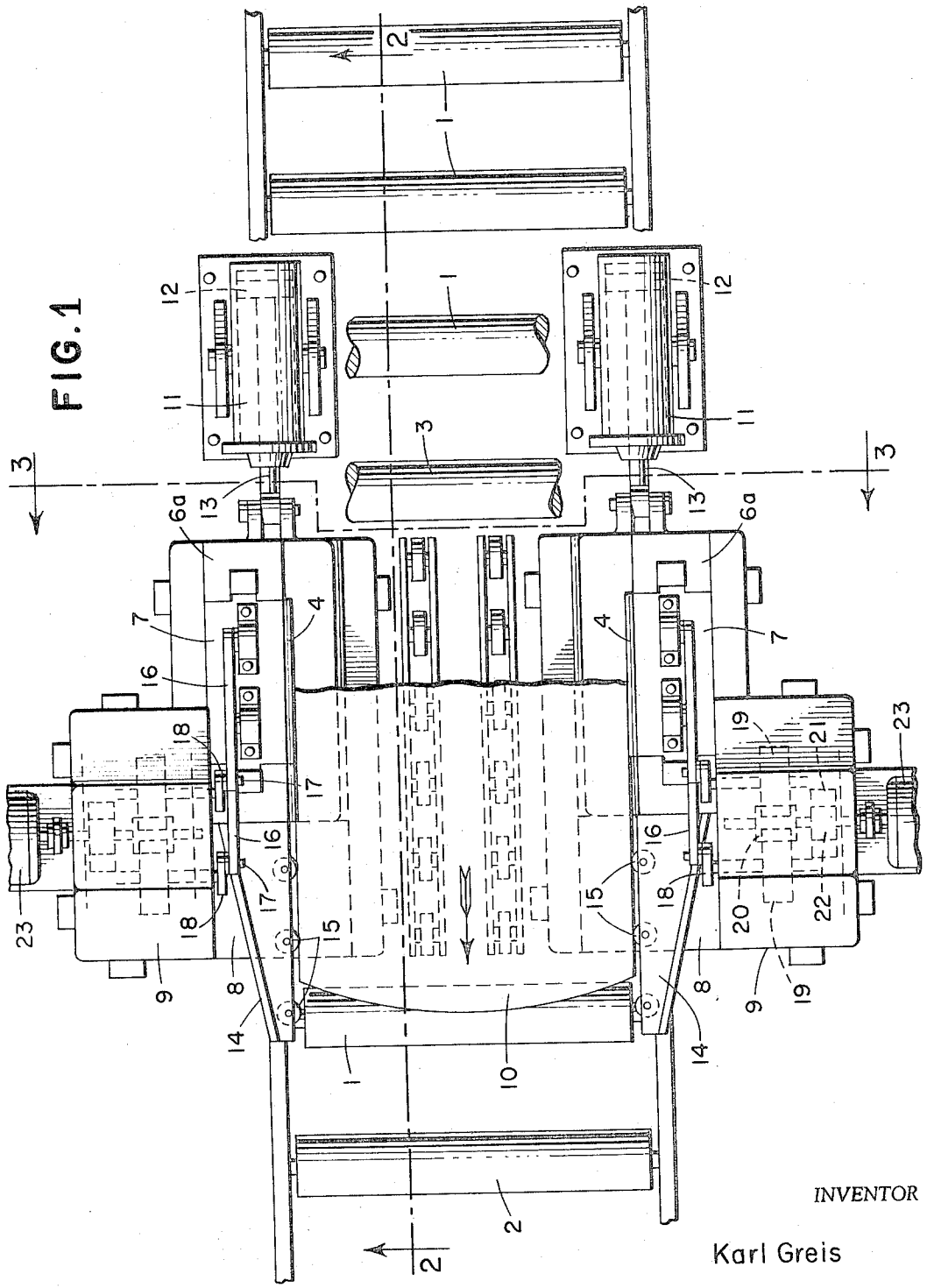
Dec. 27, 1966 K. GREIS 3,293,969

EDGE TRIMMING SHEARS FOR OPPOSITE POSITIONING IN SHEARING LINES

Filed July 1, 1963 5 Sheets-Sheet 1

FIG. 1



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EDGE TRIMMING SHEARS FOR OPPOSITE POSITIONING IN SHEARING LINES

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FIG. 2

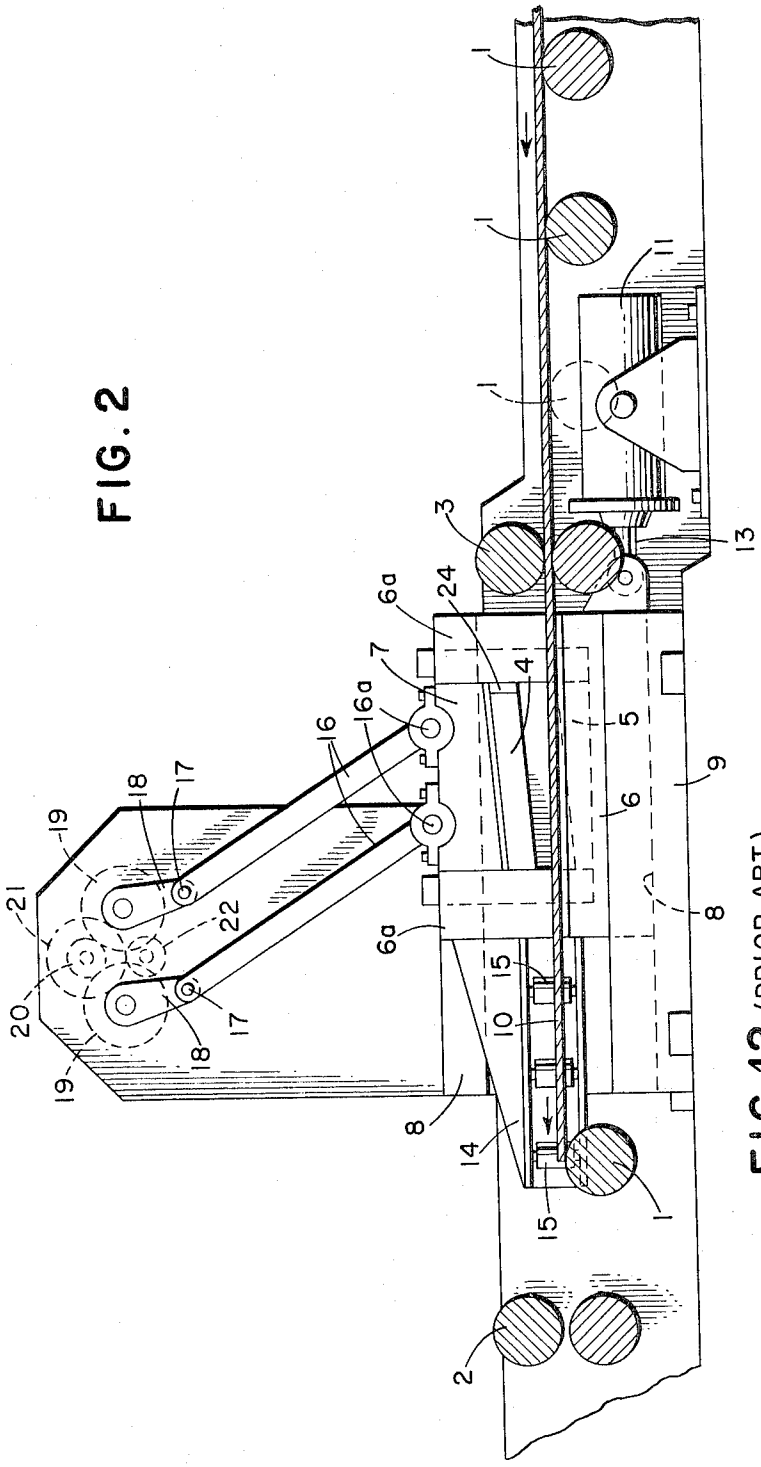

FIG. 12 (PRIOR ART)

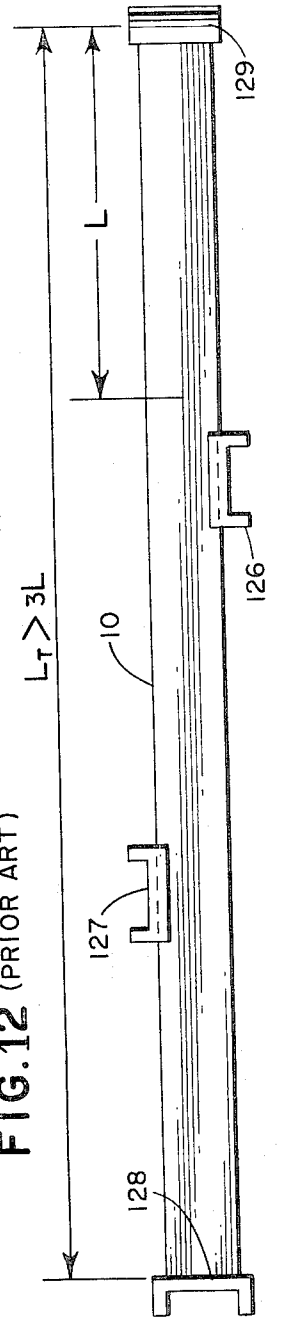

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FIG. 3

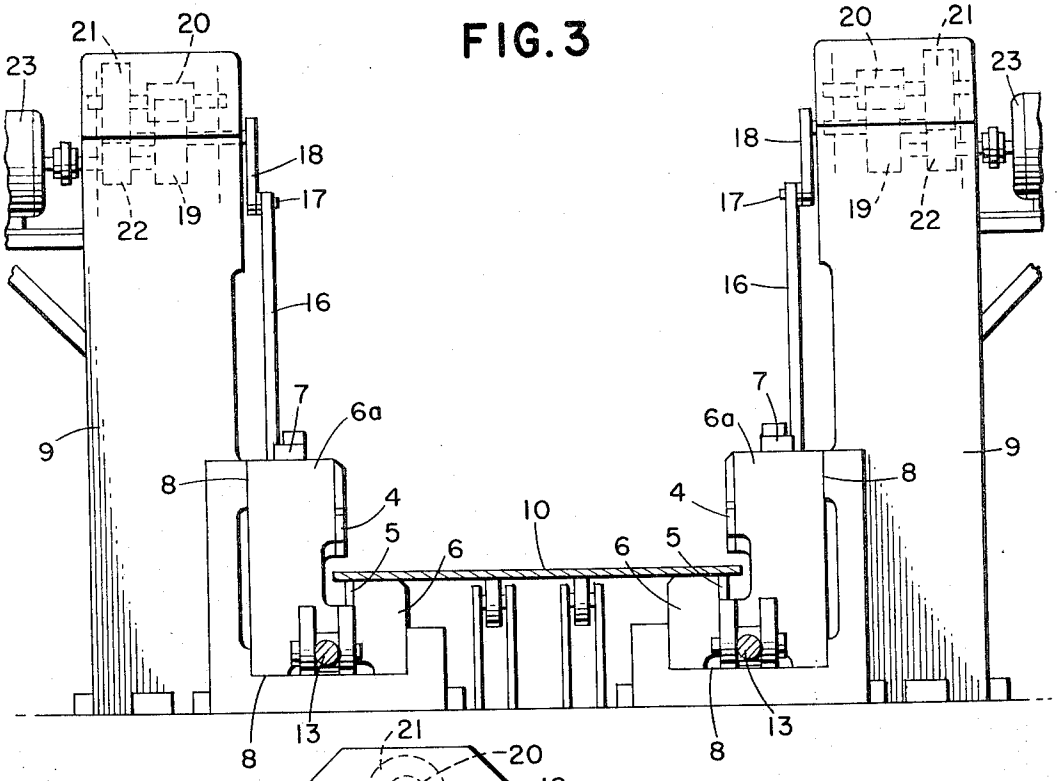
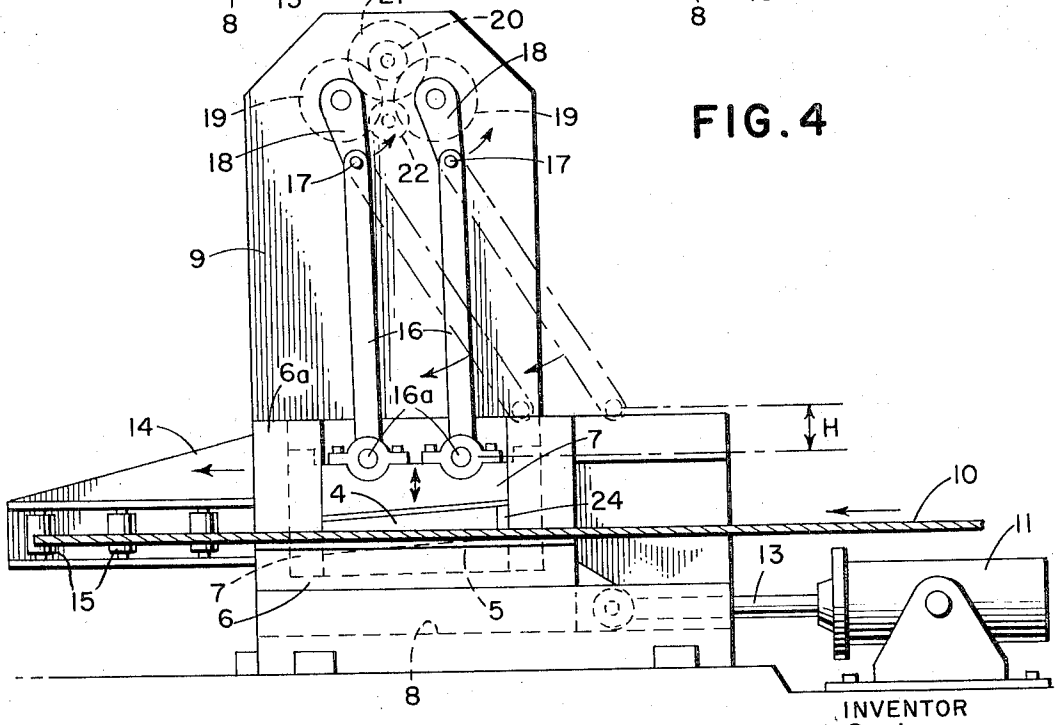


FIG. 4



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EDGE TRIMMING SHEARS FOR OPPOSITE POSITIONING IN SHEARING LINES

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FIG. 5

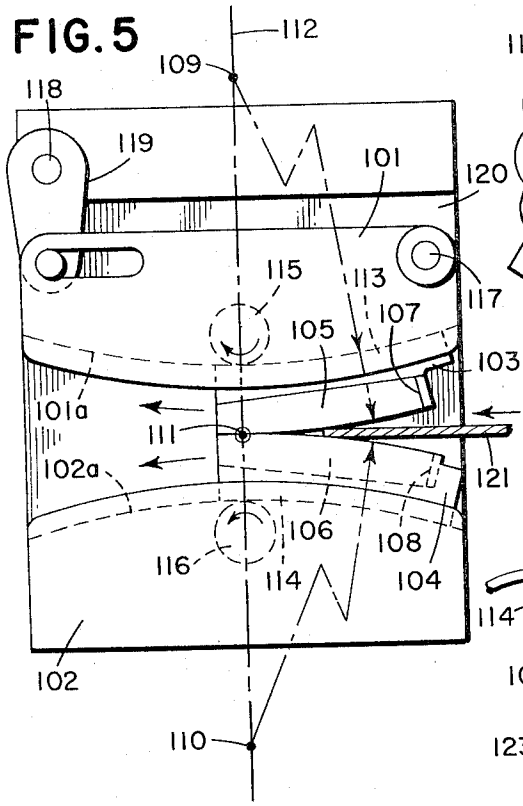


FIG. 7

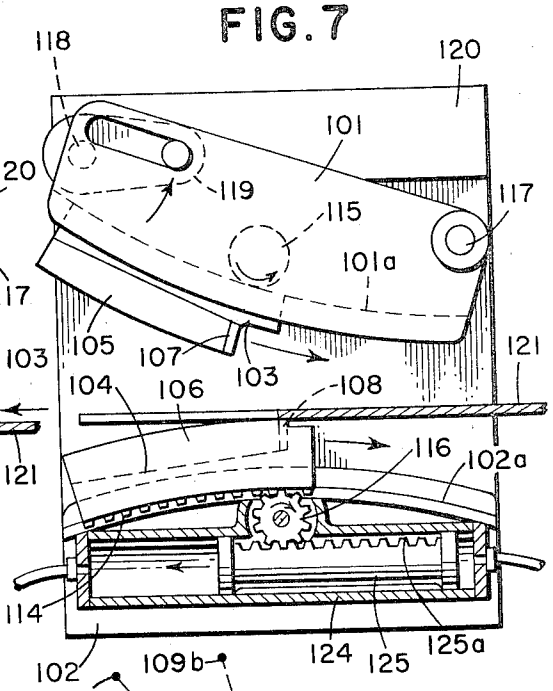


FIG. 8

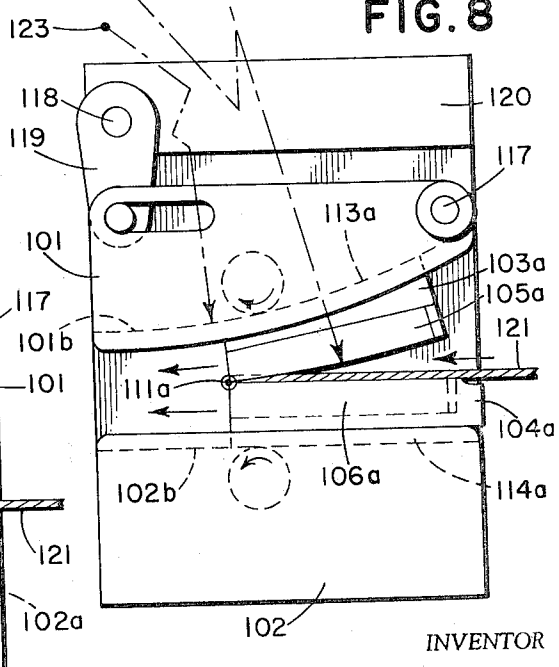
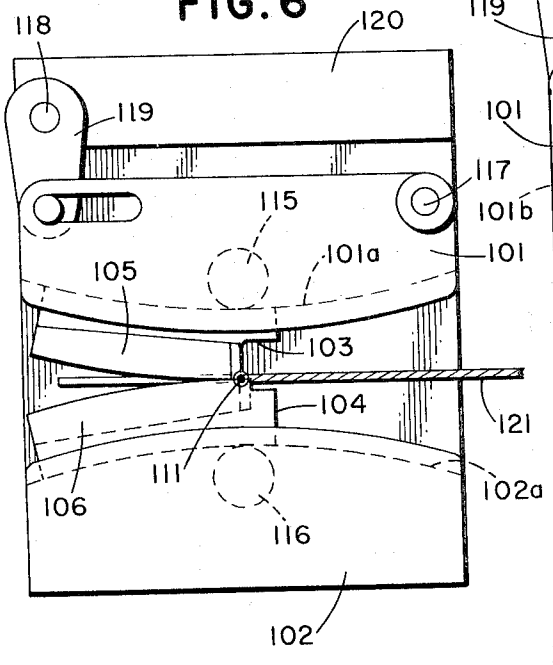


FIG. 6



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EDGE TRIMMING SHEARS FOR OPPOSITE POSITIONING IN SHEARING LINES

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FIG. 9

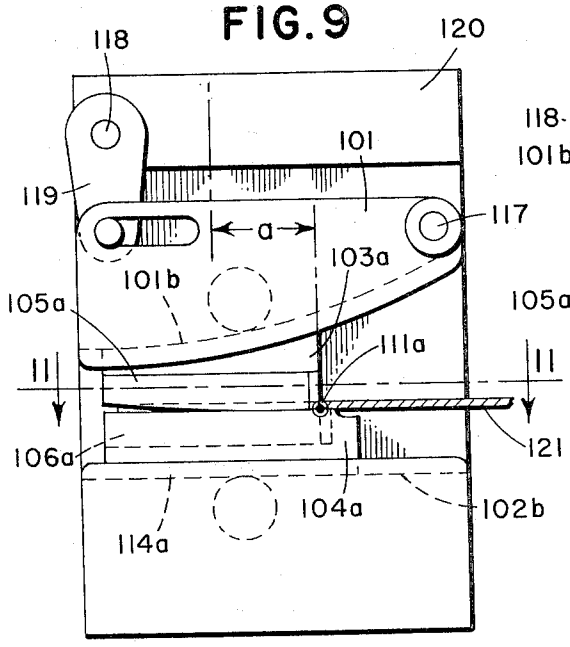
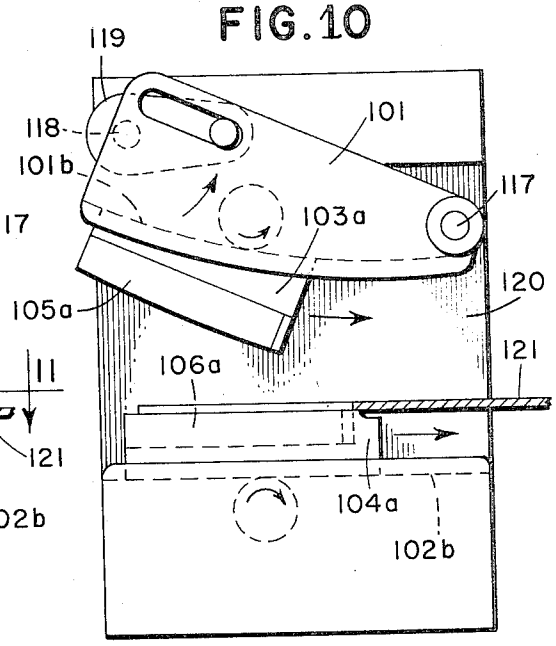


FIG. 10



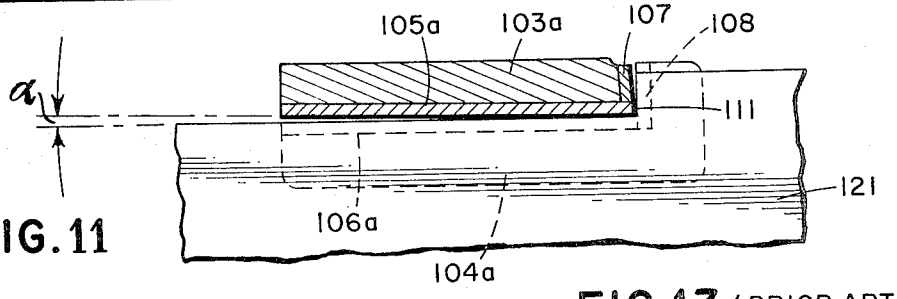


FIG. 11

FIG. 13 (PRIOR ART)

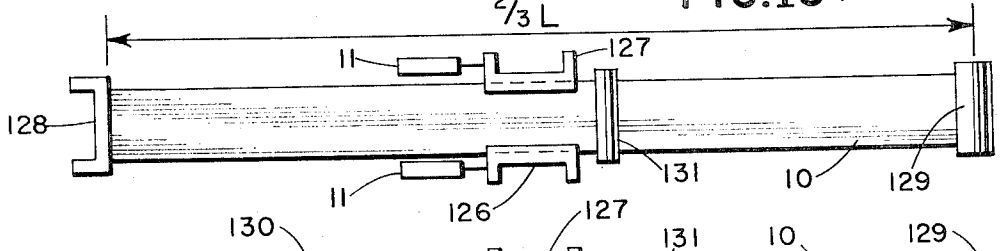
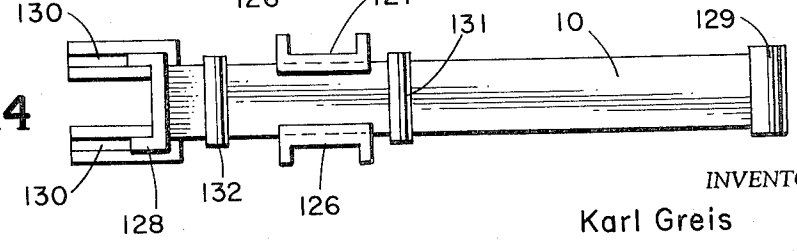


FIG. 14



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United States Patent Office 3,293,969 Patented Dec. 27, 1966

3,293,969

EDGE TRIMMING SHEARS FOR OPPOSITE POSITIONING IN SHEARING LINES

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Filed July 1, 1963, Ser. No. 293,228
Claims priority, application Germany, June 29, 1962, V 22,716
17 Claims. (Cl. 83—318)

This invention relates to edge trimming shears for cutting the uneven sides of metal sheets arriving from a rolling mill to provide straight and parallel side edges and more particularly to edge trimming shears which provide an effective cutting action while permitting a substantial reduction in the length of the shearing lines.

A shears construction which is provided with straight knives and mounted in the manner known in disc-type shears provides a reduction in the length of shearing lines by about ⅓. One difficulty in this facing arrangement is the fact that the metal sheet is tightly clamped between the simultaneously cutting edge trimming shears, and therefore the upper knife exerts a strong friction force against the sheet edges during the return stroke, especially in the case of rigid thick metal sheets. To avoid this, it has already been proposed to move the upper knife which performs the cutting operation in oppositely disposed edge trimming shears, away from the sheet edge during the return stroke of the knife.

This invention relates also to the problems of the opposite mounting of edge trimming shears for cutting thick metal sheets. The present disclosure present solutions in which the movement of the cutting knives away from the sheet edge during the return stroke is unnecessary. Furthermore, edge trimming shears are disclosed with which the metal sheets may be continuously advanced as in the case of disc-type shears so that the motors which drive the roller track and the conveyor rollers may be of a type which will be required to carry out fewer switching operations.

This invention is directed to edge trimming shears having straight knives in contrast to disc-type knives and the shears parts which carry out the cutting action, at least the knives and the knife supports, are movable from a starting position during the cutting action horizontally at the same speed as the advance of the metal sheet. During the return of the shears parts participating in the cutting action the relative movement between the upper knives and the sheet edges which may be arranged to continue their travel is different from the relative movement during the cutting action. During the return travel the relative movement is at an angle to the vertical whereby the sheet is not pulled up by the upper knife to the same extent as if the upper knife of each shears were moved back vertically relative to the surface of the metal sheet. However, it is within the scope of this invention to arrange the upper knives so as to be movable away from the sheet edge, the operation of the shears line with continuous advancing of the sheet being considered a substantial improvement in itself.

Depending on the construction of the edge trimming shears various possibilities relative to the number of the horizontally reciprocating shears parts are offered. If the knife supports are guided in a stand or pedestal the shears together with their stand may be moved. The slide surfaces for the stands are relieved of the shearing pressure due to the closed power flow in the stands. But it is also possible to move only the vertical shears guides horizontally relative to the stands and to superimpose to this movement a cutting movement of the knives which is derived from the horizontal advancing movement.

The invention discloses also a solution for providing a "flying" edge cut for the purpose of making the application of the principle of the disc-type knife cut also possible in the case of greater sheet thicknesses, thus for thick sheets or plates. It is known that the application of disc-type edge trimming shears which hitherto were able to provide alone a continuous advancing of the sheet, is limited to thicknesses of about 20 mm. This is due to the fact that such large disc-type knife diameters which would be necessary to obtain a favorable shearing angle with thick sheets are hardly sensible in practical construction. For this reason the edge trimming of the thick sheets or plates is carried out with straight shears having a vertical knife stroke. In addition to the continuous advancing of the sheet the cutting with disc-type knives has the advantage that the knives produce hardly any overcutting and thus the cutting stroke" coincides virtually with the "return stroke" so that the sheet cannot be pulled upward due to a friction between the upper disc-type knife and the cut sheet edge. The cutting pressure which is continuously effective at the sheet prevents this.

In order to provide this advatage of the disc-type knife cut also in the edge trimming of thick sheets or plates, edge trimming shears are developed according to the invention in such a way that at least one of the knives has a convexly bent cutting edge and that its knife support is guided along a track which is similarly curved and is driven so as to reciprocate in the direction of the roller track or the travel of the metal sheet. When the cutting edges of both knives have the same center of curvature as their curvilinear guides the knives cut exactly like disc-type shears with rotating knives and of very large diameter. But due to their limited length the knives do not effect a continuous cutting but cut only during their advancing motion when the sheet is being moved forward. As the point of greatest approximation of the knives is stationary in space, the sheet must stand still during the return travel of the knives in the knife support track while one knife support is separated from the other knife support in a vertical direction.

According to the invention a cutting of the edges is possible with a continuous advancement of the sheet if the point of greatest approximation between the knives, thus approximately the point of separation, is not fixed in space but move toward or against the direction of movement of the sheet. In this manner time is gained within which the lifting off and the return of the knives may be carried out while the sheet continuous is advanced.

In order to obtain this various possibilities are offered in which the shearing angle of the knives may be reduced during the cutting operation according to the invention whereby the point of separation actually is moved toward the advancement of the sheet. A possibility is created by the fact that the center of curvature of the curve cutting edge of one knife is placed ahead of the center of curvature of the track of its knife support toward the direction of movement of the sheet. In order to maintain the curvature centers of both knife support tracks in a vertical plane so as to have a simplified drive another possibility is preferred according to which the curvature center of the curved cutting edge of one knife is at a greater vertical distance from the sheet than the curvature center of the track of its knife support.

Additional features and advantages of the invention will appear from the following detailed description in conjunction with the accompanying drawings in which the invention is illustrated by means of various embodiments of edge trimming shears and in which:

FIG. 1 is a plan view of two opposite edge trimming

shears in a shears line with the cutting drive taken from the drive for moving the knife guides.

FIG. 2 is a side view of the shears according to FIG. 1 in the starting position showing the greatest shears opening.

FIG. 3 is a side view of the shears according to FIG. 1 in the direction of the roller track.

FIG. 4 is a side view similar to FIG. 2 showing the position of the shears parts after a completed cut.

FIGS. 5–7 show edge trimming shears for providing a circular knife cut with discontinuous movement of the metal sheet in three cutting phases.

FIGS. 8–10 show edge trimming shears for providing a circular knife cut with continuous advancement of the sheet in three cutting phases.

FIG. 11 shows a section through an upper knife along line XI—XI in FIG. 8 on a large scale, and

FIGURES 12–14 illustrate a comparison of prior art shearing lines and the novel shearing line for thick metal sheets or plates according to the invention.

Referring now more specifically to the embodiment illustrated in FIGURES 1–4 it will be seen that at the sides of a roller track having rollers **1** and between a pair of pinch rolls having upper rollers **2** and **3** two edge trimming shears are arranged in opposite disposition. The parts of the shears which participate directly in the cutting action are the upper knife **4**, the lower knife **5** and the lower knife support **6** provided with a guide **6***a* in which the upper knife support **7** is guided.

The lower knife support **6** is mounted on slide tracks **8** which form part of a fixed stand **9** and is slidable relative to the roller track or direction of movement of the metal sheet **10**. In order to slide the shears parts which carry out the cutting action, in the present case in particular the lower knife support **6** of each shears, power cylinders **11** containing pistons **12** and piston rods **13** are provided.

At the lower knife support **6** extension arms **14** are attached which carry guide rollers **15**. One of the shears is movable in its entirety including its power drive crosswise to the roller track in order to be able to adjust the distance between two opposite shears to the desired cutting width.

At the upper knife support **7** two rams **16** are connected which are coupled to pins **17** of a pair of crank arms **18**. The crank arms are driven by an electric motor **23** through spur gears **19, 20 21** and **22**. Motor **23** is designed merely for the return movement of the upper knife support **7** which will be explained further hereafter in explaining the operation of the shears.

In the starting position the shear parts **4–7** which participate in the cutting action are in the position shown in FIGURE 2. The rams **16** which are connected to the pin **17** of cranks **18** which are stationary during the cutting action and mounted for swinging movement are independent of the movement of the shears parts and assume a swung out position at the start of the cutting action.

In order to produce the cutting action the pistons **12** of the horizontally disposed slide drive are struck on their larger piston surface by the pressure medium so that the piston rods **13** are moved to the left and the lower knife supports are caused to slide on their slide tracks **8** until they reach the end position shown in FIGURE 4. During this horizontal sliding movement of the shears parts **4–7** the upper knife support **7** is forced to carry out the cut because the rams **16** are oscillated from their swung out position of FIGURE 2 into the vertical position of FIGURE 4 while the crank pins **17** remain stationary. The height difference **4** between the levels of the ram ends **16***a* in the swung out position and the vertical position is the stroke of the upper knife support **7** indicated in FIGURE 4. The crank pins **17** are maintained during the cutting action approximately in the lower dead point approximately while the cranks **18** are

in a slightly inclined position. In this manner it is obtained that the cutting pressure which is transmitted through the rams **16** to the pins **17** exerts as small as possible a moment or stress on the stationary drive of the crank arms **18**. For this reason the transmission elements between the motors and crank arms could be arranged to be self-locking or sliding armature motors could be employed which are automatically braked while standing still.

According to the invention the metal sheet **10** is advanced continuously so that the conveyor roller pairs **2** and **3** are constantly rotating. The speed of the horizontal displacement of the shears parts **4–7** which participate in the cutting action should be the same as that of the constant advancing speed of the metal sheet **10** so that the relative speed between the metal sheet and the knives is zero as in the case of normal shears. This may be obtained by using adjustable synchronously operating oil pressure pumps for each slide drive. The return travel of the horizontally movable shears parts **4–7** cannot take place immediately after the cutting action from the position shown in FIGURE 4 because the scrap cutting knives **24** would bump against the metal edge of the strip just cut by them, particularly since the metal sheet is continuously moving forward. At this point the drive for rotating the crank arms **18** is operated in that after a completed cut the crank arms **18** are pivoted in the counterclockwise direction as indicated by the arrows in FIGURE 4 already before the start of the horizontal return of the shears parts **4–7** to such an extent that the knives **24** are lifted away from the edge they have just cut. Preferably the shears parts **4–7** execute in the first phase of the upward movement of pin **17** a small excess movement in the direction of the movement of the metal sheet. After the shears have been lifted sufficiently to free the scrap knives **24**, the slide drive is reversed and the admission of the pressure is against the smaller pressure surfaces of the stepped pistons **12**. At the same output of the pumps there is produced thus an increased return speed of the shears parts **4–7**. The further upward movement of the crank pins **17** is superimposed on this horizontal movement so that the upper knives **4** slide past the cut surfaces in a slanted sliding movement which prevents that the metal sheet is bent upwardly at the cut edges during the return movement of the upper knives in spite of hold-down means provided for this purpose, whereby also an increased friction between the cut edges and the knives would be produced. When the return of the shears parts **4–7** has been completed back into the starting position shown in FIGURE 2, the crank pins **17** assume again their approximate lower dead point position either after a complete revolution or after an oscillating movement of the crank arms **18**.

The cutting pressure is directed into the slide tracks **8** of the fixed stands **9** except in the case where all the shears parts which participate in the cutting action are guided in the stands proper and the shears together with the stands are moved horizontally. The slide drive elements **11–13** must thus provide the cutting power by overcoming the friction forces which arise at these slide tracks. According to the invention the cutting drive is derived from the drive which provides the horizontal movement of the shears parts which carry out the cutting action so that the drive for the crank arms **18** does not have to provide the power for the cutting action and needs to be merely an adjusting drive for the shears parts.

The cutting drive derived from the horizontal slide drive by means of the rams and the pins **17** which are stationary during the cutting action may also be obtained by means of an upwardly slanting track on the stands **9** in which the upper knife support **7** is suitably guided. Also in the case where the shears in their entirely together with the stands are reciprocated horizontally, upwardly slanting tracks for carrying out the cutting and return movements of the upper knife supports may be provided

as indicated in FIGURE 13 by the two synchronized hydraulic cylinders 11. The guides of the upwardly slanting tracks must in that case also remain stationary during the cutting action.

Referring now particularly to the embodiment illustrated in FIGURES 5–7 the edge trimming shears consist of an upper part 101 and a lower part 102 into which curvilinear guide tracks 101*a* and 102*a* having the same curvature radius are machined for knife supports 103 and 104 which are similarly bent at the support surfaces. Into the knife supports straight knives 105 and 106 having convexly curved cutting edges as well as scrap cutting knives 107 and 108 for cutting the edge strips are set (FIGURE 11). The cutting edges have in each case the same curvature center points 109 and 110 as the guide tracks 101*a* and 102*a*. However, the curvature radii of the same parts may be different at the top and bottom and the curvature center point may lie at the top in a different vertical plane than the curvature center point of the lower part. But when knives 105 and 106 are reciprocated at the same speed in their tracks 101*a* and 102*a* the point 111 of greatest approximation of the cutting edges remains always on the connection line between the curvature center points 109 and 110, thus in the case of FIGURES 5–7 in the vertical center plane 112.

The knife supports 103 and 104 carry on their back sides a suitable tooth system 113, 114 respectively into which meshes a pinion gear 115 and 116 mounted respectively in upper part 101 and lower part 102. The pinion gears are driven synchronously and reversibly in opposite directions by suitable transmission gears or appropriately by slide piston rotary drives. Such a slide piston rotary drive is shown in FIGURE 7 for the purpose of rotating the lower pinion gear 116 and consists of a cylinder housing 124 which carries the bearing elements for the pinion gear 116, and a piston 125 which may be actuated from both sides is received in housing 124. The piston has a rack and pinion toothing 125*a* which meshes with the pinion gear 116. The cylinder housing 124 is carried by the lower part 102 of the shears. The upper part 101 of the shears is pivotable around pin 117 by means of a crank drive 118, 119. Pin 117 and crank 118 are mounted in a rear wall 120 which is rigidly connected with the lower part 102 and the shearing pressure is transmitted back to the lower part 102 through this wall.

In FIGURE 5 the starting position of knives 105 and 106 or 107 and 108 is shown in the case where the metal sheet 121 arrives from the right. When the drive of the pinion gears 115 and 116 is actuated to rotate in the direction indicated in the drawing the knives 105 and 106 execute during their curvilinear travel toward the left a circular knife cut as the knives are virtually sectors of circular knives of extremely large diameter and move around their center of curvature. In point 111 the separation point between the metal sheet and the edge strip remains stationary in space while the sheet advances, and after the completed cutting movement of the knives shown in FIGURE 6 the scrap cutting knives 107 and 108 become effective in the vertical center plane 112 and separate the edge strip. For these reasons the advancing of the sheet must be halted during the return of the knives toward the right. Because the upper scrap cutting knife 107 is located in front of the metal edge of the edge strip just cut, the crank 118 must be displaced by 180° before reversing the drive of pinion gears 115 and 116 so that the upper part 101 is lifted up as seen in FIGURE 7. Subsequently the knives return into the starting position shown in FIGURE 5, the upper part being set down again and a new cut may be carried out.

The embodiment illustrated in FIGURES 8–10 is developed further for a continuous forward movement of the metal sheet by providing a kinematic condition whereby the point of greatest approximation of the knives, i.e., the separation point, advances against the sheet movement during the cutting action. As variation from the embodiment of FIGURES 5–7 may be observed first of all the uncurved form of the lower knife 106*a*, lower knife support 104*a* and of the associated guide track 102*b*. Thus the tooth system at the lower side of the knife support becomes a rack and pinion gear 114*a*. This simplification would also be feasible in the construction of the shears illustrated in FIGURES 5–7 without causing a change in respect of the inalterable position of the separation point.

The characteristic feature that the curvature center 109*a* of the upper knife 105*a* lies in a larger vertical distance from the sheet 121 than the curvature center 123 of the associated track 101*b* for the knife support 103*a* is essential for the changed kinematics of this arrangement. The curved cutting edge of upper knife 105*a* is thus with its greater curvature radius excentric to the track 101*b* in the sense that the separation point 111*a* moves from the starting position of FIGURE 8 to the end position after a completed cut according to FIGURE 9 toward the sheet 121 by the value *a*. The upper knife 105*a* carries out something like a rocking cut relative to the lower knife. Within the time which the sheet requires during the continuous forward movement to pass the value or distance *a* the upper part 101 can be lifted up and the knives returned to the starting position of FIGURE 8. If the speed of the knives is varied during the return movement, for example if it is increased, the length of the separated edge strip may be shortened.

The same effect may also be obtained when the curvature center 109*a* is moved ahead to 109*b* against the direction of movement of the sheet 121. According to FIGURE 6 the cutting edges of the knives separate while in the cutting positon, their "return stroke" taking place for the largest part with the sheet still being cut. In this way the upper knife 105 is largely free of the metal edge just cut when the upper part 101 is moved upward. This is different in the embodiment of FIGURES 8–10 having shortened guide tracks 101*b* where the upper knife 105*a* would have to slide past the cut metal edge almost in its entire length during the upward movement of the upper part 101 as seen in FIGURE 9 and the sheet located between two opposite edge trimming shears would be pulled upwardly. This is prevented by applying a measure which is known in disc-type shears in that the guide tracks of the upper knife supports 103*a* and lower knife supports 104*a* and thus the cutting edges of both knives form a small angle α in the vertical projection so that the upper knife 105*a* is lifted behind the separation point 111*a* in the horizontal direction from the cutting edge of the sheet (FIGURE 11). The inclination of the guide tracks toward each other has the same purpose as the known inclination of the center shaft of the upper circular knife in normal disc-type shears.

In order to adjust the knife gap the upper knife support alone or together with the upper part of the shears may be adjusted parallel to itself in a known manner and not shown in the drawing.

According to the invention arrangements for shearing lines for thick sheets or plates are proposed which are based on the effect of an uninterrupted forward movement of the sheet during the edge shearing at least during the cut but which may be employed also in known straight knife edge trimming shears placed oppositely and having a step-wise advancing movement during the return of the cutting knife.

In order to illustrate the development of these edge trimming shears a conventional shearing line is illustrated in FIGURE 12 where two edge trimming shears 126 and 127 are shown displaced in staggered relation lengthwise from each other, and also showing cross-cut shears 128. The total length L of the shearing line calculated from the last rolling frame 129 is more than three times the maximum sheet length L. FIGURE 13 shows a known opposite arrangement of the edge trimming shears whereby the length of the shearing line is reduced to about ⅔ of the length L.

According to the invention a shearing line for thick sheets or plates according to FIGURE 14 may be shortened further by almost a sheet length L when the edge trimming shears **126** and **127** are arranged oppositely, correspond to the construction of the embodiments in FIGURES 1–4 or 8–10 of the invention and if the separating shears **128** which is located at a distance which is less than the sheet length L behind the edge trimming shears is a flying or rotating shears whose rectilinear knife movement is synchronized during the cutting action with the continuous forward movement of the sheet.

From the large number of known flying and rotating shears a construction should be selected which has knives that are guided parallel during the cutting action unless it is preferred to use normal separating shears, perhaps rocking shears which are arranged slidably as a whole on base plates **130** in the direction of movement of the sheet. Pinch rollers **131** and **132** may be mounted in front and in back of the shears to provide a uniform parallel advance of the metal sheets.

What is claimed is:

1. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is in motion comprising in combination a support stand, a knife support mounted for reciprocating movement on said support stand, a straight lower knife fixed to said knife support, a straight upper knife mounted in said knife support for vertical movement relative to said knife support and said lower knife, first power operated means for moving said knife support on said support stand, rigid, elongate means connected to said upper knife at one end, second power operated means for engaging said rigid elongate means at the other end, said second power operated means being adapted to lock in position to provide a stationary support for said rigid elongate means during the cutting action and adapted to move from said locked position to lift said upper knife at the end of the cutting action, said first power operated means actuating said knife support to move said rigid elongate means from an inclined upper position at the start of the cutting action to a vertical lower position at the end of the trimming action to lower said upper knife and trim said metal sheet.

2. Edge trimming shears according to claim **1** wherein said first power operated means move said knife support during the cutting action in the same direction and at the same speed as the metal sheet.

3. Edge trimming shears according to claim **1** wherein a scrap knife is fixed to said upper and lower knives for severing the strip cut by said upper and lower knives at the end of the cutting action.

4. Edge trimming shears according to claim **1** wherein said knife support is fixed to said support stand and wherein said support stand is reciprocated by said first power operated means.

5. Edge trimming shears for positioning opposite each other along a metal sheet for trimming the sheet edges while the sheet is in motion, comprising in combination a stand having a base plate, a knife support mounted for horizontal reciprocating movement relative to said stand and said base plate, a straight lower knife fixed to said knife support for movement therewith, a straight upper knife mounted in said knife support for vertical movement relative to said knife support and said lower knife, a scrap knife fixed to said upper and lower knives, fluid operated piston means connected to said knife support for reciprocating said knife support horizontally on said base plate, at least one ram means pivotably connected to said upper knife at one end, a crank arm mounted on said stand above said upper knife and pivotably connected to said ram means at the other end, drive means for maintaining said crank arm in a stationary position during the cutting action and for rotating said crank arm to lift said upper knife at the end of the cutting action, said ram means extending laterally away from said crank arm in the starting position of said knife support and extending vertically downwardly from said crank arm in the end position of said knife support, said ram means pushing said upper knife downwardly during movement of said knife support from the starting position to the end position to thereby cut the metal sheet, said fluid operated piston means moving said knife support at least during its movement from the starting position to the end position at the same speed as the metal sheet.

6. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, a pair of vertically spaced shears supports connected to said support stand, a convexly curved guide track in said shears supports and having the same curvature sense, a pair of knife supports mounted for sliding movement in said curved guide tracks and having a correspondingly curved slide surface, a pair of straight knives fixed to each knife support and adapted to cooperate with each other during the cutting action, at least one of said straight knives having an outwardly curved cutting edge, power operated means for engaging and reciprocating said knife supports in said curved guide tracks to cut the metal sheet and return said knife supports to the starting position, said tracks forming rigid guiding and backing means for moving at least one of said shears supports towards the other shears support in connection with the movement of said shears supports into the end position to make a cut, and independently actuated means for moving at least one of said shears supports temporarily away from the other shears support and the metal sheet after the cut and during the return stroke of said shears supports into the starting position.

7. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, a lower shears support and an upper shears support connected to said support stand, a convexly curved guide track in said upper and lower shears supports and having the same curvature sense, a knife support mounted for sliding movement in said curved guide tracks and having a correspondingly curved slide surface, a straight knife fixed to each knife support, and having an outwardly curved cutting edge, power operated means for engaging and reciprocating said knife supports in said curved guide tracks to cut the metal sheet and return said knife supports to the starting position, said tracks forming rigid guiding and backing means for moving at least one of said shears supports towards the other shears support in connection with the movement of said shears supports into the end position to make a cut, and independently actuated means for moving at least one of said shears supports temporarily away from the other shears support and the metal sheet after the cut and during the return stroke of said shears supports into the starting position.

8. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, a lower shears support and an upper shears support connected to said support stand, a convexly curved guide track in said upper shears support, an upper knife support mounted for sliding movement in said curved guide track and having a correspondingly curved slide surface, a straight guide track in said lower shears support, a lower knife support mounted for sliding movement in said straight guide track and having a straight slide surface, a straight knife having an outwardly curved cutting edge fixed to said upper knife support, a straight knife having a straight cutting edge fixed to said lower knife support, power operated means for engaging and re-

ciprocating said upper knife support in said curved guide track and for engaging and reciprocating said lower knife support in said straight guide track, said tracks forming rigid guiding and backing means for moving at least one of said shears supports towards the other shears support in connection with the movement of said shears supports into the end position to make a cut, and independently actuated means for moving at least one of said shears supports temporarily away from the other shears support and the metal sheet after the cut and during the return stroke of said shears supports into the starting position.

9. Edge trimming shears according to claim 7 wherein the metal sheet is moving continuously and wherein the center of curvature of the curved cutting edge of said knives is located ahead of the center of curvature of the path described by its knife support against the direction of movement of the metal sheet.

10. Edge trimming shears according to claim 8 wherein the metal sheet is moving continuously and wherein the center of curvature of said knife having a curved cutting edge is located a greater vertical distance from the sheet than the center of curvature of the path described by its knife support.

11. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, knife supporting means slidably guided in said support stand and movable between a horizontal starting position and a horizontal end position of the cutting operation, power operated means for moving said knife supporting means at least from the starting position to the end position longitudinally in the direction of movement of said metal sheet at the same speed as the speed of movement of said metal sheet, said support stand rigidly guiding and backing at least one knife supporting means towards the other knife supporting means in connection with the movement of said knife supporting means into the horizontal end position to make a cut, an independently actuating means for moving at least one of said knife supporting means temporarily away from the other knife supporting means and the metal sheet after the cut and during the return stroke of said knife supporting means into the starting position.

12. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, a lower shears support and an upper shears support connected to said support stand, a convexly curved guide track in said upper and lower shears supports and having the same curvature sense, a knife support mounted for sliding movement in said curved guide tracks and having a correspondingly curved slide surface, said tracks forming rigid guiding and backing means for moving one of said shears supports towards the other shears support in connection with the movement of said shears supports into the end position to make a cut, and independently actuated means for moving one of said shears supports temporarily away from the other shears support and the metal sheet after the cut and during the return stroke of said shears supports into the starting position.

13. Edge trimming shears for positioning opposite each other along a metal sheet to trim the sheet edges while the sheet is continuously in motion at least during the cutting action comprising in combination a support stand, a lower shears support and an upper shears support connected to said support stand, a convexly curved guide track in said upper shears supports, a straight guide track in said lower shears support, a knife support mounted for sliding movement in said curved guide track and having a correspondingly curved slide surface, a knife support mounted for sliding movement in said straight guide track and having a corresponding straight slide surface, a straight knife having an outwardly curved cutting edge fixed to said upper knife support, a straight knife having a straight cutting edge fixed to said lower knife support, gear teeth on said curved slide surfaces of said knife supports, gear means fixed to said shears supports and coupled with said gear teeth, driving means for operating said gear means to slide said knife supports in said guide tracks simultaneously in one direction to cut the metal sheet and in the other direction to return said knife supports to the starting position, pivot means fixed to said support stand and supporting said upper shears support at one side, a crank drive fixed to said support stand and connected to said upper shears support at the other side, said tracks forming rigid guiding and backing means for moving one of said shears supports towards the other shears support in connection with the movement of said shears supports into the end position to make a cut, and independently actuated means for moving one of said shears supports temporarily away from the other shears support and the metal sheet after the cut and during the return stroke of said shears supports into the starting position.

14. Edge trimming shears according to claim 6 wherein said power operated means include pinion gears coupled to a piston drive comprising a piston cylinder adapted to admit a fluid pressure medium at opposite ends and a piston having a toothed rack engaging said pinion gear.

15. Edge trimming shears according to claim 11 wherein the metal sheet is moving continuously comprising cross-cut shears mounted behind the edge trimming shears a distance less than the length of the metal sheet to be cut and consisting of rotary shears whose cutting speed is synchronized with the speed of the metal sheet during the cutting operation.

16. Edge trimming shears according to claim 7 wherein said power operating means includes gear teeth on said curved slide surfaces of said knife supports, gear means fixed to said shears supports and coupled with said gear teeth, driving means for operating said gear means to slide said knife supports in said guide tracks simultaneously in one direction to cut the metal sheet and in the other direction to return said knife supports to the starting position, pivot means fixed to said support stand and supporting said upper shears support at one side, a crank drive fixed to said support stand and connected to said upper shears support at the other side.

17. Edge trimming shears according to claim 8 wherein said power operated means includes gear teeth on said curved slide surfaces of said knife supports, gear means fixed to said shears supports and coupled with said gear teeth, driving means for operating said gear means to slide said knife supports in said guide tracks simultaneously in said one direction to cut the metal sheet and in the other direction to return said knife supports to the starting position, pivot means fixed to said support stand and supporting said upper shears support at one side, a crank drive fixed to said support stand and connected to said upper shears support at the other side.

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