April 10, 1928. 1,665,319

G. E. MIRFIELD

SHEARING METAL SHEETS

Filed Jan. 10, 1925 5 Sheets-Sheet 1

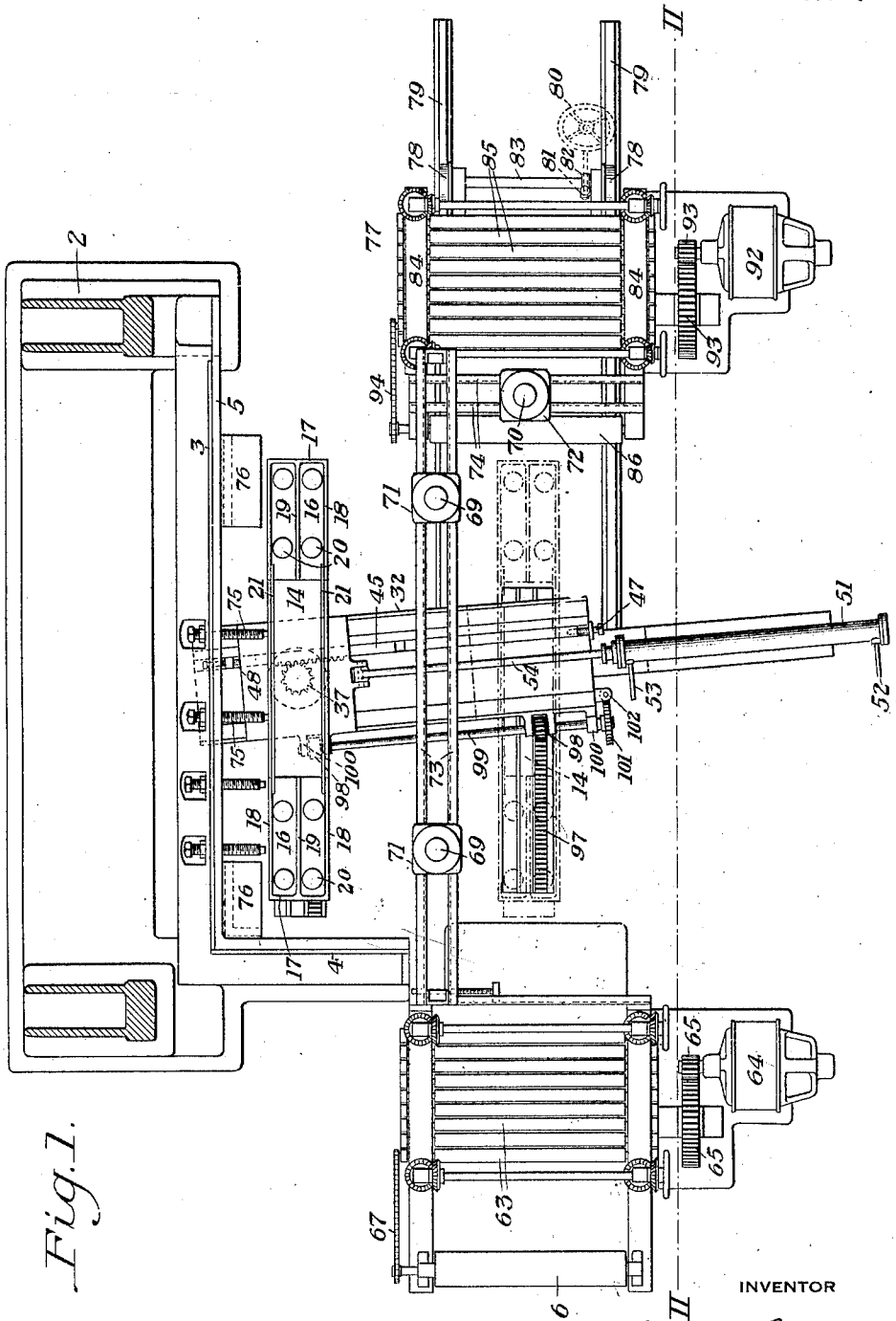


Fig. 1.

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SHEARING METAL SHEETS

Filed Jan. 10, 1925 5 Sheets-Sheet 2

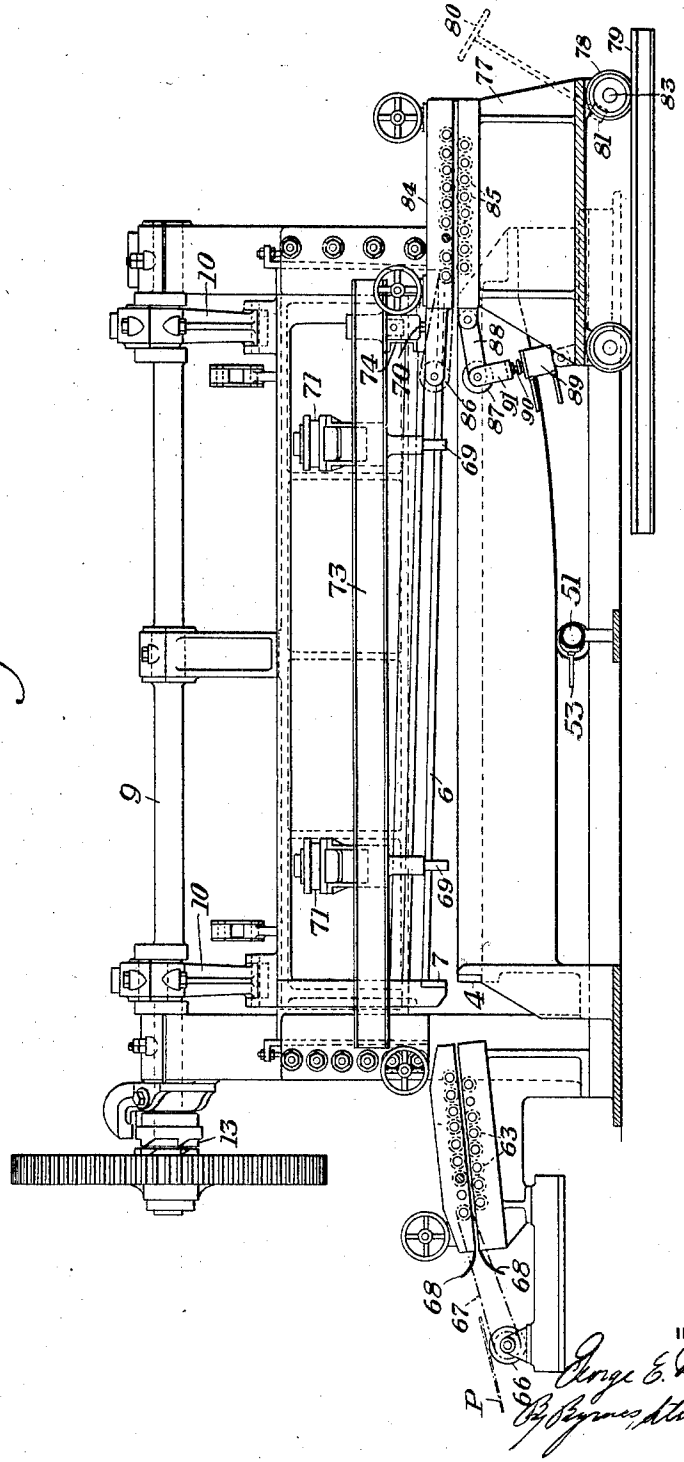


Fig. 2.

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SHEARING METAL SHEETS

Filed Jan. 10, 1925

5 Sheets-Sheet 3

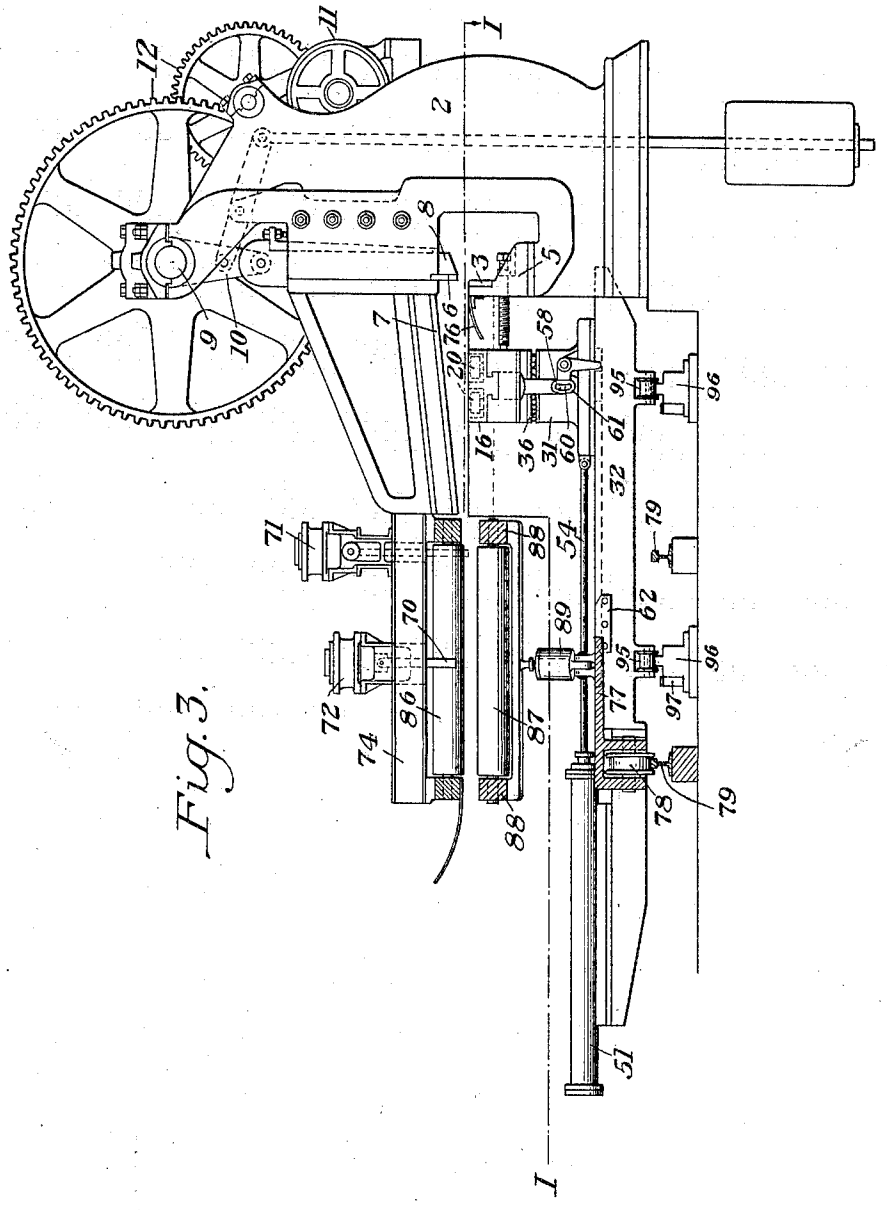


Fig. 3.

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5 Sheets-Sheet 3

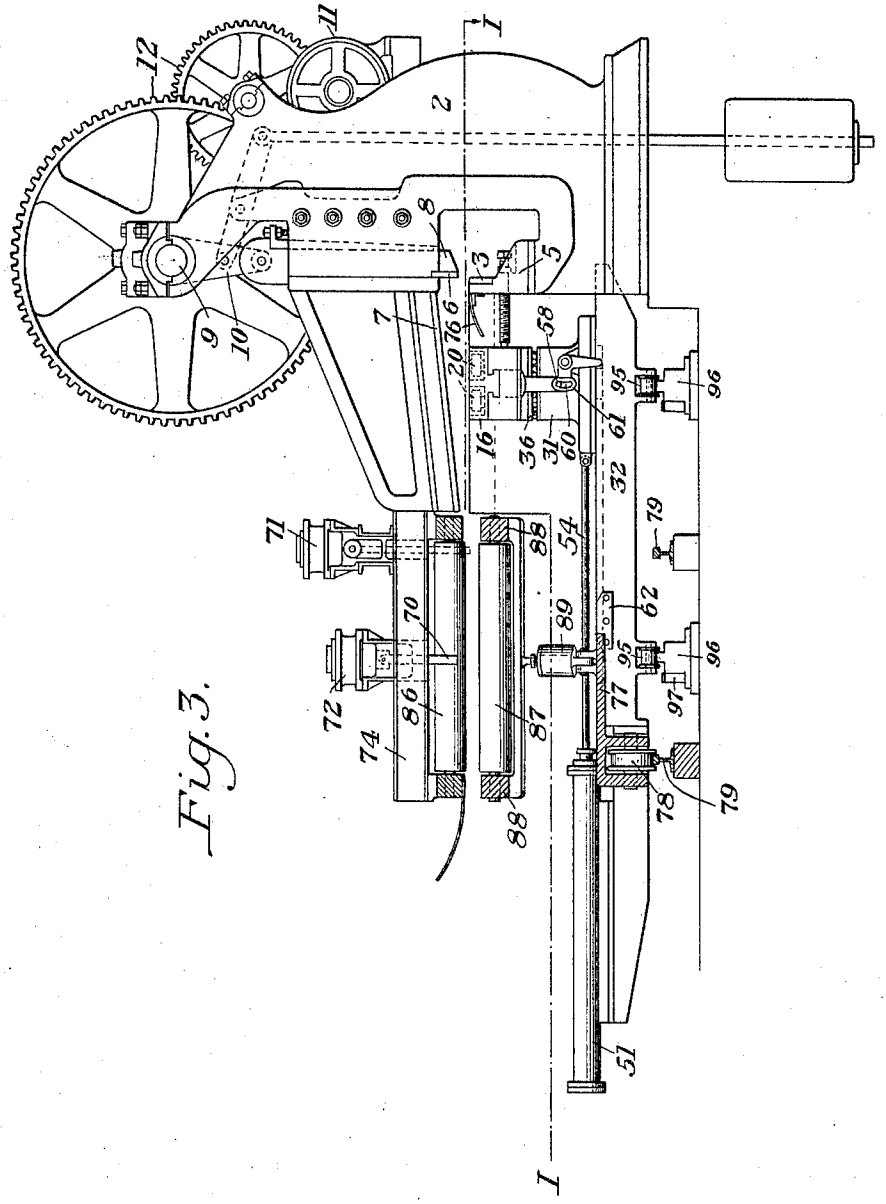


Fig. 3.

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SHEARING METAL SHEETS

Filed Jan. 10, 1925

5 Sheets-Sheet 4

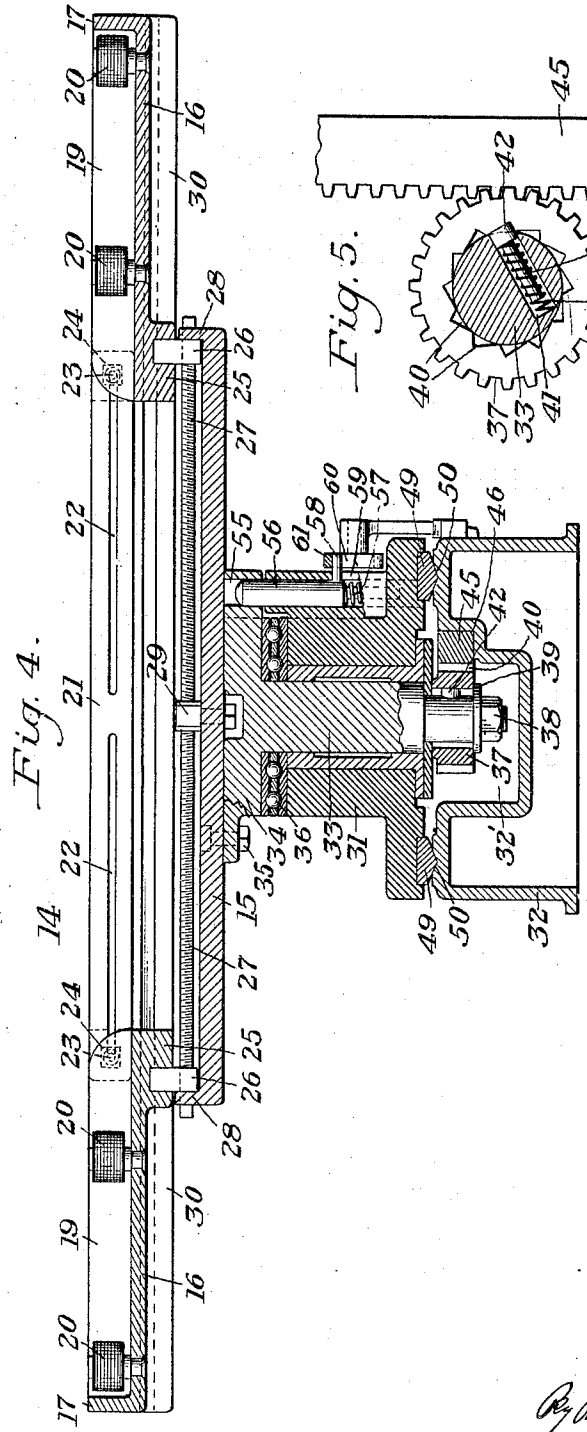


Fig. 4.

Fig. 5.

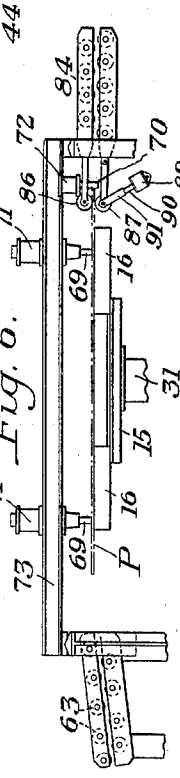


Fig. 6.

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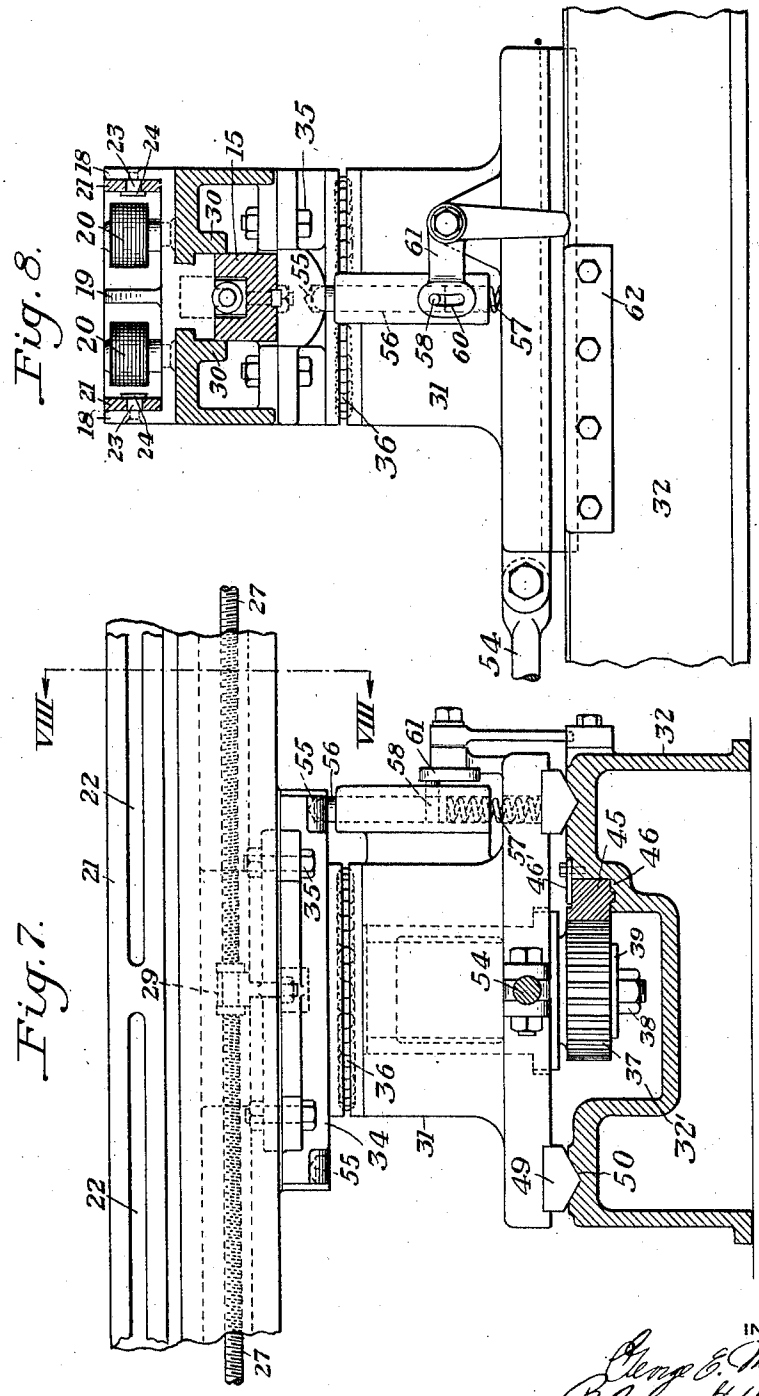
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SHEARING METAL SHEETS

Filed Jan. 10, 1925 5 Sheets-Sheet 5



INVENTOR

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Patented Apr. 10, 1928. 1,665,319

UNITED STATES PATENT OFFICE.

GEORGE E. MIRFIELD, OF YOUNGSTOWN, OHIO.

SHEARING METAL SHEETS.

Application filed January 10, 1925. Serial No. 1,563.

My invention relates to shearing metal sheets, and more particularly to shearing packs of sheets, although it may be applied to shearing single sheets.

Heretofore in rolling mills the practice has been to take the pack as it is finally rolled and shear the edges thereof successively. This pack usually consists of six sheets doubled over to make a pack of twelve sheets in thickness, each sheet being doubled over to form what is called the bound end of the pack. The practice has been to take this pack from the finishing rolls and deliver it to a stationary table at one side of which was the usual guillotine type of shear. The workmen first presented one side edge of the pack to the shear, then drew the pack back on the table, turned it through 180°, and presented the other side edge thereof to the shear. Then the pack was turned 90° and the end edge of the pack opposite the bound end was cut off. Finally the pack was turned 180° and the bound end of the pack sheared off. The accuracy with which the opposite edges of the packs were sheared parallel to each other depended entirely upon the skill of the workmen, and it was necessary where specifications called for accurate dimensioning to reshear the sheets singly.

The shearing mechanism shown in the preferred embodiment of the present invention has two shears of the usual guillotine type set at right angles to each other. The packs are carried on a table which first presents one side edge of each pack and the end edge thereof opposite the bound end to the shears, which shear off such side edge and end edge. The table is then withdrawn and is automatically given a rotation of 180° and the pack represented to the shears for shearing off the two remaining edges. It is therefore possible to accomplish the shearing of the four edges of a pack with this mechanism in less than half the time required by the old method. Furthermore, the mechanism embodies means for automatically positioning the packs for the shearing operations, whereby the shearing of the opposite edges of the packs parallel to each other does not depend upon the skill of the workmen. This insures accurate work and eliminates the necessity for re-shearing individual sheets in order to bring their edges into parallelism.

In the accompanying drawings, wherein I have illustrated shearing mechanism embodying a preferred form of my invention:

Figure 1 is a sectional plan view of the mechanism, the section being taken on the line I—I of Figure 3;

Figure 2 shows the mechanism partly in front elevation and partly in vertical section, the section being taken on the line II—II of Figure 1;

Figure 3 is a view showing the mechanism in end elevation, the truck which supports the pinch rolls and leveler rolls at the right hand end of the machine (Figure 2) being shown partly in section and partly broken away;

Figure 4 is a central longitudinal vertical sectional view through the magnetic turn-table, its supporting head and the carriage on which the head reciprocates;

Figure 5 is a detail sectional view, on a larger scale, showing the rack and pinion means for turning the magnetic turn-table, the section being taken on the line V—V of Figure 4;

Figure 6 is a detail view, more or less diagrammatic, showing a pack on the magnetic turn-table positioned against the solenoid operated stops;

Figure 7 is a detail view, on a larger scale, showing a portion of the magnetic turn-table and its supporting and operating means; and

Figure 8 is a section on the line VIII—VIII of Figure 7.

The illustrated mechanism comprises a shear 2 having stationary lower knives 3 and 4 set at right angles to each other and carried by the knife block 5. Cooperating with the knives 3 and 4 are the upper knives 6 and 7 carried by the vertically movable knife block 8. The knife block 8 is reciprocated by means comprising a horizontal crank-shaft 9 operatively connected to the knife block 8 by pitmen 10. The shaft 9 may be driven by a motor 11 through the gear train 12 and clutch 13.

Arranged in front of the shear 2 is the magnetic turn-table 14 which supports the packs while being sheared. This table comprises a base 15 on which are adapted to slide the two table ends 16. The table ends have end and side flanges 17 and 18 and partitions 19 intermediate the side flanges and in the spaces between the side flanges

18 and partitions 19 carry electromagnets 20.

Connecting the side flanges 18 of the table ends are bars 21 having elongated slots 22 therein. Pins 23 rigidly mounted in the side flanges 18 extend through the slots 22 and have heads 24 which engage the inner faces of said bars. It will be seen by reference to Figure 4 that the bars 21, flanges 17 and 18, and partitions 19 have their upper edges in the same horizontal plane. The packs rest on these edges while being sheared and are held in firm engagement therewith by the downward pull of the electromagnets 20 which can be energized by operating a suitable switch. The table ends 16 have integral downwardly projecting lugs 25 at their inner ends in which are mounted nuts 26. These nuts engage a right and left handed screw 27 which extends longitudinally of the table base 15 and is journaled at its ends in the upwardly projecting flanges 28 at the ends of the table base. It is also journaled at its center in a bearing 29 having a swivel connection with the table base. The table ends 16 can be separated to the extent shown in Figure 4 or can be moved towards each other until their inner ends abut by turning the screw 27. The table ends have downwardly extending parallel flanges 30 which engage the opposite side faces of the table base 15 (Figure 8), whereby the movements of the table ends are guided.

The magnetic turn-table 14 is rotatably supported upon a head 31 which in turn is mounted for reciprocation on a carriage 32 in the form of a casting. A shaft 33 is journaled in the head 31 and this shaft has an integral head 34 at its upper end upon which the table base 15 rests and to which it is secured by bolts 35. Interposed between the head 34 and the head 31 is a ball bearing 36. The shaft 33 has a reduced lower end which projects into a channel 32′ in the base casting 32 and journaled on said reduced lower end of the shaft is a pinion 37, the pinion being held thereon by a nut 38 and washer 39. The pinion has internal ratchet teeth 40 and the reduced end of the shaft on which the pinion is journaled has a socket 41 therein in which is mounted a plunger 42 constituting a pawl for cooperation with the ratchet teeth. This plunger has a stem 43 surrounded by a coil spring 44 which engages against the plunger and the bottom of the socket 41 and yieldingly holds the plunger in engagement with the rack teeth. The pinion 37 meshes with the teeth of a ratchet bar 45 which slides upon a seat 46 formed in the carriage casting 32, being held on said seat by a detachable plate 46′ (Figure 7). Adjacent the opposite ends of the seat are set screws 47 and 48 which limit the movements of the rack bar in opposite directions on the seat. These set screws are mounted in the carriage casting 32. The head 31 has shoes 49 mounted in its lower surface which engage in grooves 50 in the carriage casting 32, whereby the reciprocatory movements of the head on the carriage are guided.

Supported on a forward extension of the carriage 32 is a fluid cylinder 51 which has pipes 52 and 53 connected to its opposite ends, whereby the opposite ends of the cylinder can be alternately connected to a source of fluid supply. Working in the cylinder is a piston having a piston rod 54 which is pivotally connected at its outer end to the head 31. Assuming the parts in the position shown in Figure 1, if fluid is admitted to the forward end of the cylinder 51 through the pipe 53, the head 31 and the magnetic turn-table supported thereby will be drawn rearwardly. Since the pinion 37 is locked against left hand rotation by the pawl 42, the rack bar 45 will be drawn rearwardly by the pinion until it engages the adjustable stop 47. Further rearward movement of the head 31 will then cause the pinion to be turned by the rack bar and, since the pinion is locked to the shaft 33 by the pawl 42, the magnetic turn-table will be revolved during such further rearward movement of the head 31.

By reference to Figures 4 and 7, it will be seen that the head 34 of the shaft 33 has two diametrically opposite sockets 55 therein into which the end of a plunger 56 carried by the head 31 is adapted to be projected when either of said sockets registers with the upper end of the plunger during the rotation of the magnetic turn-table. A coil spring 57 acts on the lower end of the plunger and tends to thrust it upwardly. A pin 58 extends laterally from the lower end of the plunger through a slot 59 in the head 31 and into an arcuate slot 60 in one arm of a bell crank lever 61 pivoted to the head 31. The other arm of the bell crank lever projects downwardly and is adapted to engage a cam plate 62 bolted to one side of the carriage casting 32. The upper corners of this cam plate are rounded as shown in Figure 8. During the rearward movement of the head 31 and magnetic turn-table 14, the downwardly projecting end of the bell crank lever engages the forward end of the cam plate and is thereby rocked in a counter-clockwise direction (Figure 8) to withdraw the plunger 56 from the socket 55 in which it is engaged. This takes place just before the rack bar 45 engages the adjustable stop 47. During further rearward movement of the head 31, the lower end of the downwardly projecting arm of the bell crank lever rides on the upper edge of the cam plate until the rear end of the cam plate is reached. Meantime, however, the rack bar has engaged the stop 47 and the magnetic

turn-table has begun to revolve so that the plunger 56 is held in retracted position by the engagement of its upper end with the lower surface of the head 34 of the shaft 33. When the magnetic turn-table has been revolved 180°, the other socket 55 registers with the upper end of the plunger 56 and the spring 57 immediately projects the plunger into the socket and locks the table against further rotation. Upward movement of the plunger at this time is permitted by reason of the fact that the downwardly projecting arm of the bell crank lever 61 has moved out of engagement with the cam plate 62.

If fluid is now admitted to the rear end of the cylinder 51 through the pipe 52, the head 31 and magnetic turn-table 14 will be moved back to the position which they occupy in Figure 1. During this movement the downwardly projecting arm of the bell crank lever 61 will engage the rear end of the cam plate 62 and will be rocked thereby in a clockwise direction, this being permitted by reason of the arcuate slot 60 in said lever. When the forward end of the cam plate is reached, the bell crank lever will again assume the position shown in Figure 8. During the initial portion of the forward movement of the head 31, the friction between the pawl 42 and the pinion 37 will be sufficient to cause the pinion to slide the rack bar 45 forward until it engages the adjustable stop 48. Thereafter the further forward movement of the head 31 will cause the pinion 37 to rotate on the shaft 33.

At the left hand end of the mechanism (Figures 1 and 2), there is a leveler 63 embodying a plurality of leveler rolls 63 driven by an electric motor 64 through gearing 65. In front of the leveler 63 is a magnetic feed roll 66 driven from the leveler rolls through a sprocket chain 67.

In the operation of this mechanism a pack of sheets P to be sheared is dragged along the floor by the workmen by means of tongs and placed on the magnetic feed roll 66, as illustrated in Figure 2. This feed roll feeds the pack, bound end foremost, between guides 68 to the leveler rolls 63. The rolls 63 feed the pack onto the table 14 which at that time occupies its rearward position, as indicated in dot-and-dash lines in Figure 1. A workman slides the pack on the table into engagement with stops 69 and 70, the stops 69 engaging one side edge of the pack and the stop 70 engaging the bound end edge of the pack. These stops are adapted to accurately position the pack on the table for the shearing operation. The stops 69 and 70 are operated by solenoids 71 and 72 adjustably mounted on supports 73 and 74. These supports are in turn adjustably mounted on the frame work of the mechanism.

After the pack is positioned against the stops 69 and 70, the electromagnets 20 are energized in order to clamp the pack on the table and the solenoids 71 and 72 are simultaneously energized to raise the stops 69 and 70 out of engagement with the pack. The current to the electromagnets 20 and solenoids 71 and 72 can be controlled by suitable switch devices. Fluid is then admitted to the rear end of the cylinder 51 through the pipe 52 and the table moves forwardly until it engages the adjustable alignment stops provided by the set screws 75 carried by the lower knife block 5. These stops are adjusted in accordance with the various widths of the packs which are sheared. In order to support the overhanging side edge portion of a pack and prevent it from sagging down in front of the shear, a guide 76 is provided in front of the lower knife 3. This guide is in the form of a downwardly curved plate upon which the projecting side edge of the pack rides as the table approaches the shear, whereby said edge portion of the pack is guided over the upper edge of the lower knife block and over the lower knife 3. After the shear has been operated to shear one side edge and one end edge of the pack, fluid is admitted to the forward end of the cylinder 51 through the pipe 53 to draw back the magnetic turn-table. During the rearward movement of the table it is automatically turned 180°, as previously explained, and locked in such position. It will be noted that the turn-table moves rearwardly in a direction diagonal to the shear knives so that the pack is withdrawn some distance from both sets of knives before it is turned. The lost motion of the rack bar is provided so that the pack is pulley away from the shear a sufficient distance before turning in order that there will be no danger of the pack striking the shear while being turned.

After the table has been drawn back and turned through 180°, fluid is again admitted to the rear end of the cylinder 51 and the table moved forward to the shear and the other two edges of the pack sheared off. Then fluid is admitted to the forward end of the cylinder 51 and the tabe withdrawn to its initial position, indicated in dot-and-dash lines in Figure 1.

At the right hand end of the mechanism (Figure 2), there is a truck 77 having traction wheels 78 running on tracks 79. The position of this truck can be adjusted by operating a hand wheel 80 which has a worm 81 at its lower end engaging a worm wheel 82 and the axle 83 of a pair of the traction wheels 78. The truck 77 supports a leveler 84 embodying leveler rolls 85. This truck also supports a stationary upper pinch roll 86 and a cooperating movable lower pinch roll 87. The lower pinch roll is connected by links 88 to the truck 77. Normally the

lower pinch roll occupies the position shown in Figure 2 but it is adapted to be raised by the fluid cylinder 89 the piston 90 of which is connected to a yoke 91 in which the lower pinch roll is journaled. After the two side edges and the two end edges of a pack P have been sheared in the manner described and the magnetic turn table withdrawn to its initial position, one end portion of the pack projects between the pinch rolls 86 and 87. The fluid cylinder 89 is then operated and the projecting end portion of the pack is gripped between the pinch rolls, as illustrated in Figure 6.

The leveler rolls 85 are driven by an electric motor 92 through gearing 93 and the upper pinch roll 86 is driven from the leveler rolls through the sprocket chain 94. After the projecting end portion of the pack has been gripped between the pinch rolls and the electric magnets 20 deenergized, the motor 92 is started and the pinch rolls feed the pack to the leveler rolls 85 and the latter deliver the sheared pack onto a truck or other suitable conveyor.

The carriage 32 has traction wheels 95 on its lower side which engage tracks 96 extending between the levelers 62 and 84. One of these tracks has a rack 97 associated therewith which is engaged by a pinion 98 on a shaft 99 journaled in bearings 100 projecting from one side of the carriage 32. The shaft 99 has a worm wheel 101 on its rear end engaged by a worm 102. By turning the worm 102, the carriage 32 can be moved on the tracks 96 to adjust its position relative to the levelers 62 and 84.

It will be apparent that I have provided a shearing mechanism whereby the edges of a pack of sheets can be quickly and accurately sheared with very little handling on the part of the workmen and in much less time than by the usual method of shearing only one edge of a pack at a time.

While I have shown and described a preferred embodiment of my invention, it will be understood that the invention is not limited to the details of construction shown and described, but that the invention may be otherwise embodied within the scope of the appended claims.

I claim:

1. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear two edges of a pack or sheet, a support for holding the pack or sheet while being sheared, and means for turning the support into different operative positions whereby to first present two edges of the pack or sheet to the shear and then the other two edges, substantially as described.

2. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, and means for supporting the pack or sheet while being sheared, said means being adapted to be moved into different positions whereby to first present two edges of the pack or sheet to the shear and then the other two edges, substantially as described.

3. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear two edges of a pack or sheet, a support for the pack or sheet while being sheared, and means for moving said support into and out of cooperative relation with said shear and for turning it into different operative positions whereby to first present two edges of the pack or sheet to the shear and then the other two edges, substantially as described.

4. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a support for the pack or sheet while being sheared, and means for moving said support into and out of cooperative relation with said shear and for turning it into different operative positions whereby to first present two edges of the pack or sheet to the shear and then the other two edges, substantially as described.

5. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a support movable towards and from said shear, a table rotatably mounted on said support for supporting the pack or sheet while being sheared, and means for moving said support towards and from said shear and for reversing the position of said table thereon during such movement of said support, substantially as described.

6. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, and means for moving said table alternately into operative relation to said feeding means and to said shear, substantially as described.

7. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, and means for moving said table alternately into operative relation to said feeding means and to said shear and for rotating said table 180° during such movement thereof, substantially as described.

8. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table

for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, said table being movable alternately into operative relation to said feeding means and to said shear, and stops arranged in operative relation to said table when the latter is opposite said feeding means whereby to enable the pack or sheet to be correctly positioned on said table for the shearing operations, substantially as described.

9. A shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, delivery means spaced from said feeding means for conveying a sheared pack or sheet from said table, means for moving said table alternately to a position between said feeding means and said delivery means and to a position in which it is in operative relation to said shear, and means for automatically reversing the position of said table during such movement thereof, substantially as described.

10. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, delivery means spaced from said feeding means for conveying a sheared pack or sheet from said table, means for moving said table alternately to a position between said feeding means and said delivery means and to a position in which it is in operative relation to said shear, means for automatically reversing the position of said table during such movement thereof, and stops for cooperation with the edges of a pack or sheet whereby to enable the same to be correctly positioned on said table for the shearing operations, substantially as described.

11. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, delivery means spaced from said feeding means for conveying a sheared pack or sheet from said table, means for moving said table alternately to a position between said feeding means and said delivery means and to a position in which it is in operative relation to said shear, means for automatically reversing the position of said table during such movement thereof, and electrically controlled stops supported independently of said table for engagement with the edges of a pack or sheet whereby to enable the same to be correctly positioned on said table for the shearing operations, substantially as described.

12. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a table for supporting the pack or sheet while being sheared, said table being adapted to be moved into different operative positions whereby to first present two edges of the pack or sheet to the shear and then the two other edges, and electromagnetic means for holding the pack or sheet on the table, substantially as described.

13. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, an extensible table for supporting the pack or sheet while being sheared, said table being adapted to be moved into different operative positions whereby to first present two edges of the pack or sheet to the shear and then the two other edges, and electromagnetic means for holding the pack or sheet on the table, substantially as described.

14. Shearing mechanism for metal sheets, comprising a shear adapted to simultaneously shear a side edge and an end edge of a pack or sheet, a rotatably mounted table for supporting the pack or sheet while being sheared, means for feeding a pack or sheet onto said table, delivery means spaced from said feeding means for conveying a sheared pack or sheet from said table, a carrier arranged between said feeding and delivery means and upon which said table is adapted to be moved alternately to a position between said feeding and delivery means and to a position in which it is in operative relation to said shear, means for reciprocating said table on said carrier, means for reversing the position of said table during such movement thereof, and means for adjusting the position of said carrier with respect to said feeding and delivery means, substantially as described.

In testimony whereof I have hereunto set my hand.

GEORGE E. MIRFIELD.