Nov. 12, 1935. G. L. WINTERS 2,020,491

SHEARING MECHANISM

Filed July 18, 1933 4 Sheets-Sheet 1

Fig. 1.

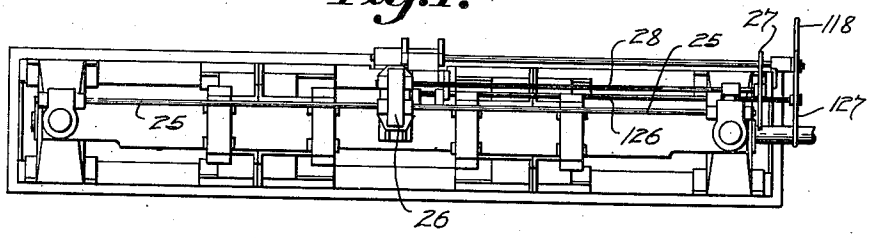


Fig. 2.

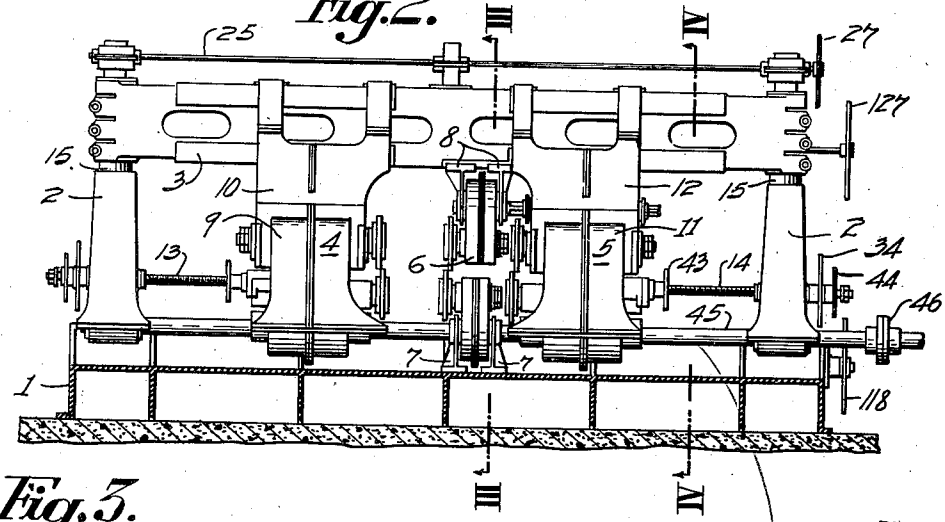


Fig. 3.

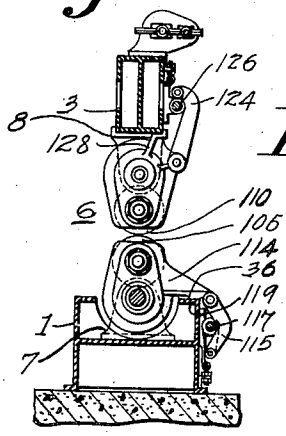


Fig. 4.

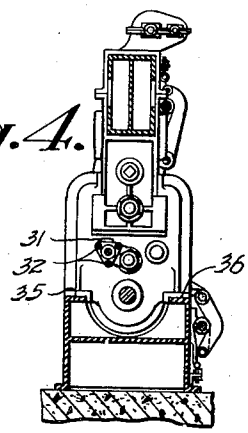
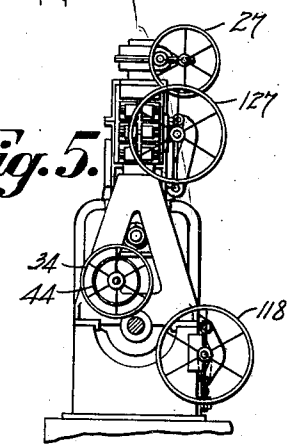


Fig. 5.



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Nov. 12, 1935. G. L. WINTERS 2,020,491

SHEARING MECHANISM

Filed July 18, 1933 4 Sheets-Sheet 2

Fig. 7.

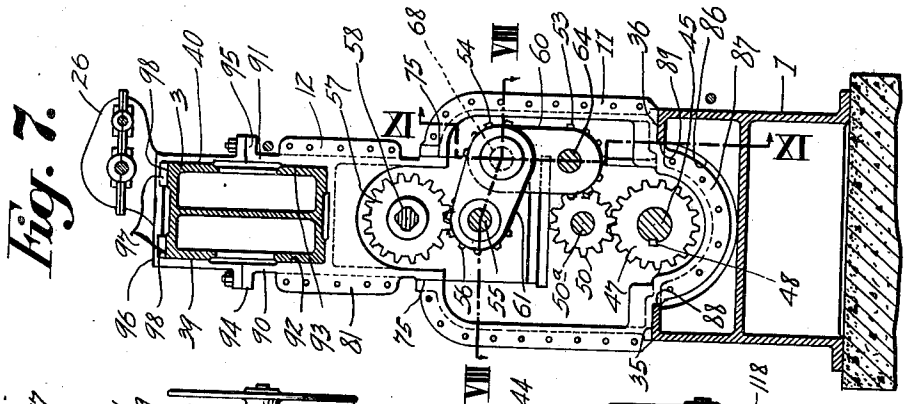
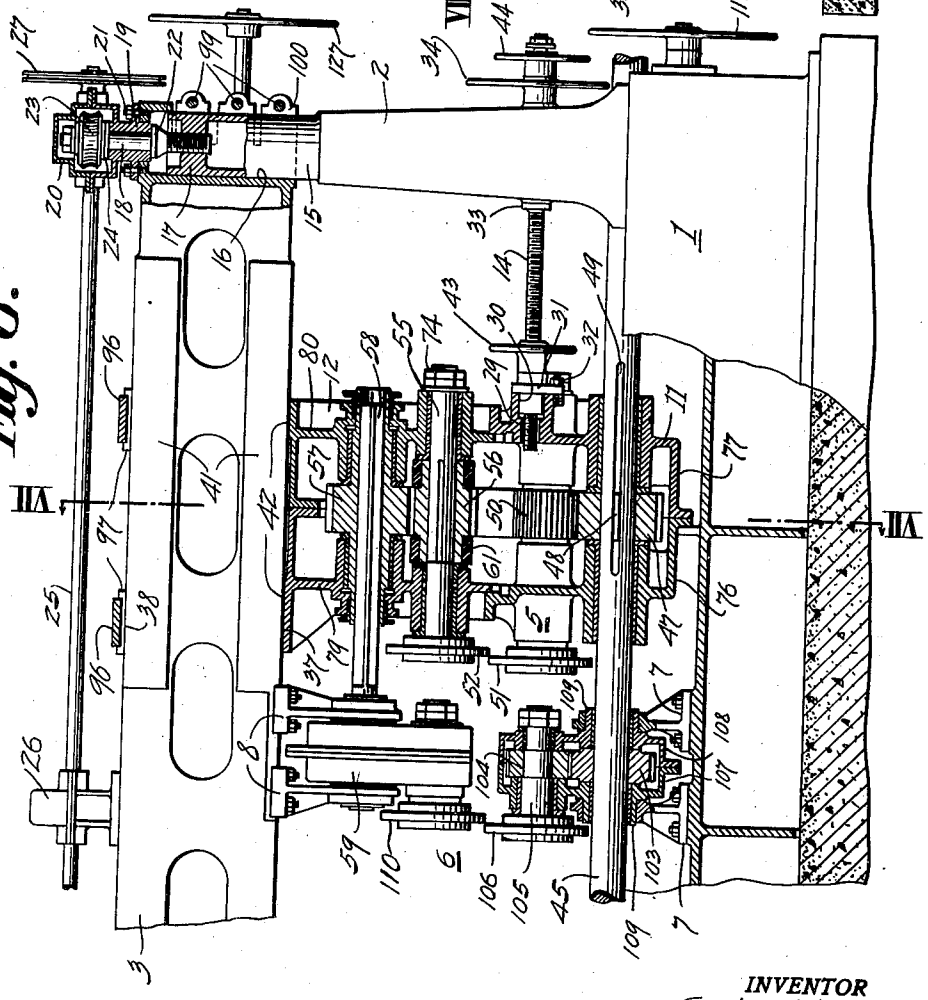


Fig. 6.



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SHEARING MECHANISM

Filed July 18, 1933 4 Sheets-Sheet 3

Fig. 8.

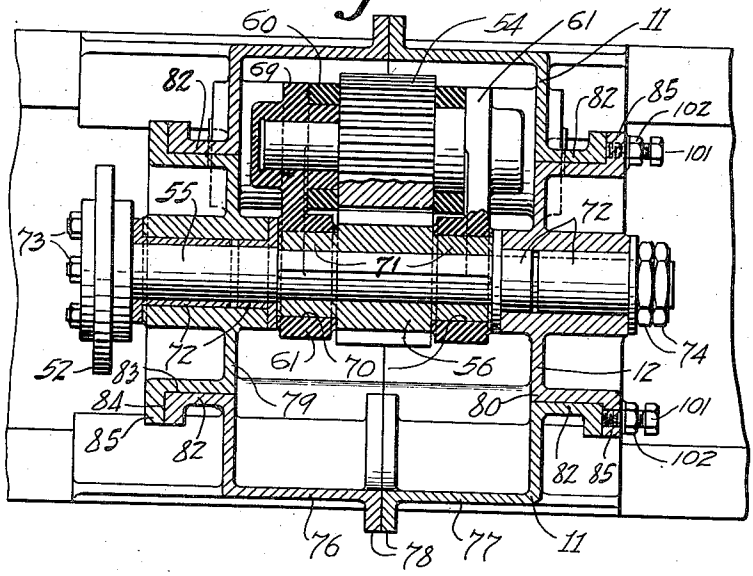
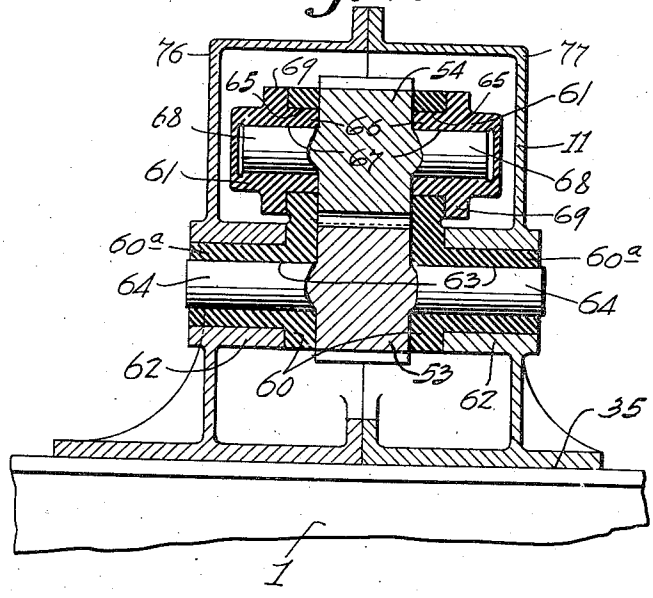


Fig. 9.



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Nov. 12, 1935. G. L. WINTERS 2,020,491

SHEARING MECHANISM

Filed July 18, 1933 4 Sheets-Sheet 4

Fig. 11.

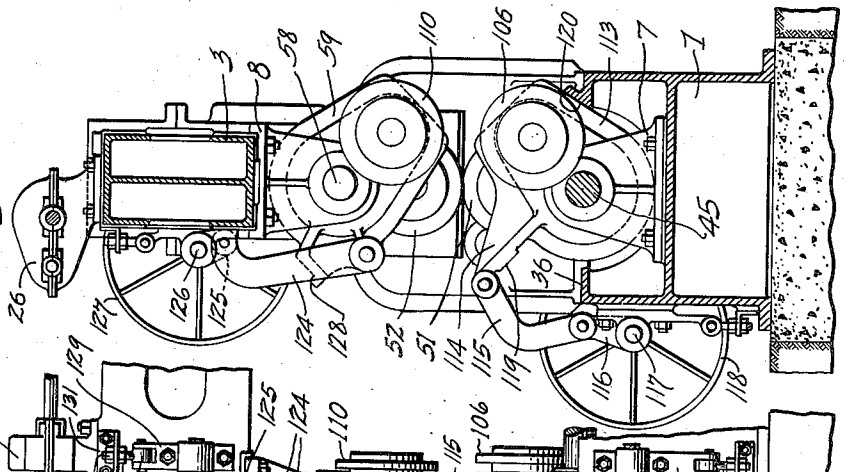
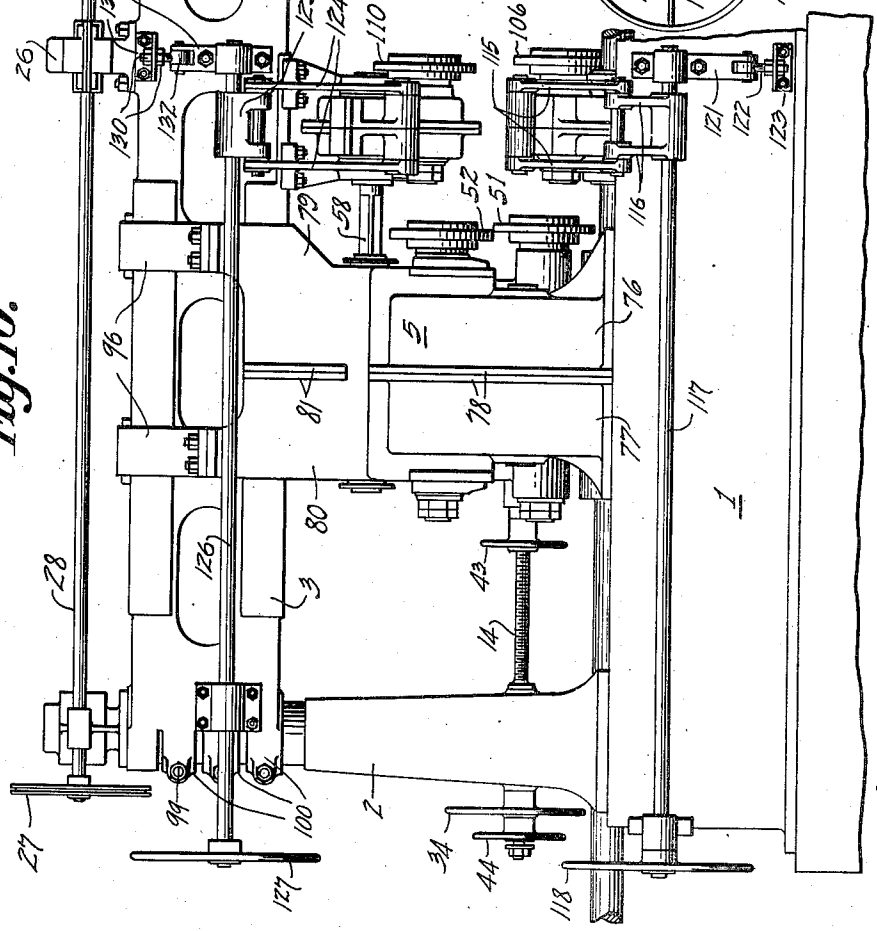


Fig. 10.



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Patented Nov. 12, 1935

2,020,491

UNITED STATES PATENT OFFICE

2,020,491

SHEARING MECHANISM

Gardner L. Winters, Dormont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa., a corporation of Pennsylvania

Application July 18, 1933, Serial No. 680,938

31 Claims. (Cl. 164—60)

The invention relates to machines for trimming and slitting sheet material, with particular reference to the performance of these operations on sheet metal and metal foil.

An object of my invention is to provide a machine of the type indicated which is simple and compact in construction and yet which permits of an unusually wide range of adjustment. In providing the desired adjustments, I have also worked toward facility of adjustment and a reduction in the number of operations necessary to be performed in connection with a given adjustment.

In trimming and slitting machines it is frequently desirable that the machine be converted from a trimmer and slitter to a trimmer and vice versa. It is accordingly an object of the invention to provide means for rendering the slitting mechanism inoperative or moving it out of the way so that the edge trimming operation may be accomplished without interference. Another object is to provide a vertical adjustment between the trimming and slitting knives so that compensation can be made for wear and the decreasing diameter of the knives as they are ground down from time to time.

A further and controlling object is to provide a machine in which the foregoing objects, as well as others, may be satisfied by an organization of elements in which a single source of power will suffice. In addition, I have aimed to provide the usual adjustment between the pairs of edge trimming knives with respect to each other to accommodate different widths of sheet and also with respect to the slitting knives.

A particular object is to provide a flexible driving gear of novel character to permit adjustment of the edge trimming knives, and a slitting unit, the upper knife of which is driven through the medium of such flexible drive and which is laterally adjustable with respect thereto.

Another object is to provide a machine in which the upper trimming and slitting knives of each set are carried by a single member which is so arranged that it can be raised and lowered with respect to the main frame, thus permitting uniform and simultaneous adjustment of the various cooperating sets of rotary knives. Other objects and advantages will appear in connection with a description of the drawings in which:

Fig. 1 is a plan view showing the general organization of a machine embodying the invention. Fig. 2 is a front elevational view of the same machine, the main base frame being shown in central vertical cross section. Fig. 3 is a cross sectional view taken on the line III—III of Fig. 2.

Fig. 4 is a similar cross sectional view taken on the line IV—IV of Fig. 2. Fig. 5 is an end elevational view of the same machine.

Fig. 6 is a fragmentary view showing to a somewhat enlarged scale the right-hand portion of the machine shown in Fig. 2, with essential portions of the mechanism broken away in central vertical cross section. Fig. 7 is a cross sectional view taken through the center of one of the edge trimming units, as indicated at VII—VII in Fig. 6.

Figs. 8 and 9 are fragmentary sectional views taken as indicated at VIII—VIII and IX—IX on Fig. 7 and showing to an enlarged scale the flexible driving connection between the two operating shafts of an edge trimming unit, on which shafts are mounted a cooperating pair of rotary knives. Fig. 10 is a back elevational view of the same end of the machine as shown in Fig. 6, and this view, together with Fig. 11, shows the mechanism for swinging the slitting knives into and out of operative position, Fig. 11 being an elevational view of the slitting unit with its associated mechanism, as viewed from the right end of Fig. 10, the frame of the machine appearing in cross section.

The machine in its general organization comprises a main base frame 1, vertical end supports or pedestals 2, and a horizontal supporting beam 3, which is slidably mounted on the pedestals for vertical adjustment with respect to the base 1 of the machine. The mechanism for effecting this adjustment will be subsequently described. Supported by and between the base frame 1 and the horizontal beam 3 are the edge trimming units 4 and 5 and the slitting unit 6. Each of these "units" comprises a cooperating set of rotary knives, one of the knives of each set being carried by a shaft which is supported in a member carried by the base frame 1, whereas the supporting structure and a part of the operating mechanism for the upper knife of each set is carried by a member supported on and depending from the beam 3.

The slitting unit does not require lateral adjustment and the lower part of this mechanism is pivotally mounted on the frame 1 by means of the brackets 7, while the upper part is pivotally secured to the beam 3 by means of the brackets 8. The edge trimming units 4 and 5 likewise comprise two parts in the form of telescoping housings 9, 10 and 11, 12, respectively. The lower housings 9 and 11 are carried by the frame 1 of the machine, and the upper housings 10 and 12 are carried by the cross beam 3. The edge trim-

ming units 4 and 5 are laterally adjustable to accommodate varying widths of sheet, and this adjustment is effected by means of lead screws 13 and 14 which pass through the pedestals 2. This mechanism will be more fully described further on.

The manner of mounting the horizontal beam 3 upon the end supports or pedestals 2 is shown in Fig. 6. The construction there shown is duplicated at the other end of the machine. The upper portion of the end support 2 is provided with a cylindrical guiding surface 15 conforming with a cylindrical aperture 16 in the beam casting 3. The surfaces 15 and 16 are accurately machined to provide a guide for the vertical movement of the beam 3. Near the upper end of the cylindrical portion 15 of the end support is a transverse wall 17 in which there is a centrally located aperture threaded to receive a spindle 18 which is correspondingly threaded. The upper end of the cylindrical aperture 16 in the beam casting 3 is closed by a member 19 which may conveniently form a part of a housing 20, which is provided to enclose a portion of the actuating mechanism which is used to raise and lower the horizontal beam 3. The member 19 is secured to the beam casting 3 in any suitable manner, as by the studs 21. The spindle 18 is provided with an upset shoulder 22 bearing against the under side of member 19 through which the spindle extends. Keyed to the upper end of spindle 18 is a worm wheel 23 and between the worm wheel 23 and member 19 is a collar 24 bearing against an upper surface of member 19. The beam 3 is thus supported on the shoulder 22 of the threaded spindle 18 so that vertical adjustment may be effected by rotation of the spindle.

It is a feature of my preferred construction that the rotation of the adjusting spindles at each end of the machine is controlled from a single point, and the transmission of the motivating force from this common point to each of the adjusting spindles passes through gearing located at the exact center of the machine so that all lost motion is evenly divided between the two points of adjustment and thus compensated for. The worm wheels 23 cooperate with worms (not shown) mounted on the ends of a shaft 25 which passes through a gear housing 26 secured to the top of the beam 3 in the exact center with respect to the end supports 2. If reference will now be had to Fig. 1, it will be seen that adjustment of the two spindles 18 may be effected by turning the wheel 27 which is rigidly secured to a shaft 28 which enters the aforesaid housing 26 and is geared to the shaft 25 by means of pinions (not shown). The wheel 27 may be a handwheel or a sprocket wheel actuated by a chain which may in turn be driven either by hand or from any suitable source of power.

As the beam 3 is raised and lowered it carries with it the upper housings 10 and 12 of the edge trimming units 4 and 5, and also the upper part of the slitting unit 6, thus varying the distance between the cooperating rotary knives of each unit and making it possible to simultaneously and uniformly adjust the three sets of knives.

Referring again to Fig. 6, the right-hand edge trimming unit 5 is shown in central vertical cross section, and the lateral adjustment of this edge trimming unit by means of the lead screw 14 will now be described. The lower housing 11 of this unit is provided with an aperture 29 through which the lead screw 14 may freely pass. Against the outer face of the housing 11 and extending into the counter-bored portion 30 of aperture 29 is a special nut 31 which is bolted to the housing 11 at 32 (Fig. 4 and Fig. 6). Into this special nut 31 is threaded the lead screw 14 which passes through the end support 2 and is held against movement with respect thereto by the collar 33 and the hub of the adjusting handwheel 34 which is rigidly secured to the end of the lead screw 14. When the handwheel 34 is turned, the housing 11 is moved to the right or to the left, according to the direction of rotation of the lead screw, and by reason of the telescoping connection between the lower housing 11 and the upper housing 12, lateral adjustment of the complete edge trimming unit 5 is thus effected. To permit this lateral movement, the housings 11 and 12 are provided with a slidable connection to the base frame 1 and beam 3 respectively. These slidable connections are shown at 35, 36 (Figs. 4, 7, and 9) and at 37, 38, 39, 40 (Figs. 6 and 7). The beam casting 3 is conveniently provided with the raised portions 41 and the upper housing 12 with raised portions 42, which may be accurately machined to provide a smooth sliding fit between the two. After the edge trimming unit has been adjusted to the desired position it is secured in place by the locking wheels 43 and 44. The mechanism for adjusting the left-hand edge trimming unit 4 by means of the lead screw 13 is the same as the mechanism which has just been described.

An important feature of my invention resides in the flexible transmission of power through the adjustable telescoping housings of the edge trimming units 4 and 5 and from the edge trimming unit 5 to the upper part of the slitting unit 6. Reference will first be had to the general arrangement for transmitting power to the three units 4, 5 and 6 to drive the rotary knives or shears. In Fig. 2 the main drive shaft is indicated at 45. The shaft is connected through the coupling 46 to a suitable source of power (not shown). Drive shaft 45 passes through the lower part of each of the units 4, 5 and 6, and by means of gearing now to be described drives both the upper and the lower rotary knives of each of the three units.

In Fig. 6, the drive shaft 45 is shown passing through the housings of the lower parts of the edge trimming unit 5 and slitting unit 6. Keyed, as by means of a key 48, to the shaft 45 within the housing 11 is a pinion 47. The key 48 is equal in length to, or less than, the width of the hub of pinion 47 and is received within the elongated keyway 49, which construction permits the trimming unit 5 to be moved laterally without disturbing the driving connection between the drive shaft 45 and pinion 47. Pinion 47 meshes with a pinion 50 which is secured to the shaft 50a on which the lower rotary trimming knife 51 is mounted. From the pinion 50 power is transmitted to the upper rotary knife 52 through two intermediate gears or pinions 53, 54. These pinions intermesh, as will be seen in Figs. 7 and 9, to form a gear train for driving the shaft 55 on which the pinion 56 and the upper knife 52 are mounted. Pinion 56 meshes with the upper intermediate gear 54 (Figs. 7 and 8), and also with a gear 57, which is slidably mounted on a rectangular shaft 58 which drives the upper part 59 of the slitting unit 6, while allowing lateral adjustment of the edge trimming unit 5 without disturbing the driving connection between the gear 57 and the shaft 58.

The manner in which the gear train which has just been described accommodates itself to

vertical movement of the upper housing 12 with respect to lower housing 11 will now be described. The shafts of gears 47, 50 and 53 are mounted in fixed bearings in the lower housing 11. The gears 56 and 57 are mounted in fixed bearings in the upper housing 12. The upper intermediate gear 54 is mounted in bearings which are not fixed with respect to either of the housings, but which are formed in part by links 60 pivotally mounted with respect to the housing 11 and in part by links 61 which are pivotally mounted with respect to the housing 12 (Fig. 7).

The manner of constructing this flexible link connection is shown in its preferred embodiment in Figs. 8 and 9 of the drawings, which should be considered in connection with Fig. 7. In Fig. 9 the lower intermediate gear 53 is shown in mesh with the upper intermediate gear 54. The links 60 are provided with laterally extending hubs 60a which are pivotally mounted in bearings formed by the annular extensions 62 of the housing 11. Concentric with these bearings are bearings 63 in which are received the trunnions 64 of the intermediate gear 53. At their upper ends, the links 60 are apertured at 65 to receive the annular extensions 66 of the links 61 which are disposed at the sides of the upper intermediate gear 54. The links 61 are recessed at 67 to provide bearings for the trunnions 68 of the upper intermediate gear 54. The flanges 69 of the links 61 bear against the outer sides of the links 60, as will be seen in both Figs. 8 and 9. The links 61 at their other ends are provided with apertures 70 to receive annular trunnions 71 formed on the pinion 56, and concentric with the shaft 55 on which the pinion 56 is mounted. Suitable bearings 72 may be provided in the housing 12 for the shaft 55. The upper rotary edge trimming knife 52 is secured to the shaft 55 as by means of the studs 73 and the shaft is held in place in the housing 12 by a pair of lock nuts 74.

It will be seen that by the arrangement just described I have provided mechanism for transmitting power from one shaft (64) to a parallel shaft (55) movable with respect thereto comprising a gear wheel mounted on each shaft (gears 53 and 56) and an intermediate gear (54) in mesh with both of said gear wheels, the intermediate gear being connected by links (60 and 61) to each of said shafts so as to maintain tangency between the pitch circle of the intermediate gear (54) and the pitch circles of each of the gear wheels (53 and 56), while permitting variation of the center-to-center distance between the shafts. Moreover, by the particular arrangement in which the gears (50 and 53) are both employed, and regarding the gear (53) as well as the gear (54) as an intermediate gear so that we have two intermediate gears, I have provided mechanism for imparting rotation to one shaft (55) by a parallel shaft (50a) movable with respect thereto to drive them in opposite directions of rotation which comprises gear wheels (50 and 56) mounted on each shaft and two intermediate gears (53 and 54), one of which (53) is mounted on a shaft stationary with respect to the gear wheel (50) but movable with respect to the gear wheel (56), and the other of which (54) is mounted on a shaft (68) which is movable with respect to both of the gear wheels (50 and 56), the links (61) connecting the movable intermediate gear (54) with one of said gear wheels (56) and the links (60) connecting the movable intermediate gear (54) with the stationary intermediate gear (53) cooperating to maintain tangency between the pitch circles thereof while permitting variation of the center-to-center distances between the shafts.

The construction of the edge trimming unit 4 is the same as that which has been described with reference to the edge trimming unit 5, except that the parts are reversed. A detailed disclosure of the unit 4 is therefore unnecessary.

The housing 11 and the housing 12 are provided with cooperating flanges The lower housing 11 is formed of two complementary parts 76, 77, which are secured together at their meeting edges by means of flanges 78 which are bolted together. The upper housing 12 is likewise formed of two complementary parts 79, 80, which are bolted together at their meeting edges, which are provided with the flanges 81 (Fig. 10). Each half of the lower housing 11 is provided with laterally extending flanges 82 (Fig. 8) which are turned outwardly at their extremities to provide bearing surfaces 83, 84, at right angles to each other for engagement with the bearing surfaces of similar flanges 85 with which each half of the upper housing 12 is provided.

The flanges 82 and 85 on the lower housing 11 and upper housing 12, respectively, and the bearing surface 75 in the upper portion of housing 11 maintain the proper alignment between the two housings at all times, while permitting vertical adjustment of the beam 3, the upper and lower gear housings 12 and 11 cooperating to form a vertically telescoping unit. As previously mentioned, the lower housing 11 rests on horizontal guiding surfaces 35, 36, formed on the base casting 1. The central portion of the base casting 1 is cut away as indicated at 86 (Fig. 7) to allow the depending portion 87 of the housing 11 to extend below the guides 35, 36 to receive the drive shaft 45. The housing 11 is further guided and positioned by means of the drive shaft 45 which is supported in bearings at each end of the machine. Vertical guiding surfaces 88, 89 are provided at the edges of the guides 35, 36, cooperating with surfaces formed on the housing 11. The two halves 79 and 80 of the upper housing 12 are each formed with upwardly extending arms 90, 91 embracing the lower portion of beam 3 and provided with guiding surfaces 92, 93 (Fig. 7) cooperating with the previously mentioned guides 41 formed on the beam 3. The arms 90 and 91 are provided at their upper extremities with laterally projecting flanges 94, 95, which are bolted to flanges formed on the straps 96 which embrace the upper portion of the beam 3, the arms 90, 91, and the U-strap, together encircling the beam 3 to support and guide the upper housing 12 and associated mechanism thereon. Replaceable bearing blocks 97 may be inserted under the horizontal top portion of the straps 96, cooperating with the raised bearing surfaces 98 formed at each side of the beam 3.

The assembling of the units 4 and 5 may be readily accomplished by virtue of the construction which has been described. The supporting beam 3 is mounted on the end supports 2 and the two halves 79, 80 of the upper housing 12 are separately attached to their supporting straps 96, the two halves being separated a suitable distance. Likewise the two halves 76, 77 of the lower housing 11 are placed on the guideways of the frame 1 and separated laterally. It will be understood that the various bushings or bearing inserts are in place in the members 76, 77, 79 and 80. The gear 47 is held in place against either

of the housing members 76 or 77 and the drive shaft 45 inserted. The shaft 50a which carries the lower rotary knife 51 is then inserted through the housing member 76 and the pinion 50 mounted thereon. The links 60 and 61 are next assembled and slipped over the trunnions 64 and 68 of the pinions 53 and 54 and the annular trunnions 71 of the pinion 56. These pinions, together with the links, are then assembled with the lower housing member 76, inserting the annular bearing portion or hub 60a of the left-hand links, as viewed in Figs. 6 and 9, in the bearing 62 of the housing member 76. The pinion 56, with its associated linkage, is then held in alignment with the aperture in the upper housing member 79 which is to receive the shaft 55, and this shaft is then inserted so that the pinions 47, 52, 53, 54, 56, together with the two pairs of links 60 and 61, are all supported by the left-hand housing members 76 and 79 of the unit 5. The gear 57 may now be inserted in its bearing in the housing member 79 and the complementary housing members 77 and 80 slid over against the members 76 and 79 and bolted thereto to complete the assembly. It will, of course, be understood that the manner of assembling may be carried out otherwise than I have specifically indicated, but I have described one mode of assembly in order that the ease with which the edge trimming units may be assembled will be understood. Facility of assembling is considered to be one of the advantages of the invention. This, together with compactness and simplicity of construction, is believed to be noteworthy when it is considered that the machine offers a wider range of adjustment and a greater degree of flexibility than any of the slitting machines previously known to the art.

After the vertical adjustment of the beam 3 has been accomplished through the medium of the adjusting means previously described, the beam is locked in position by means of the bolts 99, which pass through integral straps 100 formed on the beam 3 and surrounding the cylindrical guiding portion 15 of the end pedestals 2 (Figs. 6 and 10). The adjustment is further maintained with respect to the lower and upper housing members 11 and 12 of the edge trimming units 4 and 5 by means of the set screws 101 which are provided with lock nuts 102 (Fig. 8). The set screws 101 extend through the outwardly turned portion of the flanges 85 and bear against the cooperating guide surface of the flanges 82.

The lower part of the slitting unit 6 is driven directly from the drive shaft 45, as will be seen in Fig. 6, by means of a pinion 103 on the drive shaft in mesh with a pinion 104 on the shaft 105 which carries the lower slitting knife 106. The pinions 103 and 104 are mounted in complementary housing members 107, 108, which are secured together at their meeting edges. The completed housing so formed is provided with trunnions 109 which are seated in bearings formed in the supporting brackets 7 mounted on the base frame 1. This construction allows the lower slitting unit to be rotated about the axis of the drive shaft 45 for a purpose which will shortly appear. The upper part of the slitting unit 6 is of similar construction, with the exception that it is driven by means of the auxiliary shaft 58 which is slidably engaged by the pinion 57 of the edge trimming unit 5. The upper part of the slitting unit 6, then, is rotatable about the axis of the shaft 56 in bearings in the brackets 8 rigidly secured to the beam 3. It will thus be seen that I have provided a slitter attachment comprising upper and lower rotary knives each mounted on a separate shaft, each of these shafts being gear-connected to a shaft (45 and 58) about which they are rotatable to swing the knives toward and away from the plane of the sheet material passing through the machine.

Referring more particularly to Figs. 10 and 11 of the drawings, the mechanism for controlling the position of the upper and lower parts of the slitting unit 6 will now be described. Fig. 3 shows the unit 6 in operative position and Figs. 10 and 11 show the unit in inoperative position with the slitting knives 106, 110 swung away from the plane of the sheet material passing through the machine but with the edge trimming knives 51, 52 in operative position. The lower part of the unit, which is indicated generally by the reference numeral 113 (Fig. 11), is provided with a lateral extension 114 to which are pivoted links 115, which in turn are pivoted to a crank 116 rigidly secured to the shaft 117, the rotation of which is controlled by a handwheel 118. When this handwheel 118 is rotated in counter-clockwise direction, as viewed in Fig. 11, the lower part 113 of the slitting unit is also rotated in a counter-clockwise direction until it occupies the position shown in Fig. 3 where the stop 119 formed on the extension 114 of the lower part 113 of the slitting unit comes to rest against the guiding surface 36 on the base casting 1 to positively position the lower part 113 of the slitting unit in operative position. As will be seen in Fig. 3, the form of the links 115 is such as to allow the two pivotal points at their ends to be brought approximately into alignment with the center of the control shaft 117 so that they act as a toggle to maintain the operative position of the slitting knife 106.

When the handwheel 118 is turned in the opposite direction to withdraw the lower part 113 of the slitting unit into inoperative position it comes to rest against a stop surface 120 formed on the base casting 1 (Fig. 11). The bearing for the inner end of the control shaft 117 is formed by a bearing member 121 (Fig. 10) which is so mounted as to provide a slight vertical adjustment. This adjustment is effected by means of the eye bolt 122 which passes through a bracket 123 secured to the base casting 1 with adjusting nuts on the eye bolt at each side of the bracket.

A similar mechanism is provided to control the position of the upper part 59 (Fig. 11) of the slitting unit. This mechanism consists of links 124 pivoted to the housing 59 and to a crank 125 rigidly secured to a control shaft 126 operated by the handwheel 127. As will be seen in Fig. 3, the links 124, like the links 115, are so formed as to provide a toggle connection in which the pivotal points at the two ends of the links are brought into substantial alignment with the axis of the control shaft 126 to hold the slitting knife 110 in operative position. A stop 128 formed on the housing 59 comes to rest against a corner of the beam 3 to positively position the supporting structure for the knife. As in the case of the bearing for the control shaft 117, the inner bearing for the control shaft 126 is likewise formed so as to permit a slight vertical adjustment. The bearing is formed by the bracket 129 which is adjusted by means of the nuts 130 disposed at each side of a fixed bracket 131 through which passes the eye bolt 132 which is in turn pivotally secured to the bracket 129. The operation of the control mechanism for the upper or beam-mounted

part of the slitting unit is the same as has been described for the lower part of the unit and need not be repeated. With particular reference to the beam-mounted slitting knife 110, it will be seen that it is not only arranged to be swung about the axis of its drive shaft 58, but is also so arranged that the edge trimming unit from which it is driven may be moved laterally parallel to the axis of shaft 58, while maintaining the driving connection between the edge trimming unit and the slitting unit.

The mechanism which I have described as representative of a specific embodiment of the various features which characterize my invention is susceptible of numerous variations, as will readily be understood by those schooled in the art to which it appertains.

I claim:

1. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, a plurality of rotary knives carried by said base frame, rotary knives carried by said horizontal beam and cooperating with said first-mention rotary knives, means for driving said rotary knives in cooperating pairs, means for adjusting cooperating pairs of knives as a unit with respect to other cooperating pairs, and means for raising and lowering the beam on said end supports to uniformly adjust the cooperating pairs of rotary knives.

2. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, a plurality of rotary knives individually supported by said base frame, rotary knives individually suspended from said horizontal beam and cooperating with said first-mentioned rotary knives, unitary means for driving each pair of cooperating knives from a common drive shaft, and means for raising and lowering the beam on said end supports to uniformly adjust the cooperating sets of rotary knives.

3. A machine for trimming and slitting sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, rotary edge trimming knives and a rotary slitting knife carried by said base frame, rotary edge trimming and slitting knives carried by said horizontal beam and cooperating with the rotary knives carried by the base frame, means for driving all of said knives from a common drive shaft including unitary means for driving each pair of cooperating edge trimming knives from said shaft, means for driving the beam-mounted slitting knife through one of said trimming knife drive means, and means for raising and lowering the beam on said end supports to uniformly adjust the cooperating sets of rotary knives.

4. A machine for trimming and slitting sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, an edge trimming unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, a slitting unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, means for driving the beam-mounted slitting knife from the edge trimming unit, and means for laterally adjusting the edge trimming unit toward and away from the slitting unit.

5. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports and vertically adjustable with respect to said base frame, an upper gear housing carried by said beam and a lower gear housing carried by said base frame, said upper and lower gear housings cooperating to form a vertically telescoping unit and permit the aforesaid vertical adjustment of the beam, and a rotary knife mounted on and driven from the upper housing and cooperating with a rotary knife mounted on and driven from the lower housing.

6. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports and vertically adjustable with respect to said base frame, an upper gear housing carried by said beam and a lower gear housing carried by said base frame, said upper and lower gear housings cooperating to form a vertically telescoping unit and permit the aforesaid vertical adjustment of the beam, a rotary knife mounted on the upper housing and cooperating with a rotary knife mounted on the lower housing, and gears mounted in said telescoping unit arranged to drive both said upper and lower knives from a drive shaft passing through said lower gear housing.

7. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports and vertically adjustable with respect to said base frame, an upper gear housing carried by said beam and a lower gear housing carried by said base frame, said upper and lower gear housings cooperating to form a vertically telescoping unit and permit the aforesaid vertical adjustment of the beam, a rotary knife mounted on the upper housing and cooperating with a rotary knife mounted on the lower housing, and a flexible gear train contained in said unit arranged to drive both said upper and lower knives from a drive shaft in said lower gear housing while permitting the aforesaid vertical adjustment.

8. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports and vertically adjustable with respect to said base frame, an upper gear housing carried by said beam and a lower gear housing carried by said base frame, said upper and lower gear housings cooperating to form a vertically telescoping unit and permit the aforesaid vertical adjustment of the beam, a rotary knife mounted on the upper housing and cooperating with a rotary knife mounted on the lower housing, gear driven means for rotating both said upper and lower knives comprising a gear connected by links to a shaft fixed with respect to said upper gear housing and to a shaft fixed with respect to said lower housing.

9. A machine for trimming and slitting sheet material comprising a base frame and end supports, a horizontal beam carried by said end supports, rotary edge trimming knives and a rotary slitting knife carried by said base frame, rotary edge trimming and slitting knives carried by said horizontal beam and cooperating with the rotary knives carried by the base frame, means for independent lateral adjustment of each cooperating pair of rotary trimming knives as a unit, and means for moving the rotary slitting knives into and out of operative position independently of said pairs of edge trimming knives.

10. A machine for trimming and slitting sheet material comprising a base frame and end supports, a horizontal beam carried by said end supports, rotary edge trimming knives and a rotary slitting knife carried by said base frame, rotary edge trimming and slitting knives carried by said horizontal beam and cooperating with the rotary knives carried by the base frame, means for independent lateral adjustment of each cooperating pair of rotary trimming knives as a unit, means for moving the rotary slitting knives into and out of operative position independently of said pairs of edge trimming knives and means for driving all of said knives from a common drive shaft.

11. A machine for trimming and slitting sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, an edge trimming unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, a slitting unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, means for driving the beam-mounted slitting knife from the edge trimming unit and for rotating said beam-mounted slitting knife into and out of operative position.

12. A machine for trimming and slitting sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, an edge trimming unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, a slitting unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, means for driving the beam-mounted slitting knife from the edge trimming unit, said means comprising a slidable shaft geared to said slitting knife whereby the slitting knife may be swung about the axis of said shaft and the edge trimming unit moved laterally parallel to said axis while maintaining the driving connection between the edge trimming unit and the slitting unit.

13. In a machine for slitting sheet material, a swinging slitter attachment comprising upper and lower rotary knives, each of said rotary knives mounted on a separate shaft and each of said shafts gear-connected to a shaft about which they are rotatable to swing said knives toward and away from the plane of the sheet material passing through the machine, and means for locking the swinging slitter knives in and out of operative position, said means comprising a link pivotally connected to a member fixed with respect to a slitter knife and a link pivotally connected to the frame of the machine, said links being pivotally connected to each other.

14. In a machine for slitting sheet material, a swinging slitter attachment comprising cooperating upper and lower slitting devices disposed on opposite sides of the sheet material passing through the machine and rotatably mounted on the frame of the machine for movement toward and away from said sheet material, links pivoted to each slitting device and connected to a shaft rotatable to control the adjustment of said slitting devices in and out of operative position.

15. In a rotary shearing machine, a vertically adjustable cutting unit comprising an upper and a lower gear housing cooperating to form a vertically telescoping unit, cooperating knives carried by a shaft in each of said housings, and flexible means carried by said housings arranged to drive said knives through their shafts from a common drive shaft.

16. In a machine for trimming sheet material, cooperating pairs of rotary edge trimming knives, means for adjusting one knife of each pair simultaneously with one knife of all other pairs, means for driving each pair of cooperating knives as a unit, and means for laterally adjusting each pair of cooperating knives as a unit.

17. In a machine for trimming and slitting sheet material, cooperating pairs of rotary knives, means for adjusting one knife in each pair simultaneously with one knife of all other pairs, means for driving each pair of cooperating knives as a unit, and means for laterally adjusting each pair of cooperating edge trimming knives as a unit.

18. In a machine for trimming sheet material, an adjustable edge trimming unit comprising an upper and lower gear housing cooperating to form a vertically telescoping unit, a shaft carried by each of said housings, a rotary knife mounted on each of said shafts, the knives being mounted to cooperate in cutting relationship, and a flexible gear train carried by said telescoping unit arranged to drive one knife shaft from the other.

19. In a machine for trimming sheet material, a vertically adjustable edge trimming unit comprising an upper and lower gear housing cooperating to form a vertically telescoping unit, a shaft carried by each of said housings, a rotary knife mounted on each of said shafts, the knives being mounted to cooperate in cutting relationship, and gears mounted in said telescoping unit arranged to drive one of said knife shafts from the other, the driving shaft itself being gear driven from a drive shaft passing through said lower gear housing.

20. In a machine for trimming sheet material wherein a base frame and vertical end frames support a horizontal beam that is vertically adjustable with respect to the base frame, the combination of an upper and lower gear housing carried by said horizontal beam and said base frame respectively, the housings cooperating to form a vertically telescoping unit, a rotary knife mounted on a shaft carried by the upper housing, a second rotary knife mounted on a shaft carried by the lower housing, the knives being arranged to cooperate in cutting relationship, and gear means for driving the upper knife shaft through the lower knife shaft from a drive shaft passing through said lower housing, said means including a gear connected by a pair of links to said upper knife shaft and by a second pair of links to a shaft driven by said lower knife shaft, said gear being fixed with respect to said lower housing.

21. A machine for trimming sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports and vertically adjustable with respect to said base frame, an upper gear housing and a lower gear housing carried by said beam and said base frame respectively, said upper and lower gear housings cooperating to form a vertically telescoping unit and permit the aforesaid vertical adjustment of the beam, a rotary knife mounted on a shaft carried by the upper housing, a rotary knife mounted on a shaft carried by said lower housing, the said knives being arranged to cooperate in cutting relationship, and means contained in said unit for driving both said upper and lower knife shafts from a common

shaft passing through said lower gear housing, said means comprising a gear wheel mounted on each of said knife shafts, two intermediate gears one of which is mounted on a shaft stationary with respect to the lower gear wheel, and the other of which is supported on a shaft movable with respect to both of said gear wheels, the knife shaft gear wheels being in mesh with the intermediate gears and the intermediate gears being in mesh with each other to form a gear train, and links connecting the said intermediate gear movable shaft with the upper knife shaft and stationary intermediate gear shaft, whereby the gear train is maintained in mesh throughout the range of vertical adjustment.

22. In a machine for trimming and slitting sheet material comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, an edge trimming unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, a slitting unit comprising two cooperating rotary knives one of which is carried by said base frame and the other by said horizontal beam, means for laterally adjusting the edge trimming unit toward and away from the slitting unit, and gear driven means for driving the beam-mounted slitting knife from the edge trimming unit, said gear driven means comprising a shaft carried by said edge trimming unit, said shaft having a central configured bore, and a second shaft geared at one end to drive said beam-mounted slitting knife, said second shaft having throughout the major portion of its length a cross section complementary to that of said bore, the configured shaft being slidably engaged within said hollow shaft to complete the driving connection throughout the range of lateral adjustment of said edge trimming unit.

23. A machine for trimming and slitting sheet material comprising a base frame and vertical end supports, an horizontal beam carried by said end supports, rotary edge trimming knives and a rotary slitting knife carried by said base frame, rotary edge trimming knives and a rotary slitting knife carried by said horizontal beam and cooperating with the knives carried by said base frame, means for driving all of said knives from a common drive shaft in cooperating pairs, means for laterally adjusting each of said edge trimming pairs as a unit with respect to the other cooperating pairs of rotary knives, and means for raising and lowering the beam on said end supports to uniformly adjust the operative cutting relationship of said pairs of knives.

24. A machine for trimming sheet material, comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, rotary edge trimming knives carried by said base frame and by said beam to form cooperating pairs, each of said pairs of cooperating knives being laterally adjusted as a unit, and means for raising and lowering the beam to adjust the rotary knives.

25. A machine for trimming sheet material, comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, lower and upper rotary knives carried by said base frame and said beam respectively to form cooperating pairs, individual means for driving each of said pairs of cooperating knives, each of said means being driven from a common drive shaft, and means for vertically adjusting the horizontal beam to increase and decrease the center to center distance between cooperating knives.

26. A machine for trimming and slitting sheet material, comprising a base frame and vertical end supports, a horizontal beam carried by said end supports, rotary edge trimming knives and a rotary slitting knife carried by said base frame, rotary edge trimming and slitting knives carried by said horizontal beam and cooperating with the rotary knives carried by the base frame, means for driving each of said pairs of cooperating knives from a common drive shaft, including individual means for driving each pair of edge trimming knives from the said common shaft, and means for raising and lowering the beam on said end supports to uniformly adjust the cooperating sets of rotary knives.

27. In a machine for trimming sheet material, cooperating pairs of rotary knives, means for adjusting one knife of each pair simultaneously with one knife of all other pairs, and individual means for driving each of said pairs of cooperating knives, each of said means being driven from a common drive shaft.

28. In a machine for trimming and slitting sheet material, cooperating pairs of rotary knives, means for adjusting one knife of each pair simultaneously with one knife of all other pairs, and means for driving each of said pairs of cooperating knives from a common source of power, including individual means for driving each pair of trimming knives.

29. In a machine for trimming and slitting sheet material, cooperating pairs of rotary knives, means for independent lateral adjustment of each coperating pair of edge trimming knives as a unit, and means for moving the rotary slitting knives into and out of operative position independently of said pairs of edge trimming knives.

30. In a machine for trimming and slitting sheet material, cooperating pairs of rotary knives, means for adjusting one knife in each pair simultaneously with one knife of all other pairs, means for independent lateral adjustment of each cooperating pair of rotary edge trimming knives as a unit, and means for moving the rotary slitting knives into and out of operative position independently of said pairs of edge trimming knives.

31. In a machine for trimming and slitting sheet material, cooperating pairs of rotary knives, means for adjusting one knife in each pair simultaneously with one knife of all other pairs, means for independent lateral adjustment of each cooperating pair of rotary edge trimming knives as a unit, means for moving the rotary slitting knives into and out of operative position independently of said pairs of edge trimming knives, and means for driving each pair of said knives from a common source of power.

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