

G. HORVATH.
SHEET METAL WORKING MACHINE.

APPLICATION FILED APR. 29, 1916. RENEWED JULY 20, 1917.

1,240,212.

Patented Sept. 18, 1917.

9 SHEETS—SHEET 1.

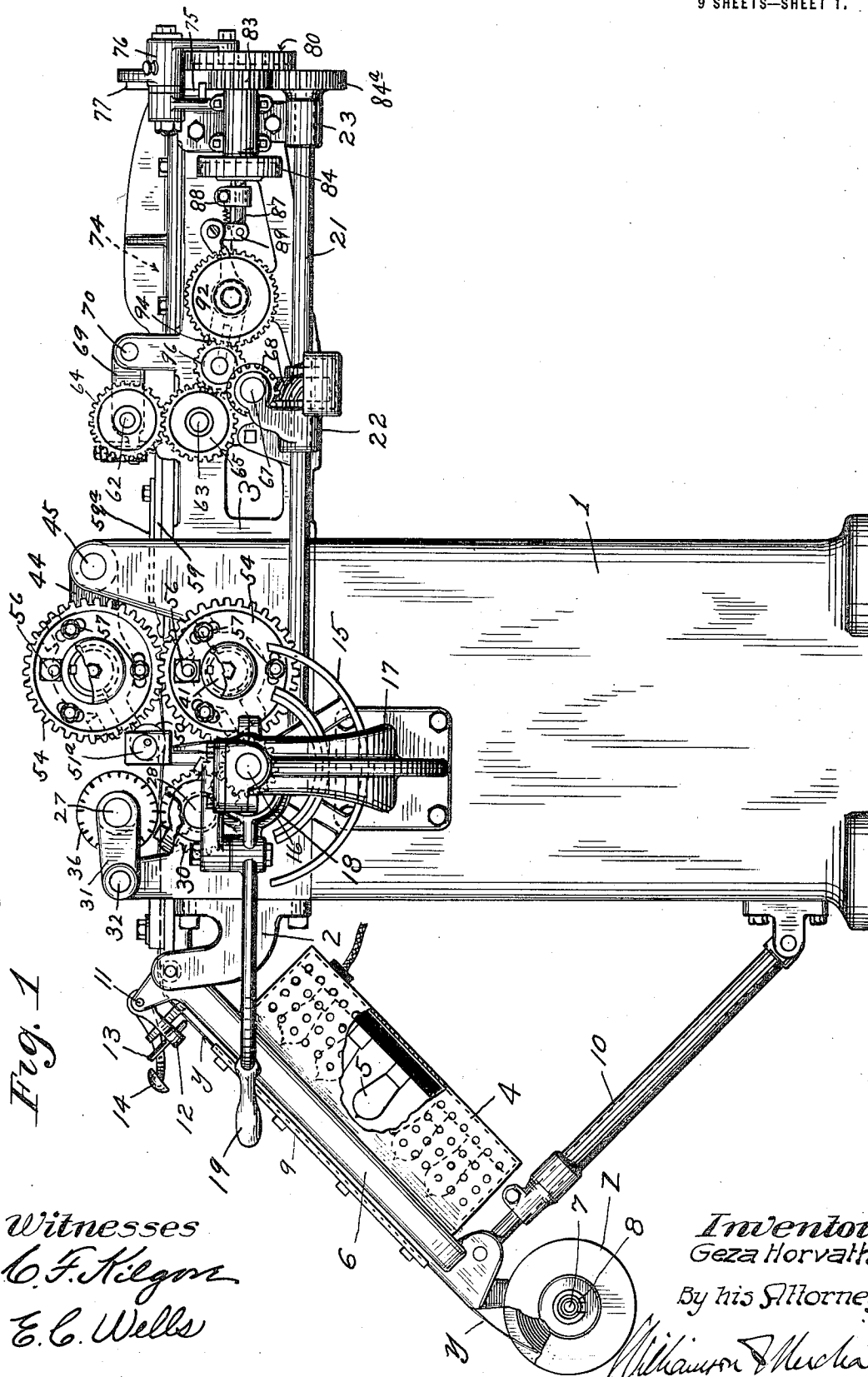


Fig. 1

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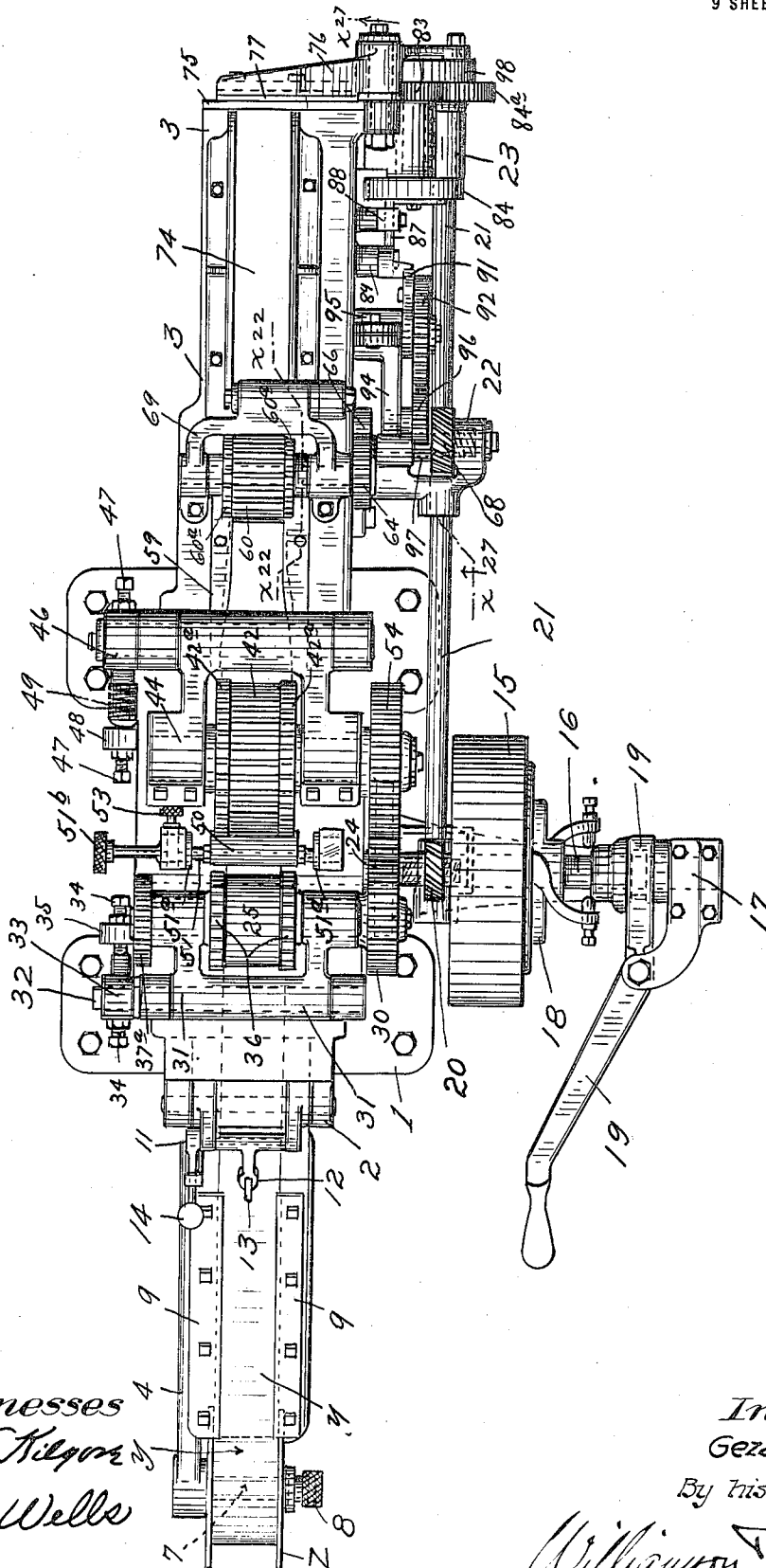
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9 SHEETS—SHEET 2.

Fig. 2.



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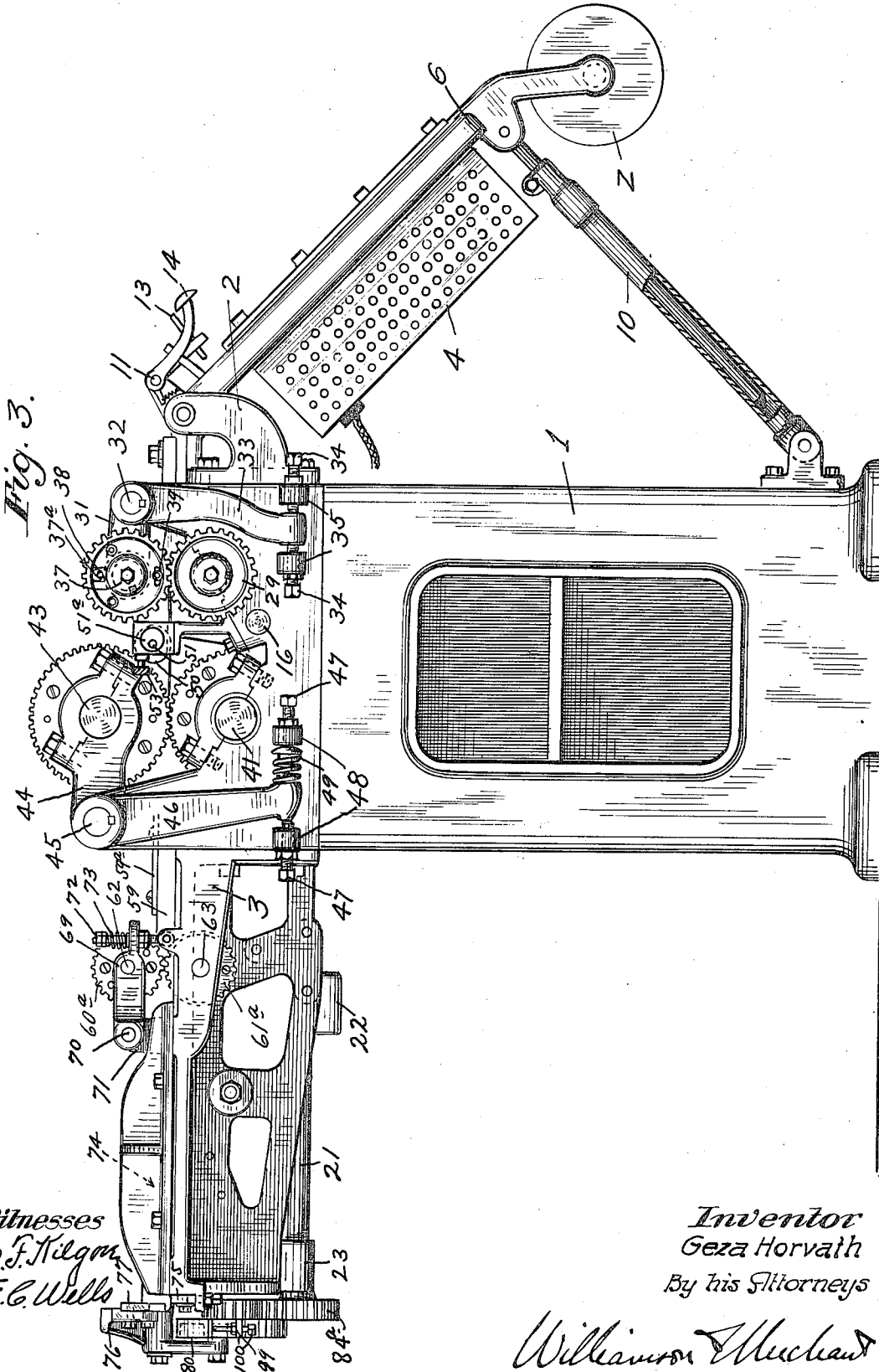
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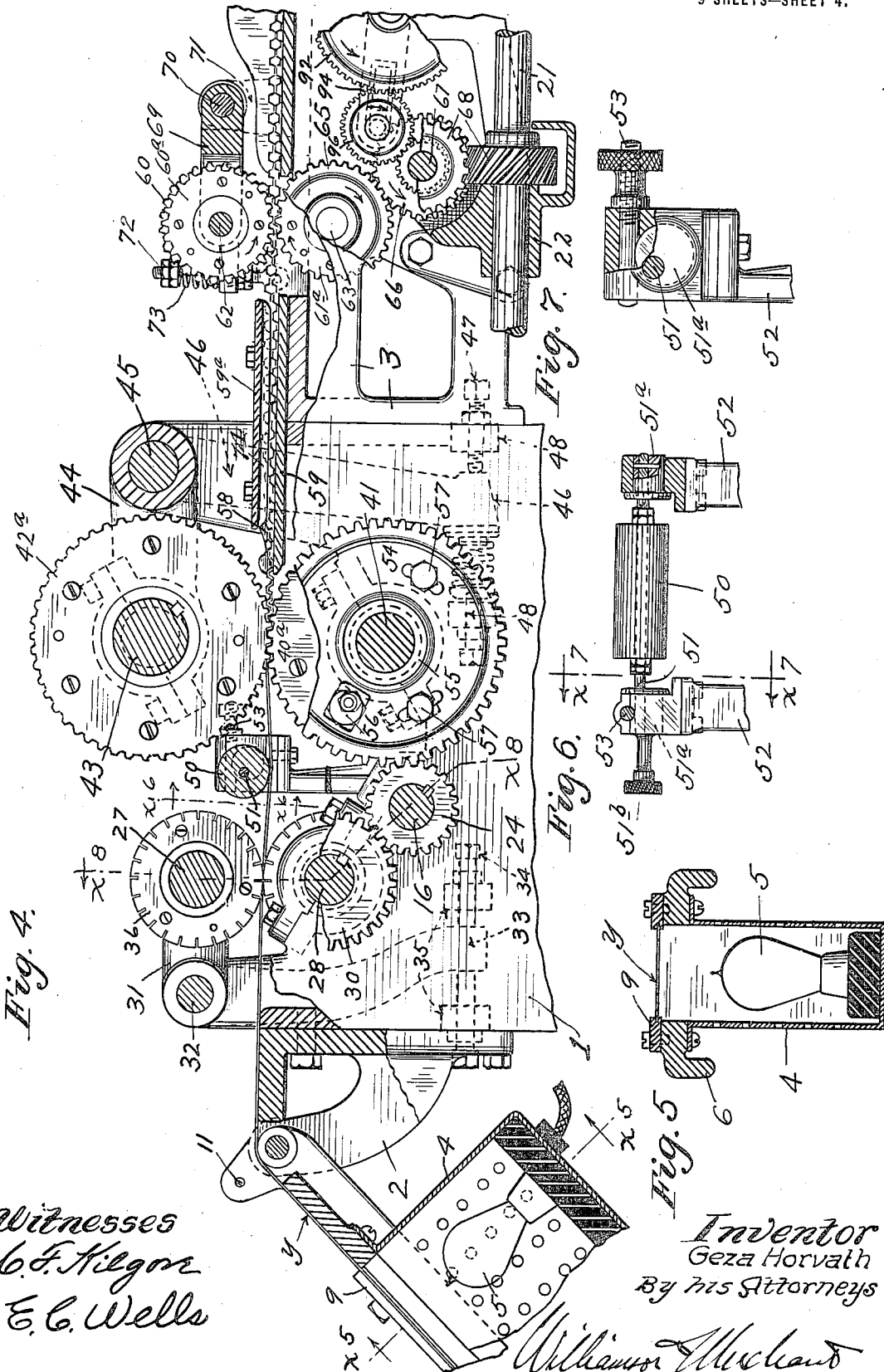
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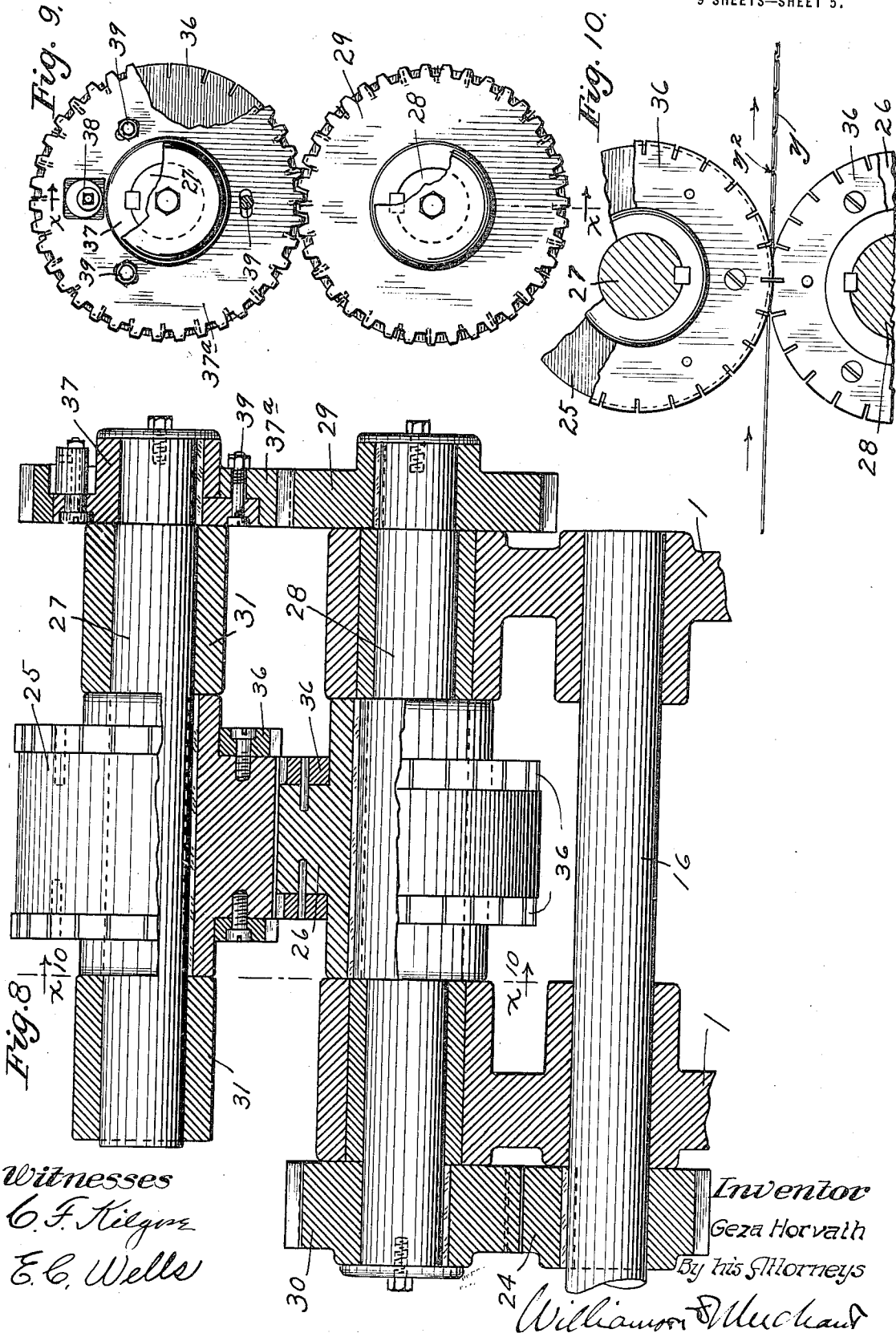
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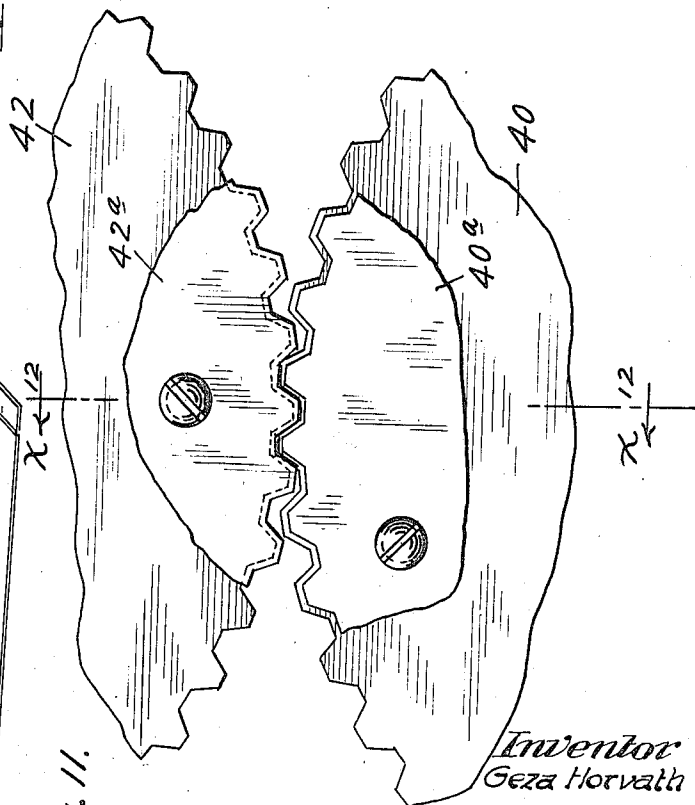
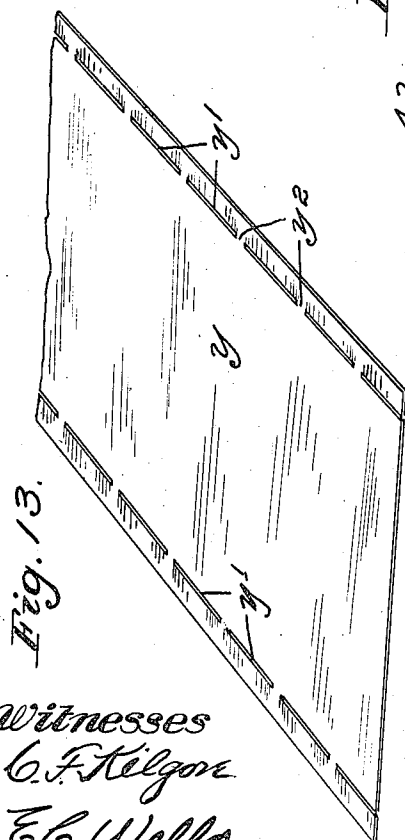
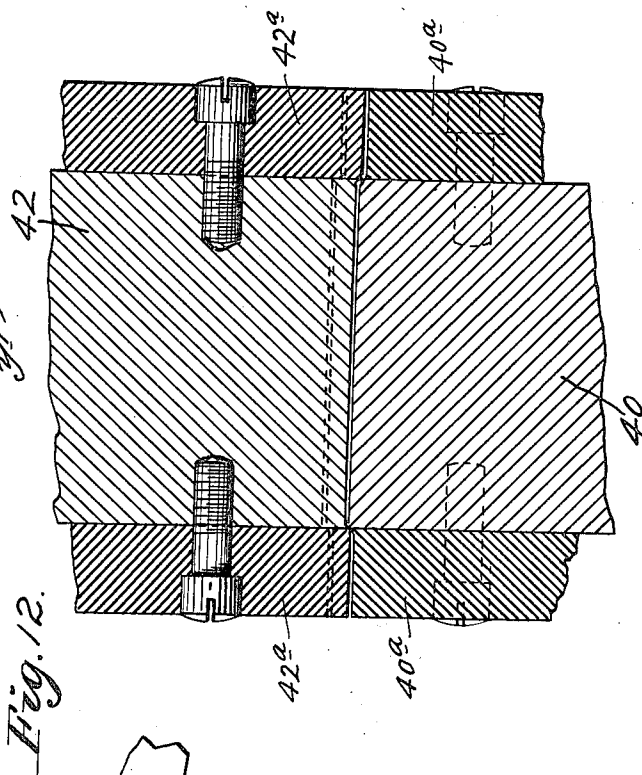
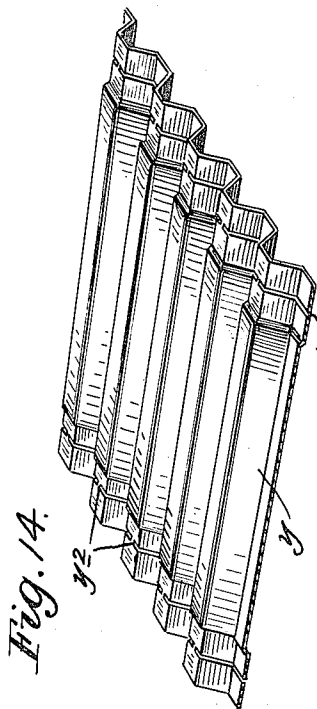
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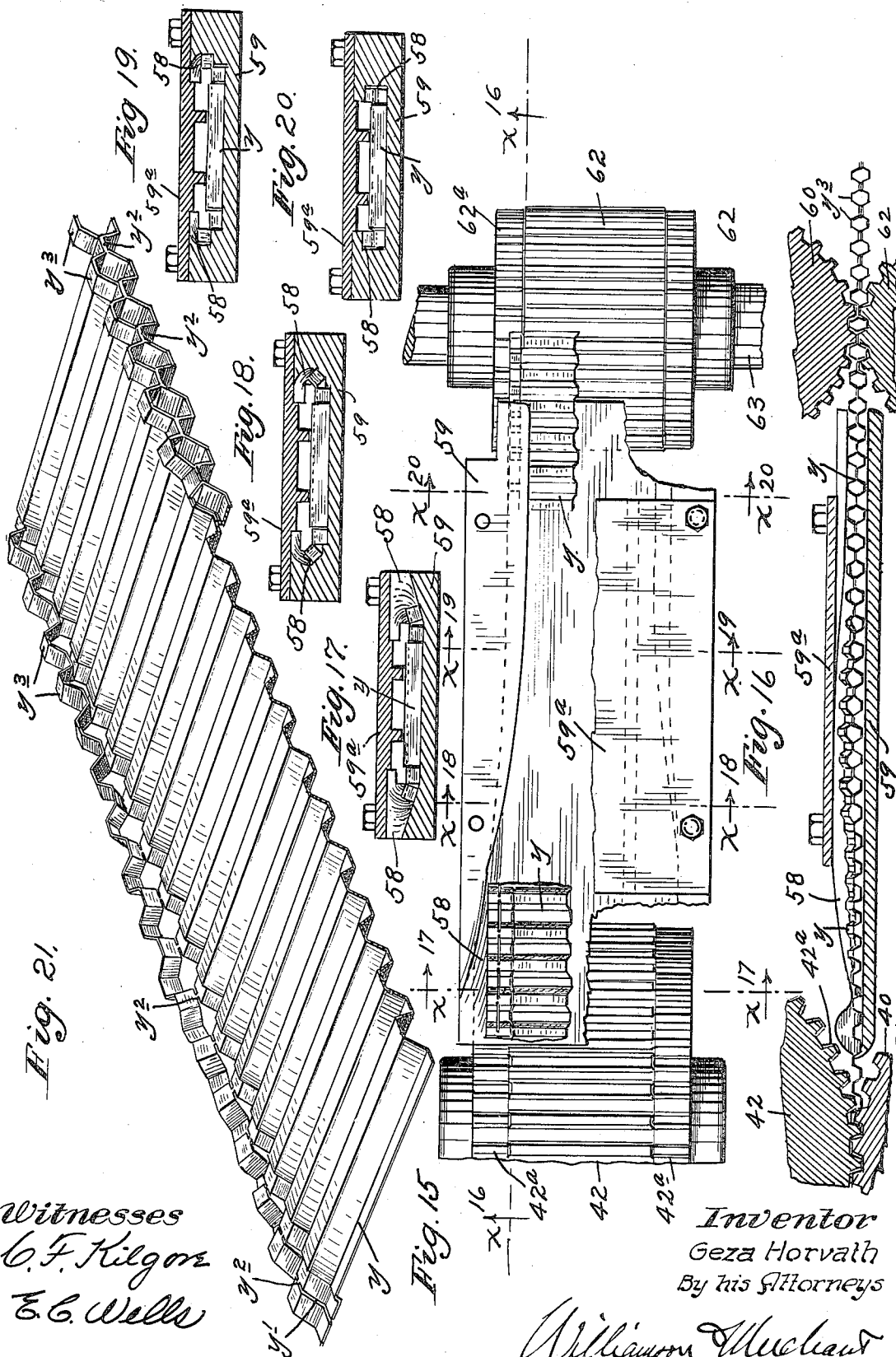
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9 SHEETS—SHEET 7.



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Fig. 23.

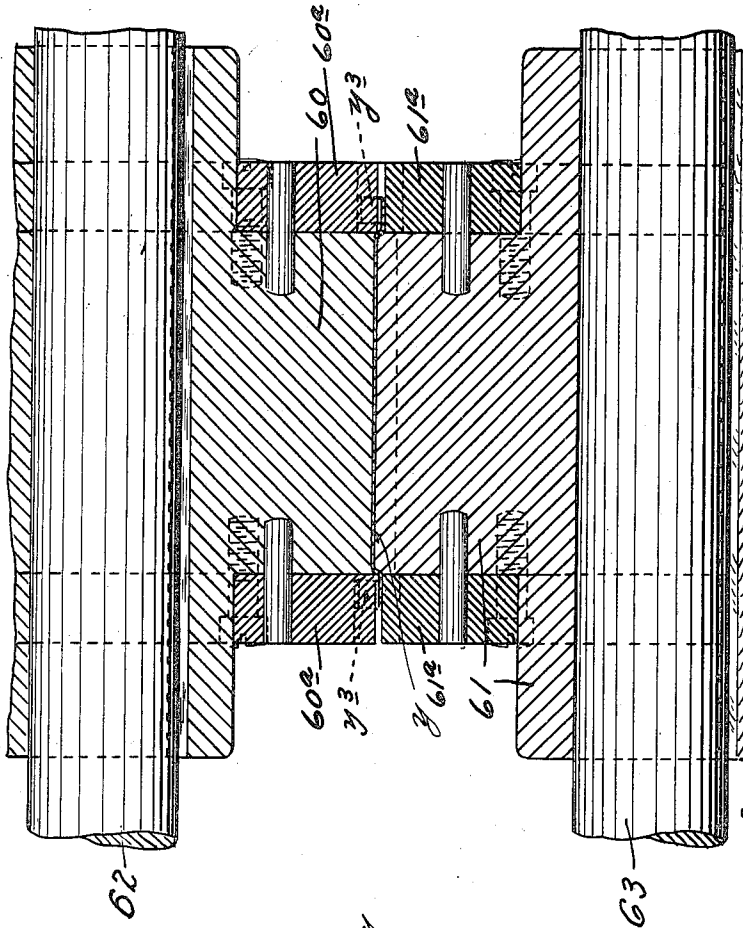
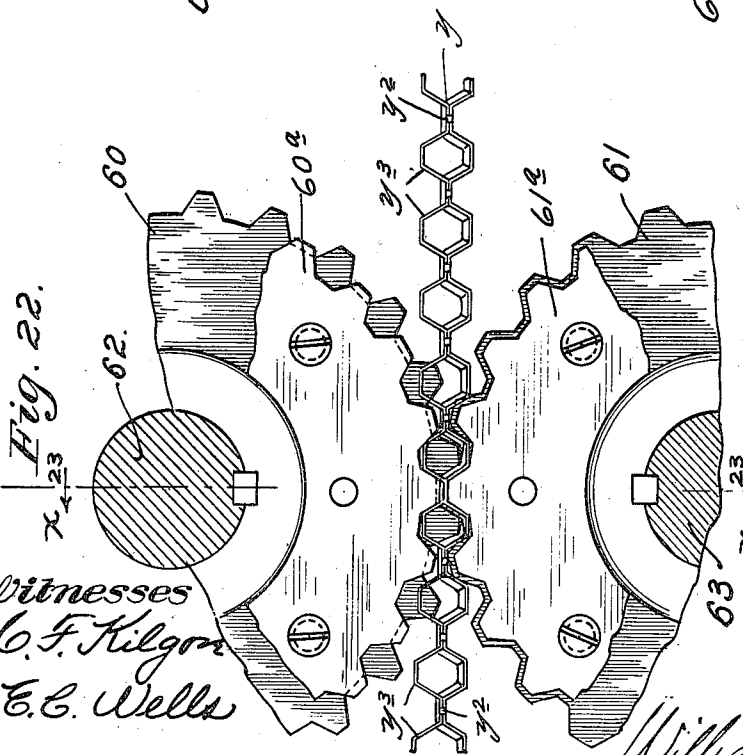


Fig. 22.



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Fig. 25

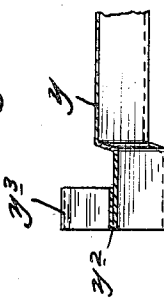


Fig. 24.

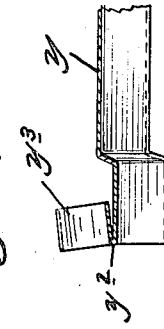
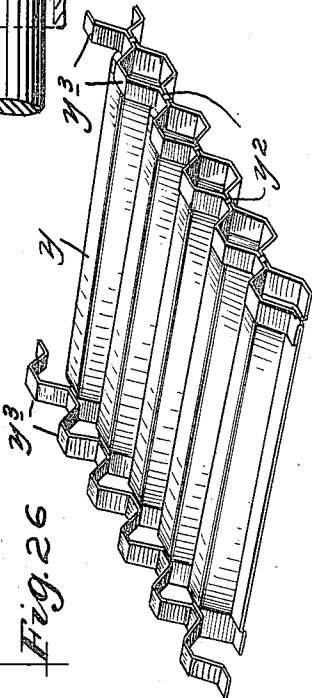


Fig. 26



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9 SHEETS—SHEET 9.

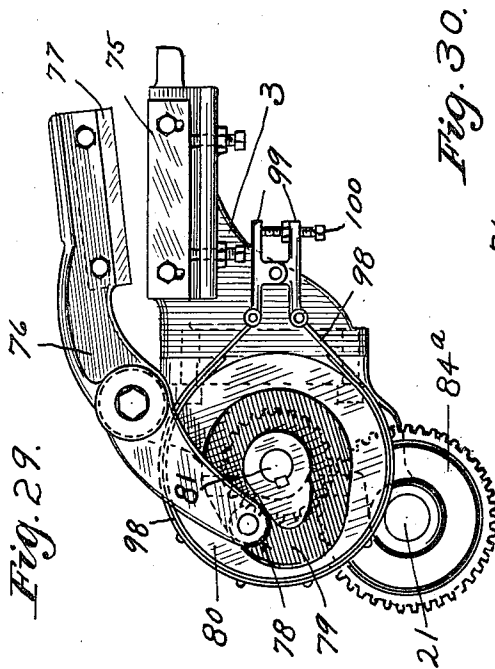


Fig. 29.

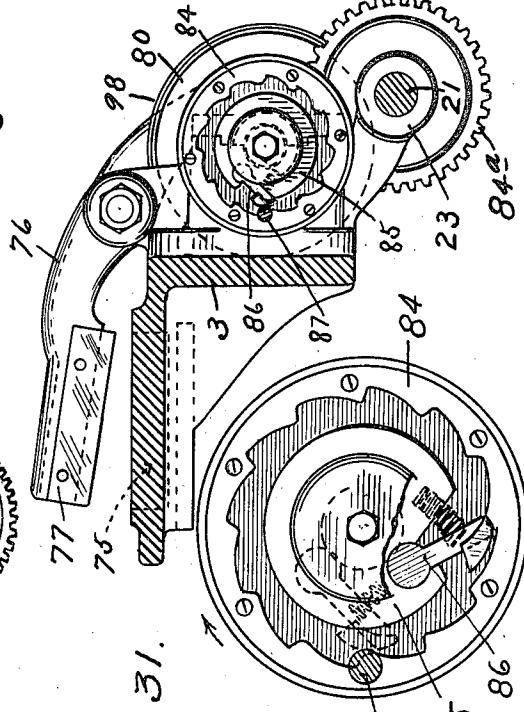


Fig. 30.

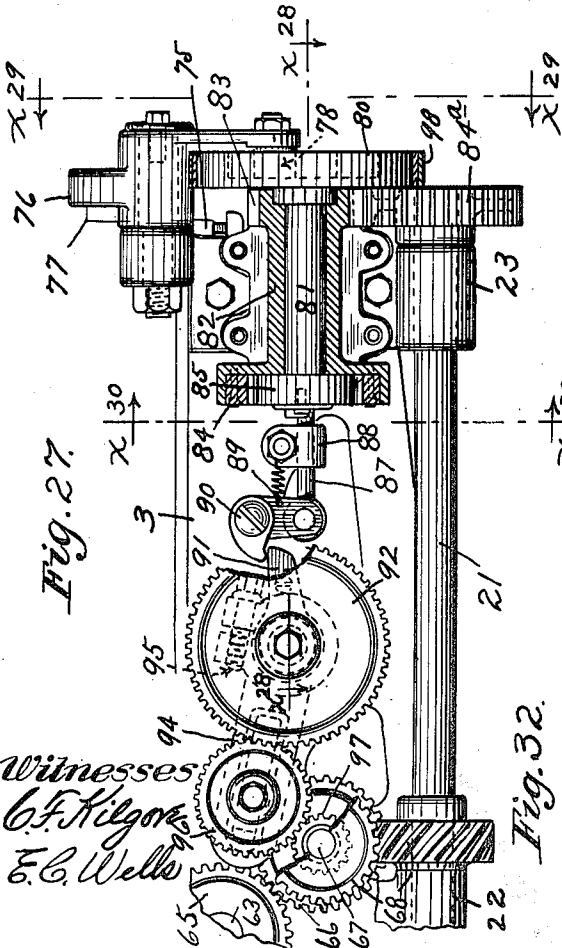


Fig. 27.

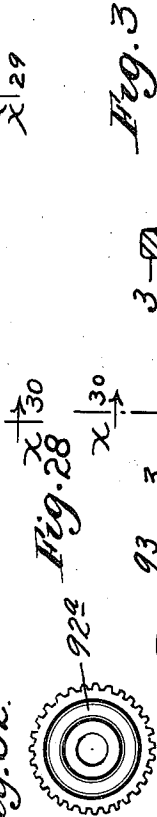


Fig. 31.

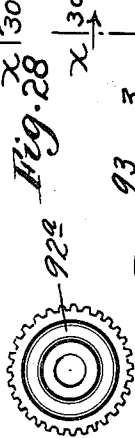


Fig. 28.

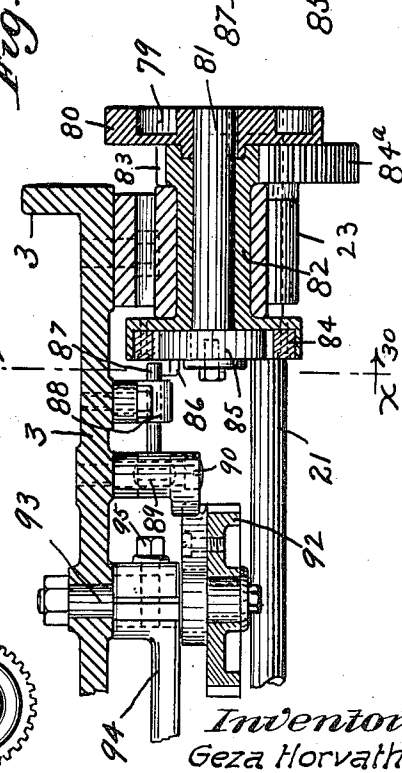


Fig. 32.

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SHEET-METAL-WORKING MACHINE.

1,240,212.

Specification of Letters Patent.

Patented Sept. 18, 1917.

Application filed April 29, 1916, Serial No. 94,325. Renewed July 20, 1917. Serial No. 181,859.

To all whom it may concern:

Be it known that I, GEZA HORVATH, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Sheet-Metal-Working Machines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to provide an improved sheet metal working machine especially adapted for automatically making from ribbon-like metal sheets, corrugated radiator plates with overturned or reversely disposed alining webs, such as disclosed and claimed in the application of Edward S. Erickson, Serial No. 67,780, filed December 20, 1915, and entitled "Cellular radiators," and particularly illustrated in Figs. 1 to 5, inclusive, of the drawings of said application.

Generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

In the complete machine, as preferably designed, the following operations are automatically performed, to-wit:

First, the ribbon-like metal sheet is passed between slitting rollers that are provided with circumferentially spaced shearing surfaces arranged to cut, in the two edges of the sheet, longitudinally spaced slits spaced by connecting strands of the metal sheet;

Second, the slitted sheet is run between corrugated rollers arranged to force transverse corrugations in the metal sheet;

Third, the corrugated edges of the metal sheet are passed through cam-acting turning channels and are thereby turned over approximately at 180 degrees, thereby forming alining webs that are oppositely disposed in respect to adjacent corrugations in the body of the sheet;

Fourth, the corrugated metal sheet, with its reversely disposed alining webs, is passed between coöperating corrugated so-called clenching rollers which press the said alining webs to final position in respect to the body corrugations of the strip; and

Fifth, and last, so far as the operation of the present machine is concerned, the completely corrugated sheet is cut into radiator

plates of predetermined length, by a cutter which has a timed action in respect to the other devices noted.

On its way from the slitting rollers to the corrugating rollers, the strip is passed in contact with the so-called distance adjuster, by means of which the length of that portion of the sheet which is between the slitting devices and corrugating rollers, is accurately adjusted so that the corrugations will be properly located in respect to the slits and intervening connecting strands of the sheet.

Also, in the machine illustrated, the ribbon of sheet metal, while on its way to the feed rollers and slitting devices, is passed over a light containing inspection box and is moved past a marking device by means of which latter, perforated or defective portions of the sheet may be clearly marked for positive identification.

In the accompanying drawings which illustrate the complete machine embodying the several features of my invention, in what, at present, are believed to be the preferred forms thereof, like characters indicate like parts throughout the several views.

Referring to the drawings:

Figure 1 is a right side elevation of the machine, some parts being broken away;

Fig. 2 is a plan view of the machine;

Fig. 3 is a left side elevation of the machine;

Fig. 4 is a longitudinal section taken through the central portion of the machine, some parts being broken away;

Fig. 5 is a transverse section on the line x^5-x^5 of Fig. 4;

Fig. 6 is a detail showing parts of the so-called travel adjuster found in the vicinity of the line marked x^6-x^6 on Fig. 4, some parts being sectioned and some parts being broken away;

Fig. 7 is a section on the line x^7-x^7 of Fig. 6, some parts being broken away;

Fig. 8 is an enlarged transverse section taken approximately on the line x^8-x^8 of Fig. 4, some parts being shown in full, and some parts being broken away;

Fig. 9 is a right side elevation of the gears and rollers shown in Fig. 8, some parts being broken away;

Fig. 10 is a section taken on the line $x^{10}-x^{10}$ of Fig. 8, some parts being broken away;

Fig. 11 is an enlarged fragmentary view

in side elevation showing parts of the corrugating rollers;

Fig. 12 is a section taken on the line $x^{12}-x^{12}$ of Fig. 11;

5 Fig. 13 is a perspective showing a portion of the metal sheet as it appears immediately after it has passed from the rotary slitting devices;

10 Fig. 14 is a perspective view showing the corrugated sheet as it appears immediately after passing from the corrugating rollers;

Fig. 15 is a plan view with some parts broken away, and some parts removed, showing the corrugating rollers, the means for 15 turning the corrugated edge of the sheet, and the so-called clenching rollers;

Fig. 16 is a section taken on the line $x^{16}-x^{16}$ of Fig. 15, some parts being broken away;

20 Figs. 17, 18, 19 and 20 are transverse sections taken through the so-called turning devices, respectively, on the line x^{17} , x^{18} , x^{19} , and x^{20} on Fig. 15;

Fig. 21 is a perspective view illustrating 25 the ribbon as it appears while within the cam channels of the turning device, some parts of the near edge of the ribbon being shown in section;

Fig. 22 is a fragmentary view in vertical 30 section taken approximately on the line $x^{22}-x^{22}$ of Fig. 2, showing the so-called clenching rollers and illustrating the action thereof on the corrugated sheet;

Fig. 23 is a section taken on the line 35 $x^{23}-x^{23}$ of Fig. 22;

Fig. 24 is a fragmentary cross section of the corrugated sheet showing the position of the turned edge or alining web portion thereof as it appears immediately after coming 40 from the cam-acting turning channels;

Fig. 25 is a view corresponding to Fig. 24, but showing the position of the said turned edge as it appears after passing between the so-called clenching rollers;

45 Fig. 26 is a perspective view of the corrugated strip as it appears after passing between the clenching rollers;

Fig. 27 is a vertical section taken approximately on the line $x^{27}-x^{27}$ of Fig. 2, some 50 parts being shown in full and some parts being broken away;

Fig. 28 is a horizontal section taken on the line $x^{28}-x^{28}$ of Fig. 27;

Fig. 29 is an elevation of the parts found 55 in the vicinity of the line marked $x^{29}-x^{29}$ of Fig. 27;

Fig. 30 is a transverse section taken on the lines $x^{30}-x^{30}$ of Figs. 27 and 28, some parts being removed;

60 Fig. 31 is a face elevation of the one revolution clutch shown in Fig. 30, some parts being broken away; and

Fig. 32 is a detail showing one of the interchangeable gears for operating the cutter 65 actuating trip.

All of the parts of the machine are, as shown, supported directly or indirectly from the box-like hollow pedestal 1, preferably in the form of a hollow casting, provided, on its upper front portion with a frame bracket 2, 70 and on its upper rear side with a long horizontal projecting frame bracket 3, (see particularly Figs. 1, 2, 3, and 4). The inspection box 4 which contains one or more electric lamp bulbs 5 and is open at its top, is 75 supported by an oblique frame 6 provided at its lower end with a long supporting stud 7 having a detachable thumb nut 8. The ribbon-like metal sheet y is contained on and supplied from a spool z removably journaled 80 on the stud 7.

On its way from the spool to the feed rollers and slitting devices, the sheet y passes over the open face of the inspection box 4, and its edges pass under the inner edges of 85 guide strips 9, secured on the upper side edges of the inspection box, (see Figs. 4 and 5).

As shown, the frame 6 is made adjustable as to inclination, by means of a telescopically 90 extensible strut 10 pivoted to the free end portion of the arm 6 and to a bearing lug on the pedestal 1.

The sheet marking device, as shown, comprises a small rock shaft 11 pivoted to lugs 95 on the upper end of the frame 6 and provided with an arm 12 equipped at its free end with a marking pin 13 adapted to perforate or indent the metal strip when forced against the same. This arm is spring retracted (see Fig. 3), and its shaft 11, at one 100 end, is provided with a projecting hand piece 14, by the depression of which, the pin 13 may be moved against the metal sheet.

All of the running parts of the machine 105 are driven indirectly from the power-driven pulley 15 that is normally loose on a driving shaft 16 journaled in a bearing bracket 17 secured to the right hand side of the pedestal 1. This pulley is adapted to be 110 connected, at will, to the shaft 16, by a suitable friction clutch 18 which may be operated in the usual way from a hand lever 19 pivoted to a lug on the outer end of the bracket 17. The shaft 16, through a pair 115 of intermeshing spiral gears 20, drives a longitudinal counter shaft 21 journaled in a suitable bearing on the bracket 17, and in longitudinally spaced bearings 22 and 23 secured on the right hand side of the frame 120 bracket 3. At its extreme inner end, the shaft 16 is provided with a spur pinion 24 which, as will presently appear, meshes with gears for driving the feed rollers and the corrugating rollers. 125

The body of the upper slitting roller 25 (see particularly Fig. 8) is wider than the body of the lower roller 26 and the said rollers are secured, respectively, to parallel 130 upper and lower shafts 27 and 28. The

lower shaft 28 is journaled in suitable fixed bearings on the sides of the pedestal 1, and secured to one end thereof, is a spur gear 29, and to the other end thereof, is a spur gear 30. The gear 30 meshes with the pinion 24 on the driving shaft 16. The upper roller shaft 27 is journaled in the pronged free portion of an oscillatory bearing 31 secured to a rock shaft 32 mounted in suitable bearings in the pedestal 1 and provided at one end with a depending arm 33. The depending free end of the arm 33 is held between opposing adjusting screws 34 that work with threaded engagement through lugs 35 on the pedestal 1 (see particularly Figs. 3 and 4).

The rollers 25 and 26 afford supports for carrying the slitting devices proper, and these slitting devices, as preferably constructed, are in the form of hardened steel slitting rings 36 (see particularly Figs. 8, 9 and 10), rigidly but detachably secured to the sides of the said rollers by screws, or otherwise, and formed with circumferentially spaced segmental shearing edges and intervening gaps or notches. The shearing surfaces of the cooperating upper and lower rings 36 are arranged to overlap slightly with close engagement, as required for proper slitting action in forming the longitudinally spaced slits in the metal sheet, and they are so timed that the gaps in the cooperating upper and lower rings will run together, and thus leave the required connecting strands, in the metal sheets, between the slits. To obtain accurate slitting action, provision is made for circumferentially adjusting, or, in other words, slightly advancing or retarding the slitting surfaces of the upper slitting rings in respect to the cooperating slitting surfaces of the lower slitting rings. As shown, this is accomplished by providing the upper roller shaft 27 at one end (see Figs. 8 and 9) with a two-part gear, the hub 37 of which is fixed to the said shaft and the toothed or rim section 37^a of which is capable of slight rotary adjustment on said hub, under the action of an eccentric 38, and is adapted to be clamped to the flange of said hub, by bolt and screw connections 39. As shown, the eccentric 38 is journaled to the flange of the hub 37 and works in an angular seat in the toothed section 37^a. Here, it should be noted further that the teeth of the gear rim 37^a mesh with the teeth of the gear 29 on the lower roller shaft 28, so that the two gears will be driven with a properly timed action.

Fig. 13 shows the metal sheet y as it appears immediately after passing from the slitting rollers. In the said view, Fig. 13, the longitudinally spaced slits are indicated at y^1 and the intervening connecting strands are indicated at y^2 .

From the slitting rollers, the slitted sheet

is passed between corrugating rollers, best shown in Figs. 1, 4, 11 and 12. The lower corrugated roller 40 is secured on a shaft 41 journaled in suitable bearings on the sides of the pedestal 1, while the upper corrugating roller 42 is secured to a shaft 43 journaled in the pronged free portion of an oscillatory bearing 44 secured to a rock shaft 45 journaled in bearing lugs on the pedestal 1 and provided at one end with a depending arm 46. The free lower end of the arm 46 is adjustably held between opposing adjusting screws 47 working in lugs 48 in the pedestal 1. A tension spring 49 is interposed between the arm 46 and the capped head of one of the adjusting screws 47. By the adjustment of these screws 47, and the spring 49, the pressure under which the cooperating corrugating rollers 40 and 42 will engage the slitted sheet, may be varied.

By reference to the Erickson application above identified, it will be noted that the corrugated plates are put together to form radiator core units in the form of zigzag water tubes and intervening zigzag air passages, and that in the formation of the water tubes, the edge portions of the plates should be offset so that they will come into contact, leaving the bodies of the two corrugated plates which form the water tube, spaced apart. To thus laterally offset the edges of the sheets from which the plate is formed, the corrugated rollers 40 and 42, at their ends, are provided with supplemental annular corrugated sections 40^a and 42^a, respectively. By reference to Figs. 11 and 12, it will be seen that the corrugations in the upper supplemental sections 42^a stand radially slightly outward of the corrugations of the upper corrugating roller 42, while the corrugations of the lower supplemental sections 40^a stand radially slightly inward of the corrugations of the said lower corrugating roller 40.

Fig. 14 shows the form of the corrugated sheet as it appears immediately after it has passed between the corrugating rollers, and by reference to this view it will be noted that the edge portions of the said sheet are laterally offset from the body corrugations of the sheet, on lines considerably inward of the slits y^1 thereof.

As already stated, the slitted sheet in passing from the slitting devices to the corrugating rollers, is subject to the so-called distance adjuster. This distance adjuster, as shown, (see Figs. 4, 6 and 7), is in the form of a guide roller 50 journaled on a spindle 51, having eccentric hubs 51^a journaled in standards 52 rigid on the pedestal 1. Obviously, the greater depression given to the slitted sheet y , by the guide roller 50, the greater will be the length of that portion of the sheet that is between the slitting

rollers and corrugating rollers. This adjustment accomplishes the same result as would be obtained by varying the distance between the slitting devices and corrugating rollers, in that it will bring the connecting strands y^2 of the sheet always into alignment with the outermost portions of the corrugations of the lower corrugating roller, and thus, in the corrugating sheet, (see Fig. 14), brings the said connecting strands into longitudinal alinement so that the corrugated edges of the sheet may be turned thereon, as hereinafter more fully described.

For locking the roller 50 of the distance adjuster in its different positions, a nut-equipped lock bolt 53 is mounted for end-wise movements in one of the standards 52 and has a segmental notch that engages the corresponding hub 51^a. As shown in Fig. 6, one of the hubs 51^a is provided with a projecting stem with a knurled head 51^b, by means of which the eccentric spindle may be adjusted.

For positively rotating the upper and lower corrugating rollers so that their corrugations will intermesh, the upper and lower roller shafts 41 and 43 (see Figs. 1 and 4) are provided with two-part gears, the toothed rims 54 of which intermesh and the hubs 55 of which are secured to the respective shafts. The said rims 54 are connected to flanges of the hubs 55, with freedom for slight circumferential adjustment, under the action of adjusting eccentrics 56 and cooperating screw-and-slot connections 57, the arrangement and operation thereof being substantially identical with the means for adjusting the hub and rim sections 37 and 37^a of the upper feed roller 27, already more fully described. The said adjustment of the rims and hubs of said gears permits of very accurate setting of the corrugations of the upper and lower corrugating rollers.

From the corrugating rollers, the corrugated sheet is next passed through edge turning devices, preferably in the form of differential cam-acting channels of varying cross section. As best shown in Figs. 15 to 20, inclusive, these differential cam-ways 58 which are formed in a bed plate 59, provided with a channel covering top plate 59^a, are so designed that as the corrugated sheet is moved therethrough, the corrugated edge portions of the sheet that are outward of the slit y^1 , will be gradually turned on the connecting strands y^2 , through 180 degrees, or until the turned edges are disposed reversely to the corresponding body corrugations from which they were turned.

For appearance sake and for certain structural reasons, it is desirable that the corrugations in the sheet be hexagonal, and hence, the corrugations in the corrugating rollers described are hexagonal, that is, each corrugation forms three sides of a hexagon,

and consequently, of course, the corrugations in the corrugated sheet will be correspondingly formed, and the turned, or reversely disposed alining webs will form hexagons, with the adjacent ends of the body of the corrugated sheet. When two such sheets are assembled, the alining webs will fit corresponding corrugations of adjacent sheets.

Figs. 17, 18, 19 and 20 progressively show different stages in the turning over of the corrugated alining webs of the sheet, and Fig. 21 shows, progressively, the condition of the corrugated sheet while it is passing through the differential cam channel. In Figs. 17 to 26, inclusive, these alining webs are designated at y^3 .

After the corrugated sheet has been passed through the turning channel, its overturned alining webs y^3 will stand substantially as shown in Fig. 24 and will be slightly oblique in respect to the corrugated edges of the body of the sheet. From the turning channels, the corrugated sheet is passed between the clenching rollers, best shown in Figs. 2, 4, 22 and 23. Both clenching rollers have corrugated surfaces, and the upper and lower clenching rollers 60 and 61, respectively, are secured to shafts 62 and 63, the latter of which is journaled in suitable bearings on the sides of the frame bracket 3. The roller shafts 62 and 63 are provided, at their right hand ends with intermeshing spur gears 64 and 65 (see Figs. 1, 2 and 4). The spur gear 65 meshes with a spur gear 66 that is carried by a short transverse counter shaft 67 journaled in the shaft bearing 22. This shaft 67 is driven from the counter shaft 21 through a pair of intermeshing spiral gears 68.

The upper roller shaft 62 is journaled in the pronged free portion of an oscillatory bearing 69 that is pivoted at 70 to a suitable bearing lug 71 located on the frame bracket 3 at one side of the turning channel. Nut-equipped bolts 72 anchored to the sides of the frame bracket 3 are passed freely through perforations in the free pronged ends of the bearing 69, and springs 73 on these bolts are compressed between the upper nuts thereof and the perforated end portions of said bearing. These springs 73, as is evident, press the clenching rollers together and against the corrugated strip which is passed between the same.

The lower clenching roller 61, which is much like the lower corrugating roller, but shown of smaller diameter, is provided with similar hexagonal peripheral corrugations and has correspondingly corrugated supplemental sections 61^a set radially slightly inward for proper engagement with the laterally offset edge portions of the corrugated body of the sheet. The upper clenching roller 60 has transverse peripheral corruga-

tions that intermesh with the correspondingly formed corrugations of the lower roller 61. Secured to the sides of this upper clenching roller 60 are annular supplemental sections 60^a formed with hexagonal corrugating teeth that are circumferentially offset in respect to the corrugations of the said roller 60 and are arranged to properly engage the overturned alining webs y^a of the metal sheet, as best shown in Fig. 22. By reference to Fig. 22 it will be seen that when the hexagonal corrugations or teeth of the supplemental sections 60^a and 61^a come together, they form hexagons and the alined projections of the teeth of the corrugations will tightly press the lower flat portions of the alining webs against the adjacent flat surfaces of the corrugated body, as best shown in Fig. 25, and is further illustrated in Fig. 26, which latter view shows the completely formed corrugated metal sheet, with reversely disposed alining webs, ready to be cut into sections to form the radiator plates.

From the clenching rollers, the corrugated metal sheet passes through an open guideway 74 (see Figs. 2 and 4), and over a relatively fixed shearing blade 75 shown as adjustably secured to the extreme rear end of the frame bracket 3 (see particularly Fig. 29). Pivoted to a lug of the bearing 23 is a cutter lever 76 equipped at one end with a shearing blade 77 for coöperation with the blade 75, and provided at its other end with a roller or lateral projection 78 that works in a profile cam groove 79 of a cam wheel 80 secured to the rear end of a short longitudinal shaft 81 journaled in the rotary sleeve 82, which, in turn, is journaled in the bearing 23. At its rear end (see Fig. 27), the sleeve 82 is provided with a spur pinion 83 that meshes with a spur gear 84^a on the extreme rear end of the counter shaft 21. At its front end, the sleeve 82 carries an internal ratchet disk 84, and at its front end, the shaft 81 has a disk-like head 85 that carries an outward spring-pressed dog 86, the end of which is adapted to be engaged with teeth of the ratchet disk 84. The said parts 84, 85 and 86 constitute a one-revolution clutch that is normally held out of action by a stop bolt 87, the end of which normally engages the free end of the dog 86 and holds the same in an inoperative position indicated by dotted lines in Fig. 31. This stop bolt 87 slides through a small bearing 88 on the bracket 3 and is pivotally connected to the depending arm of a bell crank 89 pivoted to the bracket 3, at 90.

The short arm of the bell crank 89 is adapted to be engaged by a tripping tappet 91 detachably secured to a spur gear 92, by means of a screw, or otherwise. This gear 92 is one of a series of gears of different diameter, and which gears are interchangeably usable to vary the length of the corru-

gated plates that are to be cut from the corrugated metal sheet. A smaller one of these gears is shown in Fig. 32 and is there designated by the numeral 92^a. The gear 92 is detachably journaled on the outer end of a stud 93 rigidly secured to an adjacent plate of the frame bracket 3, as best shown in Fig. 28.

The numeral 94 indicates a gear supporting arm having a slotted outer end and a split hub, which hub, by a screw 95, is adapted to be rigidly but adjustably clamped on the stud 93. The numeral 96 indicates an intermediate spur gear adjustably journaled to the slotted portion of the arm 94 and in mesh with the gear 92, and also in mesh with the spur pinion 97 that is carried by the short transverse shaft 67, which latter, it will be remembered is driven from the counter shaft 21.

The adjustment of the gear 96 and of its supporting arm 94 permits said gear 96 to be always engaged with the pinion 97 and with the gear 92, or substitute gears of different diameter.

In Fig. 29, the numeral 98 indicates a brake band that engages the periphery of the cam wheel 80 under light friction and prevents the said cam and connected parts from being given excessive movement by momentum. The ends of this brake band 98 are shown as connected to two small tension adjusting levers 99 that are intermediately pivoted to the extreme rear end of the bracket 3 and are subject to adjustment by a set screw 100.

Normally, the cutter blade 77 is raised so that the corrugated sheet may pass freely between the two shearing blades. At predetermined intervals of movement of the corrugated sheet, the tappet 91 will be brought into engagement momentarily with the short arm of the bell crank 89, and thereby retract the stop bolt 87 and release the dog 86 of the one-revolution clutch, and when this happens, the said dog will engage the teeth of the ratchet disk 84 and give the same, and the cam wheel 80, one complete rotation. This one complete rotation of the cam wheel causes the cutter blade 77 to make one complete reciprocation, downward and backward to normal position, and thus cuts off or severs the corrugated metal strip. During that short interval of time required to sever the corrugated metal sheet, feed movement of the rear end of the sheet will be intercepted and that portion of the corrugated sheet that is between the cutter and the clenching rollers will be caused to buckle slightly; but upon release from the cutter, the sheet will assume its normal shape and be advanced just as if its movement has never been intercepted by the cutting action. Obviously, the length of the plates to be cut from a corrugated sheet may be varied, at

will, by the substitution of gears 92, 92^a of different diameter. Preferably the arrangement will be such that the number of corrugations in the severed plates would correspond to the number of teeth in the interchangeable gear employed for the particular operation.

In the above described machine, the slitting rollers, the corrugating rollers, and the clenching rollers, all cooperate to feed the metal sheet with a properly timed action, and hence, it will be understood that broadly, any one or more of these devices or any other suitable feeding mechanism may be treated as ribbon feeding means.

What I claim is:—

1. A sheet-metal working machine having laterally spaced slitting devices adapted to form in the sheet parallel longitudinally spaced slits, and means for corrugating the slit sheet and for displacing portions adjacent to slits to form reversely disposed alining webs.

2. A sheet-metal working machine having slitting devices adapted to form near the edge of the sheet longitudinal slits spaced apart by connecting strands of the metal sheet, and also provided with marginal displacing devices adapted to displace portions of the margin of the sheet and thereby form reversely disposed alining webs.

3. A sheet-metal working machine having slitting devices adapted to form, near the opposite margins of the sheet, opposite parallel longitudinal slits spaced apart by connecting strands of the metal sheet, and also provided with marginal displacing devices adapted to displace portions of the margins of the sheet to afford reversely disposed alining webs.

4. In a sheet-metal working machine, the combination with slitting devices and corrugating devices, of a device for automatically turning the corrugated edge of the metal sheet.

5. A sheet-metal working machine having slitting devices adapted to form, near the opposite margins of the metal sheet, opposite parallel longitudinal slits spaced apart by connecting strands of the metal sheet, corrugating devices adapted to form transverse corrugations in the metal sheet, and marginal turning devices adapted to turn the margins of the sheet, on the said strands, to form reversely disposed alining webs.

6. In a sheet metal working machine, cooperating rollers having circumferentially spaced shearing surfaces timed so that gaps between shearing surfaces run together, the shearing surfaces on one of said rollers being circumferentially adjustable, substantially as described.

7. In a sheet-metal working machine, cooperating rollers having circumferentially spaced shearing surfaces timed so that gaps

between shearing surfaces run together, and an adjustable device holding said rollers in cooperative relation, substantially as described.

8. In a sheet-metal working machine, slitting devices adapted to form longitudinal slits in the metal sheet, a corrugating device for corrugating the slit sheet, and a travel adjuster operative to vary the length of that portion of the sheet which is between said slitting devices and said corrugating devices.

9. In a sheet-metal working machine, the combination with rotary slitting devices and corrugating rollers, of a rotary travel adjuster operative to vary the length of that portion of the sheet that is between said slitting devices and corrugating rollers.

10. In a sheet-metal working machine, slitting devices adapted to form longitudinal slits in the metal sheet, a corrugating device for corrugating the slit sheet, and a rotary eccentric travel adjuster adapted to be variably set, and operative to vary the length of that portion of the sheet which is between said slitting devices and corrugating devices.

11. In a sheet-metal working machine, the combination with slitting devices adapted to form in the sheet parallel longitudinal slits spaced by connecting strands of the metal sheet, of a corrugating device adapted to form transverse corrugations in the slitted sheet, marginal turning devices adapted to turn the corrugated margin of the sheet on said strands to form reversely disposed alining webs, and a clenching device for pressing the said alining webs to final position in respect to the corrugations of said sheet.

12. In a sheet-metal working machine, the combination with rollers having cooperating circumferentially spaced shearing edges adapted to form, near the opposite margins of the sheet, opposite parallel longitudinal slits spaced by connecting strands of the metal sheet, of corrugating rollers adapted to form transverse corrugations in the metal sheet, marginal turning devices adapted to turn the corrugated margins of the sheet on said strands to form reversely disposed alining webs, and corrugated clenching rollers timed for engagement with the turned alining webs and operative to press the same to final position in respect to the corrugation of said sheet.

13. The combination with means for turning the corrugated edge of a corrugated metal sheet having longitudinal marginal slits and intervening connecting strands, of means for feeding the said corrugated sheet to and past said edge-turning means.

14. The combination with two sets of corrugated rollers for controlling the feed movements of a corrugated sheet having longitudinal slits and intervening connect-

ing strands, of differential cam-acting channels located between said two pairs of rollers and operative to turn over the corrugated edges of said sheet.

5 15. In a sheet-metal working machine, the combination with slitting rollers adapted to form near the margins of the sheet opposite parallel longitudinal slits spaced apart by connecting strands of the metal sheet, of
10 corrugating rollers adapted to form transverse corrugations in the slitted sheet, and laterally spaced cam channels arranged to turn the corrugated margins of the sheet, on the said strands, to form reversely dis-
15 posed alining webs.

16. In a sheet-metal working machine, the combination with slitting rollers adapted to form near the margins of the sheet opposite parallel longitudinal slits spaced apart by
20 connecting strands of the metal sheet, of corrugating rollers adapted to form transverse corrugations in the slitted sheet, laterally spaced cam channels arranged to turn the corrugated margins of the sheet, on the
25 said strands, to form reversely disposed alining webs, and corrugated clenching rollers constructed to fit both the corrugated body and turned alining webs and to press the latter to final position in respect to the
30 corrugated body of said sheet.

17. In a sheet-metal working machine, the combination with rollers having coöperating circumferentially spaced shearing edges adapted to form, near the opposite margins
35 of the sheet, opposite parallel longitudinal slits spaced by connecting strands of the metal sheet, of corrugating rollers adapted to form transverse corrugations in the metal sheet, marginal turning devices adapted to
40 turn the corrugated margins of the sheet on said strands to form reversely disposed alining webs, corrugated clenching rollers timed for engagement with the turned alining webs and operative to press the same to final position
45 in respect to the corrugation of said sheet, and a travel adjuster operative to vary the length of that portion of the sheet that is between said slitting rollers and corrugating rollers.

18. In a sheet-metal working machine, the combination with rollers having coöperating circumferentially spaced shearing edges adapted to form, near the opposite margins
50 of the sheet, opposite parallel longitudinal slits spaced by connecting strands of the metal sheet, of corrugating rollers adapted to form transverse corrugations in the metal sheet, marginal turning devices adapted to
55 turn the corrugated margins of the sheet on said strands to form reversely disposed alining webs, corrugated clenching rollers timed for engagement with the turned alining webs and operative to press the same to final position in respect to the corrugation
60 of said sheet, a travel adjuster operative to

vary the length of that portion of the sheet that is between said slitting rollers and corrugating rollers, and sheet guides between said rollers and cutter permitting the corrugated sheet to buckle while it is being intercepted by the cutting action.

19. In a sheet-metal working machine, the combination with rotary slitting devices operative to cut in the metal sheet, opposite
75 parallel longitudinal slits spaced by connecting strands of the metal sheet, of corrugating rollers arranged to form transverse corrugations in the slitted sheet, marginal turning channels operative to turn the corrugated margins of the sheet on said strands, 80
to form reversely disposed alining webs, corrugated clenching rollers operative to press said turned alining webs to final position in respect to the corrugations of said sheet, and a cutter operative with a timed
85 action to cut the corrugated sheet into plates of a predetermined length.

20. In a sheet-metal working machine, the combination with rotary slitting devices operative to cut in the metal sheet, opposite
90 parallel longitudinal slits spaced by connecting strands of the metal sheet, of corrugating rollers arranged to form transverse corrugations in the slitted sheet, marginal turning channels operative to turn the corru- 95
gated margins of the sheet on said strands, to form reversely disposed alining webs, corrugated clenching rollers operative to press said turned alining webs to final position in respect to the corrugations of said sheet, a
100 cutter operative with a timed action to cut the corrugated sheet into plates of a predetermined length, and means for varying the timed action of said cutter whereby plates of variable length will be cut. 105

21. The combination with means for feeding a corrugated sheet, of a cutter for severing the sheet, a cutter-actuating mechanism, a stop normally holding said actuating mechanism out of action, and a trip driven
110 with a timed action from said sheet feeding means and operating to retract said stop and render the said cutter operative.

22. The combination with means for feeding a corrugated sheet, of a cutter for severing said sheet, a cutter-actuating mechanism, including a one-revolution clutch, a stop normally holding said clutch inoperative, and a trip driven from said sheet-feeding means and operative to retract said stop and
120 render the said clutch operative for one revolution.

23. The combination with corrugated rollers controlling a feed movement of a corrugated sheet, of a cutter for severing the cor- 125
rugated sheet, cutter-actuating mechanism, including a one-revolution clutch, a stop normally holding said clutch inoperative, an adjustable gear support, and one of a series of different sized gears journaled on said 130

adjustable support, and a trip driven by said gear and operative to retract said stop and render said clutch operative for one revolution.

5 24. In a sheet-metal working machine, the combination with means for feeding a metal sheet and for forming in the edge thereof longitudinal slits spaced by connecting
10 strands, of a light containing inspection box over which the sheet is fed on its way to said slitting devices.

25. In a sheet-metal working machine, the combination with means for feeding a metal sheet and for forming in the edge there-

of longitudinal slits spaced by connecting 15 strands, of a light containing inspection box over which the sheet is fed on its way to said slitting devices, and a marking device located between said inspection box and slitting devices operative to mark defective portions of the sheet. 20

In testimony whereof I affix my signature in presence of two witnesses.

GEZA HORVATH.

Witnesses:

EDWARD C. GRANT,

HELMER A. WALSTRUM.