

Nov. 3, 1959

R. J. ERSKINE
METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS
MOVING STRIP TO A FIXED WIDTH

2,911,044

Filed Sept. 23, 1955

5 Sheets-Sheet 1

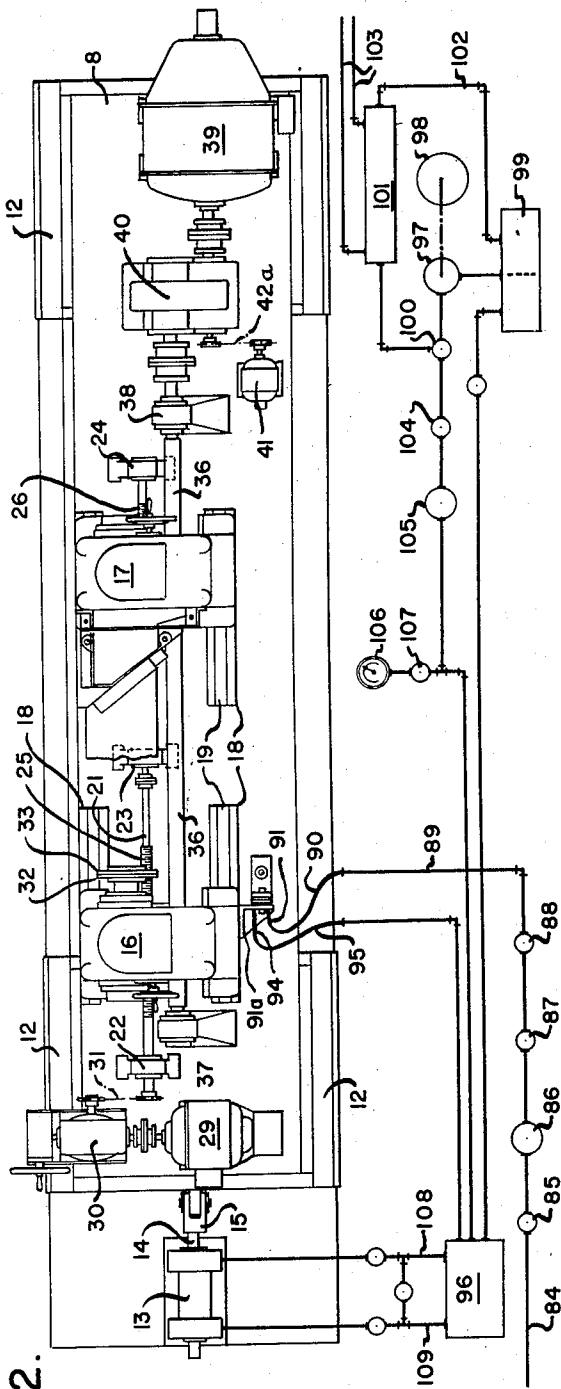


Fig. 2.

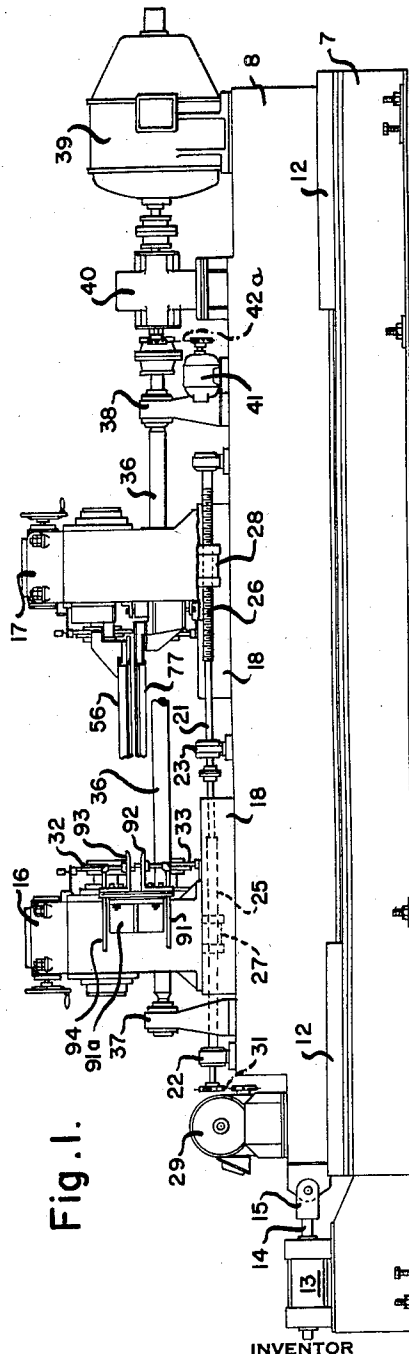


Fig. 1.

INVENTOR

Robert J. Erskine

Hoppe, Leonard & Buell
his attorneys

Nov. 3, 1959

R. J. ERSKINE
METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS
MOVING STRIP TO A FIXED WIDTH

2,911,044

Filed Sept. 23, 1955

5 Sheets-Sheet 2

Fig. 3.

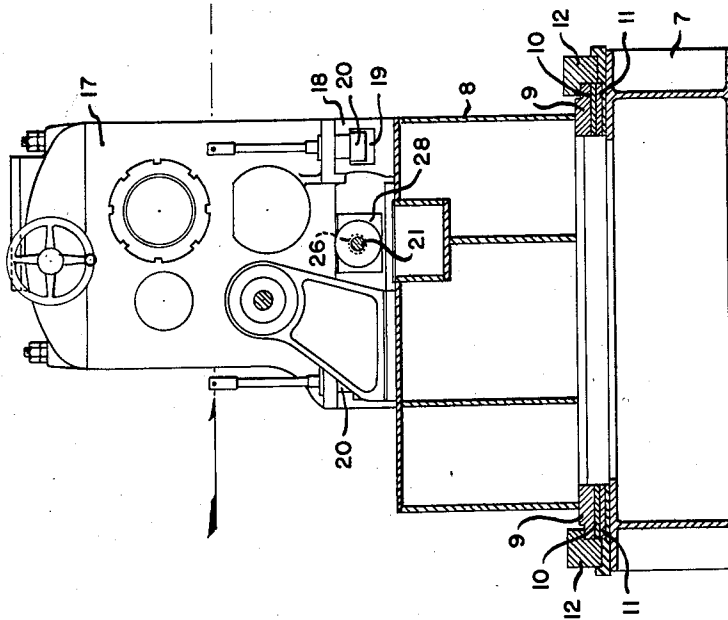
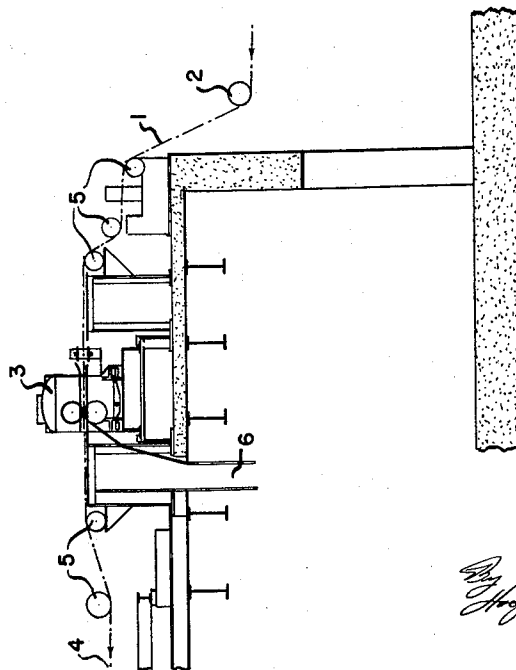


Fig. 11.



INVENTOR

Robert J. Erskine

By *Hopas, Leonard & Bull*
his attorneys

Nov. 3, 1959

R. J. ERSKINE
METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS
MOVING STRIP TO A FIXED WIDTH

2,911,044

Filed Sept. 23, 1955

5 Sheets-Sheet 3

Fig. 4.

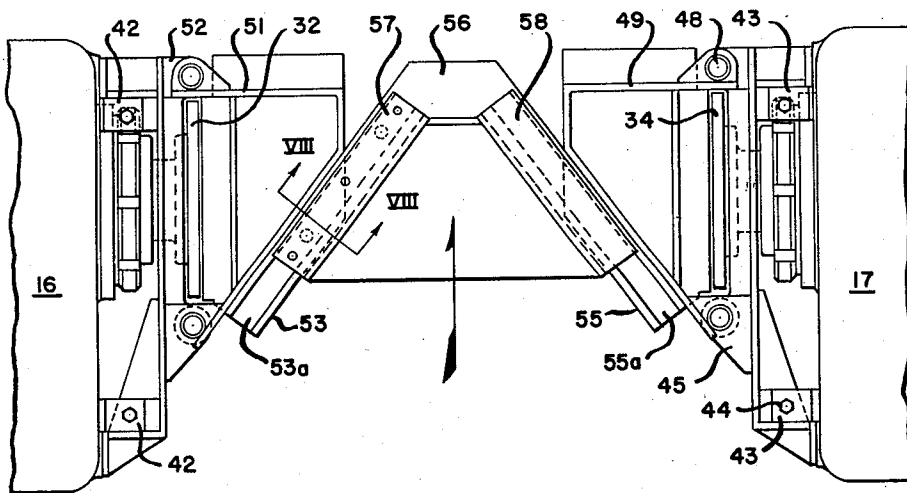
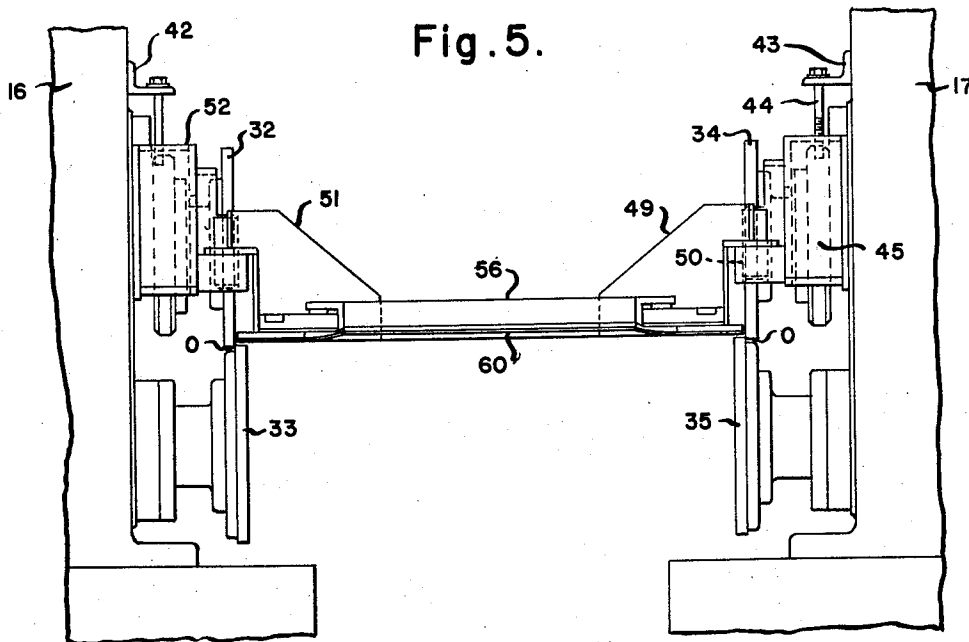


Fig. 5.



INVENTOR

Robert J. Erskine

By *James Leonard & Ewell*
his attorneys

Nov. 3, 1959

R. J. ERSKINE
METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS
MOVING STRIP TO A FIXED WIDTH

2,911,044

Filed Sept. 23, 1955

5 Sheets-Sheet 4

Fig. 6.

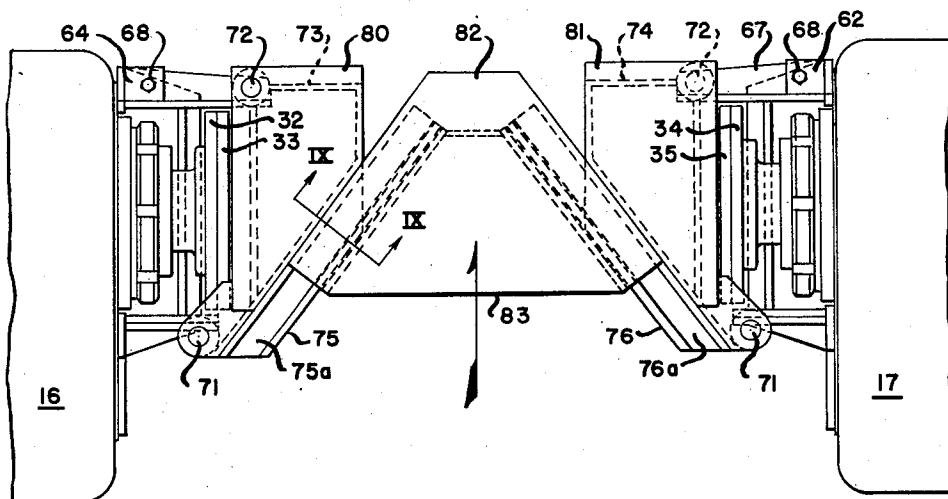
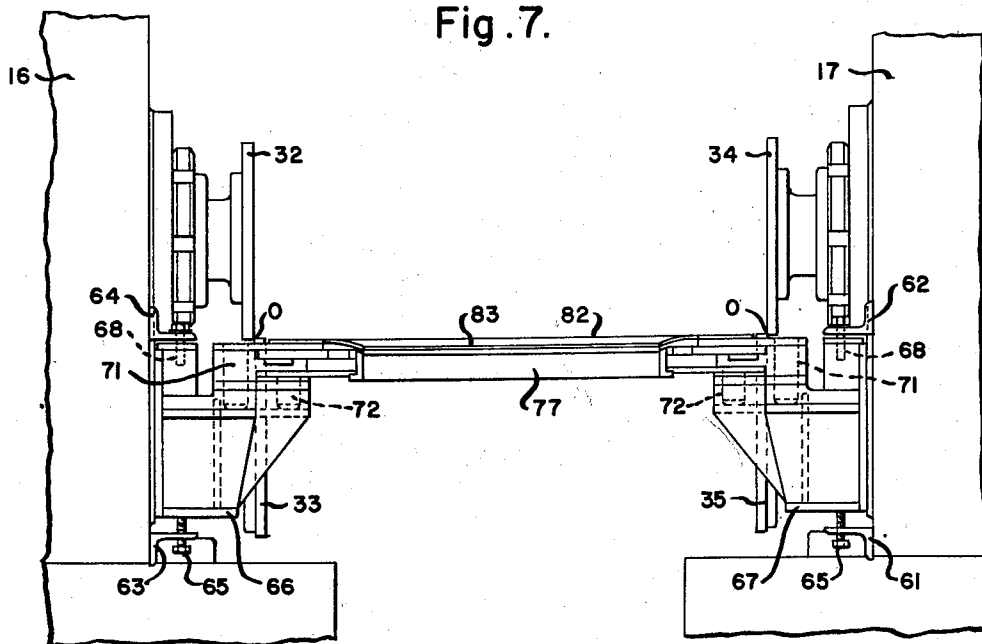


Fig. 7.



INVENTOR

Robert J. Erskine

By *James Leonard & Ball*
his Attorneys

Nov. 3, 1959

R. J. ERSKINE
METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS
MOVING STRIP TO A FIXED WIDTH

2,911,044

Filed Sept. 23, 1955

5 Sheets-Sheet 5

Fig. 10.

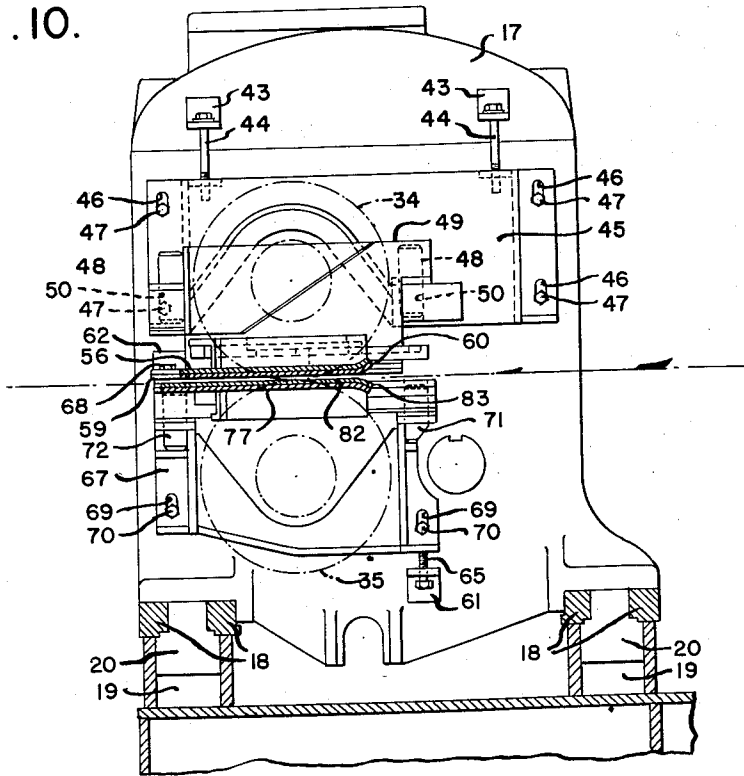


Fig. 8.

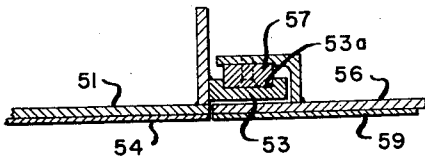
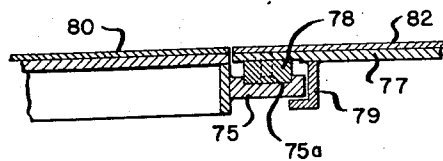


Fig. 9.



INVENTOR

Robert J. Erskine

By *Harvey Leonard & Ball*
his Attorneys

1

2,911,044

METHOD AND APPARATUS FOR TRIMMING A CONTINUOUS MOVING STRIP TO A FIXED WIDTH

Robert J. Erskine, Howland Township, Trumbull County, Ohio, assignor to The Wean Engineering Company, Inc., Warren, Ohio, a corporation of Ohio

Application September 23, 1955, Serial No. 536,162

7 Claims. (Cl. 164-61)

This invention relates to the handling of a relatively wide thin strip. More particularly, it relates to the cutting and handling thereof while the strip is passing through a continuous strip processing line.

Heretofore, it has been customary, when passing strip into a treatment line, to cut the edges so that the strip will be of precise width and will have any imperfections in the edges cut off. Such strip is commonly delivered to the line in coils of great length and displays some amount of camber. That is to say, if the coil were unrolled upon a flat surface to form a ribbon, the ribbon would not have absolutely straight edges, but would have edges with a greater or lesser degree of curvature. As laid out on the flat surface, the strip will usually appear as a curved or serpentine ribbon. Heretofore, it has been customary when such strip is being cut to width to feed the advancing strip through a pair of cutters or side trimmers which will cut it to precise width. The side trimmers are adjusted to take a small cut off each edge of the strip. Since the amount trimmed off will desirably be as small as possible to minimize scrap losses, the strip after trimming will still have the camber which it had before trimming. It has been customary to place such cutters or side trimmers in fixed position and to pass the advancing strip through a bridle or guide of some sort. The strip is gathered in a free-hanging loop ahead of the cutting means and the slack in the loop is guided by the bridle into proper alignment with the cutting means. Thus, even though camber of the strip tends to cause the strip to move sidewardly with respect to the cutting means, the bridle or guide means will feed the advancing strip centrally between the cutting means.

I provide cutting means transversely movable relative to the axis of travel of the strip. I preferably provide a carriage arranged for reciprocating movement upon which the cutting means are mounted. I further preferably provide means to cause automatic transverse movement of the cutting means to keep them in central alignment with the strip. I further preferably provide guide means between cutting means forming a strip confining surface.

Other details, objects and advantages of my invention will become more apparent from the following detailed description of a present preferred embodiment thereof and of a present preferred method of practicing the same.

In the accompanying drawings I have illustrated a present preferred embodiment of my invention in which Figure 1 is a side elevational view of a base and carriage upon which a pair of side trimmers are mounted and with portions of the guide means cut away;

Figure 2 is a plan view of the apparatus in Figure 1 and additionally shows a schematic diagram of the controls;

Figure 3 is an end elevational view partially in section of the carriage, base and one side trimmer;

Figure 4 is a plan view of the upper guide means between the side trimmers;

Figure 5 is a side elevational view of the guide means shown in Figure 4;

Figure 6 is a plan view of the lower guide means between the side trimmers;

Figure 7 is a side elevational view of the guide means shown in Figure 6;

2

Figure 8 is a sectional view taken along line VIII—VIII of Figure 4;

Figure 9 is a sectional view taken along line IX—IX of Figure 6;

Figure 10 is a side elevational view of one of the side trimmers showing the upper and lower guide means in section; and

Figure 11 is a view showing the carriage and side trimmers in position in a continuous processing line.

Referring now to Figure 11, strip 1 is shown passing through the part of a continuous strip processing line which includes side trimming apparatus. The strip passes from a preceding part of the line, under a deflector roll 2, through side trimming apparatus included generally at 3, and passes to further portions of the treatment line at 4. Tension is maintained on the strip throughout the line and it passes continuously through the apparatus. The tension on the strip maintains it taut over various deflector rolls 5 which guide it to and from the side trimming apparatus 3. Scrap from the edge of the strip will fall into a scrap chute 6 where it may be bundled and carried away.

Referring now to Figures 1, 2 and 3, a base 7 is securely mounted to a foundation. Carriage 8 is mounted for reciprocation upon base 7. Shoes 9 are formed on the lower part of the carriage and have bearing plates 10 attached to them. Bearing plates 10 are in sliding contact with bearing plates 11 fixed to base 7. Guides 12 restrain the motion of the carriage and allow it to move solely in a direction transverse to the axis of strip travel. A double-acting hydraulic piston 13 is mounted upon base 7 and its piston rod 14 is connected to carriage 8 through a clevis 15.

Side trimmers 16 and 17, which may be of conventional design, are mounted upon carriage 8. They rest upon and are in sliding contact with slides 18 which form undercut channels 19. A T-bolt 20 is attached to each corner of each side trimmer and rides within one of the channels 19, thus allowing only lateral movement of the side trimmers relative to carriage 8. A shaft 21 is mounted in bearings 22, 23 and 24 located on the upper surface of carriage 8. It has threaded screws 25 and 26 which match internal threads in blocks 27 and 28 respectively. Blocks 27 and 28 are affixed to side trimmers 16 and 17 respectively. The threaded screws 25 and 26 are cut with opposite threads to one another. In other words, one thread is a left-hand thread and the other is a right-hand thread. Shaft 21 is driven by motor 29 through gearbox 30 and endless chain 31.

Side trimmer 16 carries an upper knife 32 and a lower knife 33 (Figures 5 and 7). In like manner, side trimmer 17 carries an upper knife 34 and a lower knife 35. The cutting edges of the respective pairs of knives overlap as indicated at O. The amount of overlap and the amount of clearance may be appropriately varied through adjustment of the knives by means well-known to those skilled in the art. A slotted shaft 36 is mounted in bearings 37 and 38 affixed to carriage 8 and extends through the housings of side trimmers 16 and 17. It is driven by motor 39 through gearbox 40. Its speed is indicated by a generator tachometer 41 which is driven from gearbox 40 through endless chain 42a. The knives of each side trimmer are driven by a hollow gear in each side trimmer housing slidably mounted on shaft 36 and keyed to it for rotation therewith.

Angle brackets 42 attached to the housing of side trimmer 16 and angle brackets 43 attached to the housing of side trimmer 17 support the upper guide assembly. Bolts 44 extend through holes drilled in the extending arms of angle brackets 43 and are threaded into holes tapped into bracket 45 (Figure 10). Slots 46 accommodate studs 47 protruding from the housing of side trimmer 17 and serve to maintain bracket 45 in align-

ment with the housing of side trimmer 17. An upper guide support member 49 has two pins 48 protruding from its lower side. Holes 50 drilled in bracket 45 correspond in position to and receive the protruding pins 48. In a similar manner, upper guide support member 51 is supported from the housing of side trimmer 16 by bracket 52. Bracket 52 is in turn suspended from and aligned with the housing of side trimmer 16 similarly to the mounting of bracket 45 on side trimmer 17. An extension 53 on upper guide support member 51 (Figures 4 and 8) is slotted to form a track 53a. The lower face of upper guide support member 51 is faced with a brass liner 54. Upper guide support member 49 is similar in detail to upper guide support member 51 and carries an extension 55 slotted to form a track 55a. It is likewise faced with a brass liner. An upper central guide member 56 is located between upper guide support members 49 and 51 and has bronze wear strips 57 and 58 fitting within the tracks 53a and 55a, respectively. The lower surface of upper central guide member 56 is faced with a brass liner 59 having an upturned edge 60.

Angle brackets 61 and 62, attached to the housing of side trimmer 17, support bracket 67. Similar angle brackets 63 and 64 attached to the housing of side trimmer 16 support bracket 66. Bolts 65 are threaded into the extending portions of angle brackets 61 and 63 and have their ends bearing against the lower sides of brackets 66 and 67. Bolts 68 extend through holes in angle brackets 62 and 64 and are threaded into tapped holes in brackets 66 and 67. Bracket 67 has slots 69 which accommodate studs 70 projecting from the housing of side trimmer 17 and serve to maintain bracket 67 in alignment with side trimmer 17. Bracket 66 is similarly engaged with side trimmer 16. Two pins 71 and 72 are affixed to and project upwardly from bracket 66. Lower guide support member 73 rests upon bracket 66 and has two holes which match pins 71 and 72. When lower guide support member 73 is in position, the pins will be projecting into the holes and lower guide support member 73 will be resting upon the upper surface of bracket 66. In like manner, lower guide support member 74 is supported from bracket 67. Extensions 75 and 76 are attached to lower guide support members 73 and 74, respectively, and are slotted to form tracks 75a and 76a. A lower central guide member 77 is supported from extensions 75 and 76. It has a bronze wear strip 78 which rides in track 75a of extension 75 and has a similar wear strip riding in track 76a. An abutment 79 welded to the lower side of central guide member 77 extends under extensions 75 and 76 and retains central guide member 77 in position on tracks 75a and 76a. The upper surfaces of lower guide support members are faced with brass liners 80 and 81, respectively. In like manner, the lower central guide member 77 is faced on its upper surface with a brass liner 82 having a downturned edge 83 in position to meet the advancing strip. The brass liner on the guide support members and the central guide members provide a surface against which strip passing between the side trimmers will rub. Being relatively soft, the liners will prevent scratching of the strip as it passes.

Referring now to Figure 2 in which the control system is shown diagrammatically, compressed air is supplied through pipe 84 from some convenient source. It passes through a gate valve 85, an air filter 86, a pressure reducing valve 87 and a pressure regulating valve 88. The cleaned air then passes at reduced and regulated pressure through pipe 89 and flexible hose 90 to a pipe 91 mounted on side trimmer 16 by bracket 91a. The air flowing through pipe 91 flows through an orifice in plate 92 toward plate 93 (Figure 1). An orifice in plate 93 is generally opposite to the orifice in plate 92 and connects to pipe 94 which is connected through flexible hose 95 to a regulator 96. Pump 97 driven by a motor 98 draws oil from a reservoir 99 and delivers it to relief valve 100. When the pressure delivered by the pump exceeds the

relief valve setting, the excess pressure will be relieved and excess oil will pass through heat exchanger 101 and pipe 102 to reservoir 99. Cooling water for the heat exchanger is supplied through pipes 103. Oil supplied by the pump which does not by-pass in this manner from the relief valve is delivered through a gate valve 104 and an oil filter 105 to regulator 96. A gauge 106 connected to the line through a gate valve 107 indicates the pressure of the oil being supplied to the regulator. Regulator 96 controls the flow of oil into pipes 108 and 109 in accordance with the amount of air being piped to the regulator from pipe 94. As it applies the oil under pressure to pipe 108 or 109, it will at the same time allow oil in the other pipe to bleed through the regulator to reservoir 99. When the amount of air being received in pipe 94 is below a predetermined figure, the regulator will admit oil under pressure to pipe 108 causing piston rod 14 to be retracted into piston 13. At the same time oil will bleed from pipe 109 through the regulator to reservoir 99. When the predetermined amount of air is being received in pipe 94, then regulator 96 will block the supply to pipes 108 and 109 to retain piston rod 14 in fixed position. If more than the predetermined amount of air is being received in pipe 94, regulator 96 will admit oil to pipe 109 and bleed oil from pipe 108 causing piston rod 14 to extend from piston 13. The amount of air in pipe 94 at which the regulator will hold piston 14 fixed may be varied by appropriate adjustment of the regulator.

In preparing for operation the distance between the knives of side trimmers 16 and 17 is adjusted by use of motor 29 to deliver trimmed strip having the precise width desired. Motor 29 is energized to drive shaft 21 in one direction or the other. Since screws 25 and 26 have reverse threads, rotation of shaft 21 will cause side trimmers 16 and 17 to move simultaneously toward or away from the central axis along which strip passes. When side trimmers 16 and 17 are adjusted toward one another the triangular-shaped upper and lower central guide members 56 and 77, respectively, will be moved in a direction counter to the direction of travel of the strip or away from the apex of tracks 53a and 55a, and tracks 75a and 76a. Conversely, when side trimmers 16 and 17 are moved away from one another, the central guide members will move toward the apex of extensions 53 and 55 and extensions 75 and 76. Conveniently, central guide members of several widths may be provided to permit extreme lateral adjustment of the side trimmers.

After the preliminary adjustment of the side trimmers has been made, the line is threaded as shown in Figure 11 and started. As the line is started, motor 39 is energized. This will drive the side trimmer knives 32, 33, 34 and 35 and will cut a narrow edge from each side of the strip. The scrap will pass into scrap chute 6 while the trimmed strip proceeds into treatment tank 4 for processing. As the line is run, strip is fed into the line from a coil. Additional coils are delivered to the entry end where they are welded end to end to produce a continuous flow of strip through the line.

As the strip moves between the side trimmers, it passes below the upper guide assembly (Figures 4 and 5) and above the lower guide assembly (Figures 6 and 7). It will thus be confined in a zone which is defined top and bottom by the upper and lower guide assemblies. It will be observed that the position of the upper and lower guide assemblies may be readily adjusted by turning bolts 44, 65 and 68. In this manner, the strip passage zone may be made as thin as desired. As the knives wear, their diameter will be reduced, and one set of knives will be adjusted to ensure that the pairs continue to match, consequently the pass line of the strip will gradually change with knife wear and adjustment. The adjustment of the guide assemblies will permit them to match the changing pass line of the strip.

As the strip moves above carriage 8 and toward the side trimmers, it will pass between plates 92 and 93.

If the strip completely obstructs the flow of air from the nozzle on the end of pipe 91 across the gap between the plates and into pipe 94, regulator 96 will cause hydraulic pressure to be supplied to pipe 108. This will cause piston rod 14 to retract into piston 13 until the air supplied through pipe 91 is only partially blocked from flowing across the gap between plates 92 and 93 into pipe 94. Should the camber of the strip cause it to track generally away from plates 92 and 93, an even greater amount of air from pipe 91 will be received in pipe 94. This will cause regulator 96 to supply oil under pressure to pipe 109 causing piston rod 14 to extend from piston 13. In this manner, the position of carriage 8 and of the side trimmers mounted upon it may be precisely maintained with respect to the edge of the strip. At any time when the amount of air reaching the regulator from pipe 94 is above or below the predetermined amount, regulator 96 will cause carriage 8 to shift laterally until the edge of the strip is in proper lateral relation to plates 92 and 93. Notwithstanding that the strip may track from side to side because of camber or other irregularities in the strip, carriage 8 will be shifted to reinstate proper lateral relationship between the strip and the side trimmer knives which will thus be maintained in precise relationship to the edges of the strip. The upper and lower guide assemblies confine the strip from moving beyond the zone which they define. By appropriate adjustment of bolts 44, 65 and 68, the thickness of the zone may be varied as desired. Thus, the strip is restrained from possible movement from the pass line or buckling due to a sudden lateral shift of carriage 8 or to some irregularity in the strip itself.

It will be seen from the foregoing description that I have invented new and useful means for strip trimming. It will be observed that by use of my invention I am able to avoid the use of a slack or free-hanging loop in the strip ahead of the side trimmers. Consequently, I am able to avoid the use of bridles or pinch rolls necessary to produce a slack loop and to reduce the length of the processing line. This in turn will save equipment costs and will reduce the length of the building needed to house the treatment line with a further saving in cost.

While I have illustrated and described a present preferred embodiment of my invention, it will be understood that I do not so limit myself and that my invention may be otherwise variously practiced within the scope of the following claims.

I claim:

1. Apparatus for continuously cutting the edges of moving metal strip comprising a base, a carriage slidably mounted thereon for movement transversely of the direction of movement of the strip, a pair of opposed cutters, each of said cutters having a plurality of strip cutting knives mounted thereon, means mounted on said carriage to cause simultaneous movement of said cutters toward or away from a strip passage zone therebetween, power means connected to the base and to the carriage to cause transverse reciprocating movement of the carriage, strip edge position sensing means, and control means to control said power means according to the strip edge position as determined by said sensing means.

2. Apparatus for continuously cutting the edges of moving metal strip comprising a base, a carriage slidably mounted thereon for movement transversely of the direction of movement of the strip, a pair of opposed cutters, each of said cutters having two rotary strip cutting knives mounted thereon, means mounted on said carriage to cause simultaneous movement of said cutters toward or away from a strip passage zone therebetween, power means connected to the base and to the carriage to cause transverse reciprocating movement of the carriage, said power means comprising a direct acting fluid-powered piston, strip edge position sensing means mounted on the carriage, and control means to control said power means

according to the strip edge position as determined by said sensing means.

3. Apparatus for continuously cutting the edges of moving metal strip comprising a base, a carriage slidably mounted thereon for movement transversely of the direction of movement of the strip, a pair of opposed cutters, each of said cutters having two rotary strip cutting knives mounted thereon, means mounted on said carriage to cause simultaneous movement of said cutters toward or away from the axis of strip travel, cutter drive means comprising a rotatable member mounted on the carriage, the cutters being slidable therealong, rotation of said drive means causing rotation of said knives, direct acting power means connecting the base and the carriage, control means controlling said power means, and strip edge position detecting means to determine the edge position of the strip and adjacent the cutters and cause the control means to operate the power means according to such determination.

4. Apparatus as claimed in claim 1 wherein said apparatus lies intermediate a first strip handling point which the strip passes in approaching said apparatus and a second strip handling point to which the strip passes from said apparatus, the strip being maintained in tension between said strip handling points and while being cut by said apparatus.

5. Apparatus as claimed in claim 1 wherein a pair of strip handling means are placed one on each side of said apparatus, the strip being maintained in tension and passing at a substantial constant speed from one of said strip handling means to said apparatus and then to the other of said strip handling means.

6. Apparatus as claimed in claim 3 wherein strip handling points are provided over which the strip passes before and after being cut by said apparatus and between which the strip is maintained in tension.

7. The method of trimming to a fixed width a continuously moving strip subject to side to side movement which comprises continuously passing the strip in one direction at a substantial constant speed from a first strip handling point to a second strip handling point, maintaining the strip in tension between said points, continuously cutting the edges of the tensioned strip to the fixed width, continuously measuring the relative lateral positions of the uncut strip and the cutting means, controlling the lateral position of the cutting means, and simultaneously shifting the lateral position of the cutting means as a unit and in the same direction responsive to the measurement to maintain the cutting means in fixed lateral relationship with the strip during side to side movement of the strip.

References Cited in the file of this patent

UNITED STATES PATENTS

	557,815	Hemphill	Apr. 7, 1896
	939,897	Doman	Nov. 9, 1909
	1,133,297	Lewis	Mar. 30, 1915
	1,153,843	Greene	Sept. 14, 1915
	1,293,484	Ley	Feb. 4, 1919
	1,333,588	Lewis	Mar. 9, 1920
	1,379,597	Trogner	May 24, 1921
	2,014,248	Evans	Sept. 10, 1935
	2,088,473	Gulliksen	July 27, 1937
	2,114,716	Kunzle	Apr. 19, 1938
	2,666,639	Frommer	Jan. 19, 1954
	2,672,198	Jones	Mar. 16, 1954
	2,675,437	Theobald	Apr. 13, 1954
	2,687,885	Kroth	Aug. 31, 1954
	2,709,588	Staeger	May 31, 1955
	2,710,062	Lanstrom	June 7, 1955
	2,713,903	Smith	July 26, 1955
	2,726,858	Chergie	Dec. 13, 1955
	2,747,666	Brooks	May 29, 1956

FOREIGN PATENTS

	371,794	Great Britain	Apr. 28, 1932
--	---------	---------------	---------------