, and passes through said transverse slot 9' of the top-plate 9. After said blank has been adjusted to place the notches of the top-row

exactly opposite the expanders 13 the machine is started, whereupon the auxiliary frames 12 will be moved by the cams 19 simultaneously toward each other into the notches placed in front of them. When the knife-edged individual fingers 14 come into contact with the thin webs 43 they will slit them and gradually pass through said slits and thereby open them under the pressure exerted upon them by the auxiliary frames until the inward stroke of the latter has come to a close. This takes place when the expanders 13 have attained the position shown in Figure 6, at which moment the members 44 have reached their final bow shape and form the external boundary of the first half of the meshes 45. To complete these meshes the blank B must after the withdrawal of the expanders 13 not only be raised to bring the next lower row of notches on a level with the individual fingers 14 but must also be laterally shifted to a length equal to one half of the pitch of the linear notches 39. These movements are automatically executed by means of the cams 16 and 19 properly positioned on their shafts 2 and 7 respectively and by the ratio the wheels 5 and 6 bear to each other. After the notches previously placed exactly in front of the knife-edged fingers 14 have been opened in a similar manner as explained above, the top row of the meshes 45 is completely formed and the latter appear in their final shape shown in Figure 11. It will be noticed that on opening the notches of the second row the metal bounding each notch on the top-side is bulged upward and thus forms the border of the lower half of the meshes 45. The two operations described above are now executed alternately until the blank B has been wholly transformed into a meshed article of manufacture without the slightest loss of material. The meshed article thus produced is perfectly flat as the blank was on entering the apparatus but of a considerably greater length. In order to facilitate the meshing operation and guide the meshed end of the blank angular arms 46 are secured to the sliding frame 10 and provided with vertical extensions, on which guide-plates 47 are arranged to slide in a vertical direction. The bottom faces of these plates are chamfered in conformity with the individual fingers 14 to avoid an undercut shoulder and thus prevent the top edge of the ascending blank from coming into contact with the bottom face of said guide plates 47.

To provide flat metal bars and hoop-iron with meshes or eyes they must practically undergo the same operation as the blank B. These operations are here, however, simplified inasmuch as usually only one row of notches is necessary. For notching and meshing such bars the comparatively simple device shown in Figures 23 to 26 inclusive is

sufficient. This device may form an integral part of the machine described above, or it may form an attachment thereto, or it may form a machine wholly independent thereof as represented in said figures. The frame 48 of this machine chiefly consists of a base provided with two walls wherein a driving shaft 49 is journaled and rotated by a belt-driven pulley 50. This shaft carries a spur wheel 51, which imparts the motion of the shaft 49 to a spur wheel 52 seated upon a shaft 53 and to a similar wheel 54 carried by an intermediate shaft 55. The wheel 54 meshes with a spur wheel 56 of a shaft 57, which like the shaft 53 carries at one end a small crank disc 58 and at the other end a larger crank disc 59. To the crank pin 60 of each of said crank discs 58 is linked a connecting rod 61, the other end of which is connected with a cross-head 62 slidingly arranged between the cross-head guides 63. To each cross-head 62 a set of individual fingers 64 is secured and thus form expanders 65 similar in construction as the expanders 12. Between the fingers 64 interstices 64' of exactly the same width are arranged in such a manner that the fingers of the upper expander can enter into the interstices of the lower expander, and vice versa, as indicated on a larger scale in Figure 16. To the crank pins 66 of the larger crank discs 59 are hinged connecting rods 67, which at their other end are pivoted to double rocker-arms 68 loosely seated upon shafts 69, which on their one end carry a notching disc 70 and on the other end a ratchet wheel 71. These ratchet-wheels are provided with as many ratchet-teeth as the notching-discs have notching teeth 72, so that during each complete oscillation of the rocker-arms 68 a new pair of cooperating notching teeth is brought into operative position. To guide the flat bar 73 during the different stages of manufacture two sets of guide rollers 74 and 75 are provided of which the former is seated upon shafts 76 and the latter upon shafts 77, as indicated in Figure 23. Between the expanders 65 are arranged on brackets 78 two guide plates 79 provided with openings 80 for the passage of said individual fingers.

On starting the machine the bar 73 is pushed through the guide-rollers 74 until it reaches the notching-discs 70. As soon as the first pair of notching teeth 72 has taken hold of the bar the latter is drawn intermittently forward by said notching teeth. Each time the rocker arms 68 are moved outward by the connecting rods 67 through the angle of oscillation indicated in Figure 23 the bar is advanced toward the right to a distance equal to the pitch of the notching teeth 72, but as soon as the rocker-arms 68 commence their back stroke the spring-actuated pawls 81 shown in Figure 26 will slide back on the teeth which carry them and thus bring the

bar 73 to a stop. During the period of rest, which follows this interruption of the movement of the bar, the expanders 65 approach each other and in case the bar 73 has been already sufficiently advanced, their individual fingers 64 will enter into the linear notches 82 previously formed by the notching teeth 72, split the web 83 left standing between the registering notches 82 and continue their movement until they have reached their position shown in Figure 17, at which moment the mesh, or eye 84 is finished. Figure 18 represents the cross sectional area of the cooperating fingers 64 at the moment the mesh or eye 84 has attained its final shape. The fingers of the two expanders are now retracted, and during this movement the guide plates 79 protect the bars 73 against bending in case frictional contact should tend to move the bar upward or downward. After the fingers 64 have been completely retracted the idle movement of the pawls 81 comes to a close after they have slipped behind the next tooth of their ratchet wheels 71. During the following outward movement of the rocker arms 68 a new pair of notching teeth will act upon the bar 73 and at the same time push it forward to a predetermined extent as explained above. The operations described above may then be repeated in due succession until the entire bar is provided with meshes placed at a given distance one from another.

It is evident that the arrangement of parts of the devices shown and described may be varied to suit different conditions and purposes. It would for instance be possible to produce with the aid of one and the same machine sheet metal plates with meshes of different sizes by simply advancing the individual fingers of the expanders to different depths into the linear notches, which might be attained by means of stepped or conical cams adjustably mounted on the shafts whereon they are seated. It would likewise be possible to let the blank advance horizontally through the machine instead of vertically as shown. It would furthermore be possible to notch and mesh heavier plates and bars while in a warm condition, to which end they might be heated in the machine by gas or electricity while keeping the temperature of the tools down by water-cooling. Finally it would be sufficient to notch thin material on one side only, in which case the notching disc or discs might press the material against the face of a cooperating smooth-faced roller.

I claim:—

1. An apparatus for producing perforated sheet metal, flat bars and hoop-iron, comprising a frame, means for sustaining a notched blank in working position, two cooperating expanding means both movable relatively to said sustaining means and

driven simultaneously in opposite directions through the notches of said blank to form perforations therein, and means for retracting both of said expanding means from the

5 perforations.

2. An apparatus for producing perforated sheet metal, flat bars and hoop-iron, comprising a stationary frame, means for sustaining in working position a blank provided with registering notches in its opposite surfaces, two cooperating expanding means both movable relatively to said sustaining means and adapted to be simultaneously inserted into and driven through said

10 notches in opposite directions to form perforations in the blank, means for initiating the working stroke of said expanding means, and means for retracting said expanding means from the perforations.

3. An apparatus for producing perforated sheet metal, flat bars and hoop-iron, comprising a stationary frame, means for sustaining in working position a blank provided in its opposite faces with registering

15 linear notches separated by a web, two cooperating expanding means both movable relatively to said sustaining means and adapted to be simultaneously entered into said notches and driven through said web in opposite directions, means for introducing said expanding means into said notches and driving them through said web to form perforations in the blank, and means for retracting said expanding means from the

20 perforations.

4. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top-plate, means for sustaining in working

40 position a blank provided in its opposite faces with registering linear notches penetrating into said blank to such a depth as to keep them separated by a web, two cooperating expanders both movable relatively to said sustaining means and each consisting of individual fingers adapted to be simultaneously inserted into said notches and driven through said web in opposite directions, auxiliary frames each adapted to unite into a group one half of the number of said expanders and to move them at right angles to said blank, means for moving said auxiliary frames simultaneously toward each other for inserting said individual fingers into said notches and to drive them through said web to form meshes, and means for retracting said expanders from the meshes.

5. An apparatus for producing meshed

80 sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top plate provided with a slot, an adjustable carrier adapted to sustain in working position a blank provided in its opposite faces with registering linear notches alternately

arranged in rows and penetrating from opposite sides to a depth to leave between them a thin web, a sliding frame guided in said top-plate parallel with said slot, means for moving said sliding frame in one direction, means for retracting said sliding frame, cooperating expanders consisting each of individual fingers and arranged laterally of said slot in groups, auxiliary frames carrying said groups of expanders and slidably mounted in said sliding frame at right angles to said slot, means for moving said auxiliary frames simultaneously in opposite directions and driving said expanders carried thereby through said notches and webs to form meshes while said sliding frame sustaining them is at rest, and means for retracting said expanders from the meshes.

6. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top plate provided with a slot, a vertically adjustable carrier adapted to support in working position a blank provided in its opposite faces with registering linear notches alternately arranged in rows and penetrating to a predetermined depth into said blank, a sliding frame guided in said top-plate parallel with said slot, auxiliary frames slidably mounted on said sliding frame at right angles to said transverse slot, cooperating expanders arranged one to another at the same pitch as said notches and consisting each of individual fingers separated one from another by interstices to let the fingers of each expander enter into the interstices of an expander cooperating therewith means for moving said sliding frame and said auxiliary frames carrying said expanders in one direction after the notches of one row have been expanded, means for retracting said sliding frame and said auxiliary frames, and means for raising said blank carrier after the expansion of each row of notches to a distance equal to the pitch of said rows of notches.

7. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top-plate provided with a slot, a blank carrier adapted to push into successive working positions a blank in its opposite faces with registering linear notches alternately arranged in rows, a sliding frame compulsorily guided in said top plate parallel with said slot, expanders cooperating in pairs and terminating in individual fingers separated by interstices adapted to receive the fingers of the cooperating expanders, auxiliary frames slidably mounted on said sliding frame to move at right angles to said slot and each adapted to carry the same number of expanders, cams for moving said auxiliary frames simultaneously inward to drive said individual fingers through the linear notches

of said blank, springs retracting said expanders from the meshes, a cam adapted to move said sliding frame in one direction to place said expanders opposite the linear notches of one row, a spring adapted to place said expanders opposite the linear notches of the following row, and running ratchet gearings for raising said blank carrier after opening the notches of any row of notches to a distance equal to the pitch of said rows of notches.

8. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top plate provided with a slot, a blank carrier adapted to push a blank provided with linear notches arranged alternately in rows intermittently through said slot, a sliding frame guided in said top plate of said frame parallel with said slot, expanders arranged in two groups and terminating each in individual fingers alternating with interstices of the same width to permit the fingers of one expander to enter into the interstices of another expander cooperating therewith, an auxiliary frame provided for each group of expanders and slidably mounted on said sliding frame at right angles to said slot, cams for moving both groups of expanders simultaneously in opposite directions toward each other to enter into and drive them through the linear notches of said blank, helical springs for retracting said auxiliary frames, a cam for moving said sliding frame and said auxiliary frames in one direction for expanding said linear notches of one row, a helical spring for returning said frames in the opposite direction for expanding the linear notches of the following row, screw-spindles attached to said blank-carrier, and running ratchet gearings cooperating with said screw spindles for raising said blank-carrier after the expansion of a row of notches to a height equal to the pitch of said rows of notches.

9. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame having a top plate provided with a slot, a blank carrier, means on said carrier to grip the lower edge of a blank provided in its opposite faces with registering linear notches alternately arranged in rows, screw-spindles attached to the underside of said blank carrier, a ratchet wheel seated on each of said screw-spindles, a longitudinally movable bar guided in said stationary frame, pawls seated in said bar and kept in mesh with said ratchet wheels, means for moving said bar for intermittently rotating said ratchet wheels by means of said pawls, means for retracting said rod and pawls, expanders arranged in groups at both sides of said slot and provided with individual fingers separated by interstices of the same width, means for introducing

said individual fingers into and driving them through said notches, means for retracting said groups of expanders, and vertically movable guide-bars adapted to take the meshed end of said blank between them and to be raised by the individual fingers of said expanders.

10. An apparatus for producing meshed sheet metal, flat bars and hoop-iron, comprising a stationary frame provided with a top plate having a slot, a blank carrier, adjustable clamps on said blank carrier for gripping the bottom edge of a blank provided in it opposite faces with registering linear notches arranged alternately in rows, screw-spindles secured to said blank carrier, a ratchet-wheel seated on each of said screw-spindles, a longitudinally movable slotted bar guided in said stationary frame, pawls seated in said slotted bar and meshing with said ratchet-wheels, a cam for actuating said bar and said pawls for operating said ratchet-wheels, a coiled spring for retracting said bar and pawls, a sliding frame adapted to move parallel with said slot, auxiliary frames slidably mounted on said sliding frame to move at right angles to said slot, expanders carried by said auxiliary frames in cooperating pairs and provided with individual fingers separated by interstices of equal width, means for pushing the fingers of one expander into the interstices of the cooperating expander of the same pair, means for retracting said expanders, supports mounted on said sliding frame, and guide-bars vertically movable on said supports and adapted to be raised by the individual fingers of the cooperating expanders.

11. A machine of the class described, comprising a blank carrier, expanders located to be on opposite sides of a blank held by said carrier, said expanders being movable relatively to said carrier toward and from the blank, and mechanism for moving said expanders simultaneously in opposite directions, first into and through the blank, and then out of it.

12. A machine of the class described, comprising a blank carrier expanders located to be on opposite sides of a blank held by said carrier, said expanders having fingers movable relatively to said carrier toward and from the blank, the fingers of the expanders on one side of the blank being movable in paths different from those of the fingers of the expanders on the other side of the blank, and mechanism for moving said expanders simultaneously in opposite directions, first into and through the blank, and then out of it.

13. The method of producing expanded metal, which consists in first producing registering notches or recesses in opposite faces of a blank so as to leave between such

recesses, webs of a thickness smaller than the original thickness of the blank, and then perforating said webs and expanding the blank at the perforations thus made.

- 5 14. A machine of the class described, comprising a stationary frame, a blank guideway formed thereon, expanders located on opposite sides of said guideway and moveable relatively thereto, means for delivering

a blank with a plurality of registering de- 10
pressions on opposite faces thereof to the guideway, and mechanism for moving said expanders simultaneously in opposite directions, first through the depressions in the blank and then out of them. 15

Signed by me at Cologne, Germany this
15th day of October 1924.

HEINRICH FROHNHAUSER.