

May 5, 1953

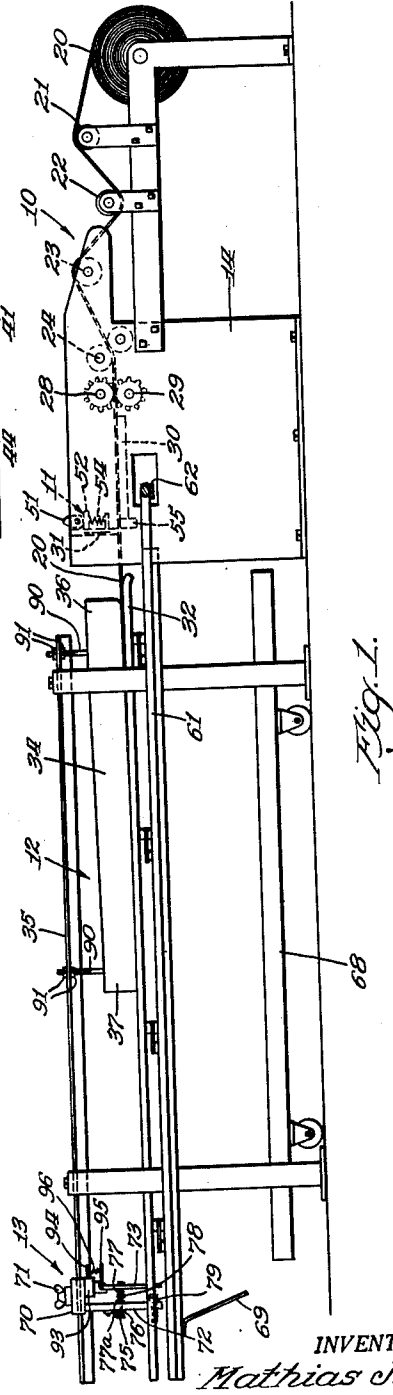
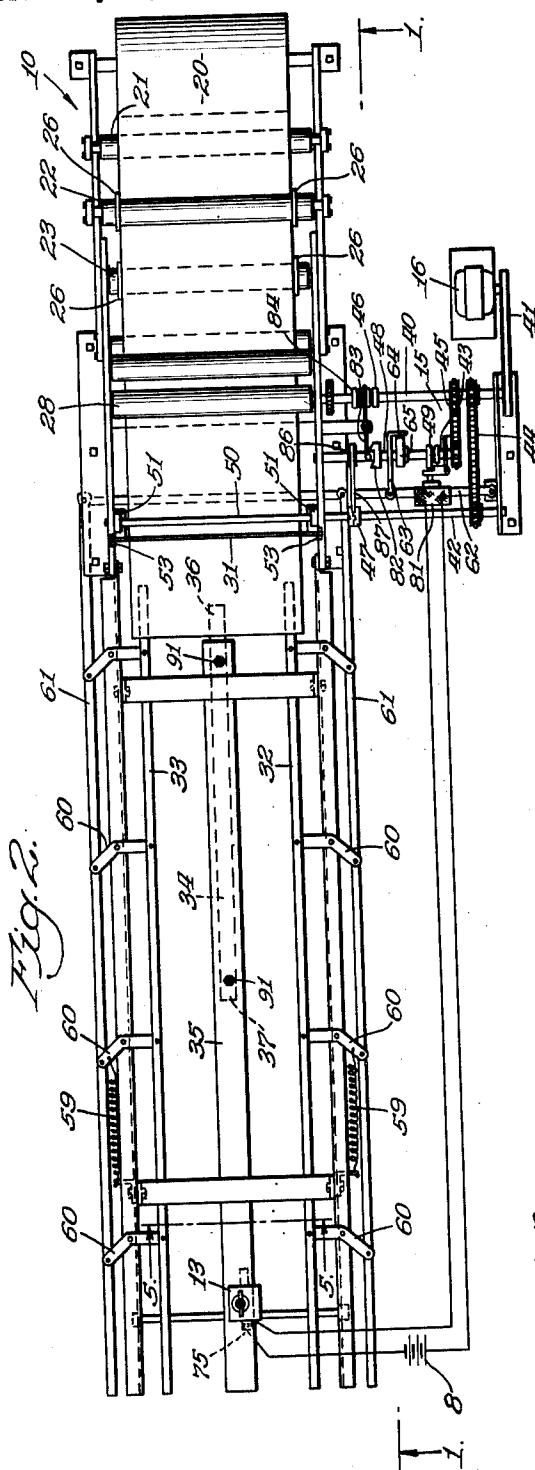
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2,637,394

SHEET CUTTING MACHINE

Filed July 16, 1947

2 SHEETS—SHEET 1



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2 SHEETS--SHEET 2

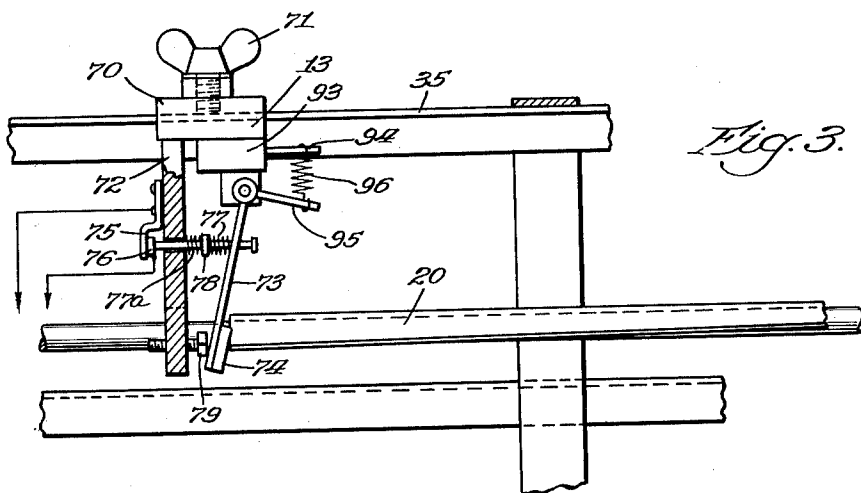


Fig. 3.

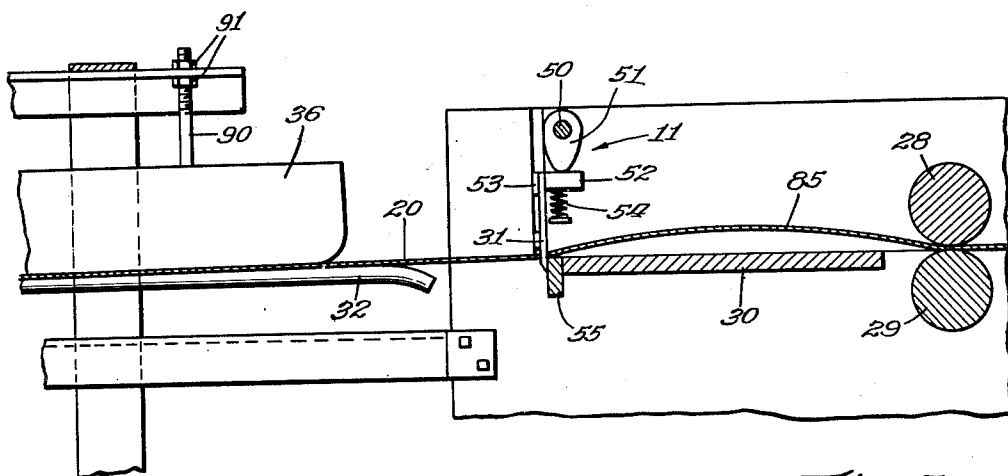


Fig. 4.

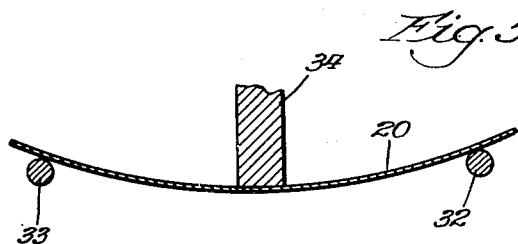


Fig. 5.

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SHEET CUTTING MACHINE

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8 Claims. (Cl. 164—49)

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This invention relates generally to cutting mechanisms and in particular to a method for cutting sheets of very accurate length from long strips of metal or other material.

In the prior art, various methods and machines have been devised for cutting sheets from long strips of material. Attempts have been made to provide automatic machines which operate rapidly and at the same time provide sheets the lengths of which are very accurate. Machines have been devised in which the strip of material is continuously fed and the cutting mechanism moves with the strip so that the operation takes place without interrupting the feeding of the strip. These machines which have been commonly designated as "flying shears" are very complicated and accordingly are expensive in original cost and require a considerable amount of maintenance resulting in high operating costs. Machines have also been produced in which a stationary shear blade is used and the length of the material cut off is determined by operation of the feeding mechanism. However, prior machines of this type have not been entirely satisfactory as they do not provide the desired accuracy, a tolerance of the order of one inch being about the best obtainable.

It is, therefore, an object of the present invention to provide an improved method for cutting sheets of very accurate length from strip material.

A further object of this invention is to provide an improved machine for automatically feeding strip material and cutting it into sheets of very accurate length.

A still further object of this invention is to provide a relatively simple machine for close tolerance cutting of sheets from a strip of metal provided on a roll and for automatically stacking the cut sheets.

A feature of this invention is the provision of a method for close tolerance cutting of sheets in which the portion of a strip from which the sheet is being cut is bowed across its width and thereby made rigid so that the portion of the strip extending between two predetermined points will be of a fixed length.

A further feature of this invention is the provision of a method for cutting sheets from flat strip material in which over-run of the strip due to the momentum of the feeding mechanism does not affect the length of the sheet which is cut off.

Another feature of this invention is the provision of a machine having a feeding mechanism for feeding a strip of material past cutting means

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and including means for disengaging the feeding mechanism before the required amount of material is fed and means for positively stopping the feeding of the material when the required length has been fed past the cutting means.

Still another feature of this invention is the provision of an automatic cutting machine in which strip material is fed along rail means and is automatically cut to the desired length and in which the rail means are retracted after the sheet is cut so that the sheets are dropped and stacked one on top of the other.

A still further feature of this invention is the provision of a machine for cutting sheets from flat strip material in which the strip is fed past cutting means and the portion beyond the cutting means is stiffened so that when the end thereof engages a positive stop, the feeding of the strip past the cutting means will be stopped and any additional portion of the strip fed will accumulate between the feeding mechanism and the cutting means so that the length of the strip cut off will not be affected thereby.

Further objects, features and advantages will be apparent from a consideration of the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a side view of the automatic cutting machine in accordance with the invention;

Fig. 2 is a top view of the cutting machine of Fig. 1;

Fig. 3 is a detailed view of the stop mechanism;

Fig. 4 illustrates the manner in which the strip is stiffened by the cutting mechanism; and

Fig. 5 is a cross-sectional view along the lines 5—5 of Fig. 2.

In accordance with the invention, a method is provided for cutting sheets of very accurate length from a strip of material which may be a roll of metal such as aluminum. In this method the strip is fed on rail means past cutting means and the portion fed beyond the cutting means is bowed across the width thereof to stiffen this portion. When the end of the strip reaches a predetermined point the feeding mechanism is disengaged from its driving means and the mechanism is stopped as soon as possible. However, in order to handle metal strips of considerable width, the feeding mechanism must be relatively heavy and accordingly a definite time is required before the feeding mechanism will stop even when using effective braking means. When the end of the strip reaches a fixed point beyond the predetermined point it is positively stopped and as the portion between the cutting means and the stop

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is relatively rigid, additional material will not be fed past the cutting means. A space is provided between the feeding mechanism and the cutting means and the portion of the strip extending in this space is not stiffened so that any additional material fed after the strip engages the positive stop may accumulate in this space. After the movement of the strip has stopped, the cutting means are actuated causing the sheet of the desired length to be cut off. This sheet is then dropped by the rails on which it is supported and the cycle started again resulting in the cutting of additional sheets. An automatic machine for accomplishing this method has also been provided and will be described in detail hereinafter.

Referring now to Figs. 1 and 2, there is illustrated one form in which the cutting machine in accordance with the invention may be embodied. This apparatus includes a feeding mechanism generally indicated at 10, cutting means 11, rail means 12 for supporting and bowing the strip, and a stop mechanism generally indicated as 13. For supporting the various operating components referred to above, a frame structure 14 is provided and a driving mechanism 15 including a driving motor 16 is provided for furnishing power for operation of the machine. The frame structure 14 includes means for supporting a roll of strip material 20 which may be metal such as aluminum. A plurality of rollers 21, 22, 23, 24 and 25 are provided for straightening the strip 20 and guiding it through the machine. Annular rims 26 may be provided on the rollers as illustrated on rollers 22 and 23 for guiding the sheet into the machine. The feeding mechanism includes additional rollers 28 and 29 which are driven by the driving mechanism 15 for feeding the strip 20 as will be further explained.

The strip 20 is fed along a support 30, under a movable shear blade 31 which is part of the cutting means 11, and then along tubular rails 32 and 33 which support the edges of the sheet. A third rail member 34 is supported above the rails 32 and 33 by a frame member 35 which is a part of the frame structure 14 of the machine. The rail 34 includes an end 36 which is positioned above the tubular rails 32 and 33 so that the strip 20 is fed therebetween. The forward end 37 of the rail 34 extends below the upper surface of the tubular rails 32 and 33 so that as the strip is fed along the rails it is bowed down in the center in a manner clearly shown in Fig. 5. The rail 34 is therefore interposed between rails 32 and 33 so that the surfaces thereof which engage the strip bow the same. This bowing of the strip across its width stiffens the strip lengthwise in a well known manner. The feeding mechanism 10 feeds the strip 20 until it engages the stop 13 after which automatic controls cause the feeding mechanism to be disengaged from the driving means, the end of the strip 20 to be positively stopped, and the cutting mechanism to cut off the strip at the desired length. These automatic controls will be later described in detail.

It is pointed out here that the feeding mechanism, the cutting means, and the driving means are not in themselves a part of the invention and components of any standard construction can be used. Specifically, the various components of the driving mechanism such as the shafts, chain and belt drives, and clutches may be of any suitable construction and are illustrated only schematically to point out the manner in which the machine operates. Also, the specific construction of the feeding mechanism and cutting means are

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merely illustrative, and these components may take any other well known form. The over-all machine which includes these elements in combination with the rail means and the stop mechanism is, however, a part of the present invention. This machine also provides one structure by which the method of the invention can be practiced.

Referring now to the driving means 15 shown in Fig. 2, it is noted that the motor 16 is connected to shaft 40 through a belt 41. Shafts 42 and 43 may be driven from shaft 40 by chains 44 and 45, respectively. The feeding roller 28 is operatively connected to the shaft 40 by clutch 46 and the roller 29 is geared to the roller 28 so that the two rollers are simultaneously driven. The cutting means 11 is adapted to be connected to the shaft 42 by clutch 47 and a control shaft 48 is connected to the shaft 43 by clutch 49. The cutting means includes a shaft 50 having a pair of cams 51 secured thereon which are adapted to engage projecting arms 52 secured to the shear blade 31. To permit movement of the shear blade 31 in a vertical direction, it is supported in guides 53. The blade is held in the normal upward position by springs 54 which bear against the projecting arms 52, and when the shaft 50 is connected to the driving mechanism 15 by clutch 47, the cams 51 rotate so that the extending portions thereof bear against the projecting arms 52 to cause the shear blade 31 to move downwardly. The blade 31 cooperates with a stationary shear blade 55 to cut off the strip 20.

The rail means 32 and 33 are retractable to drop a sheet which has been cut off. These rails are supported by arms 60 pivotally supported on the frame structure 14. For moving the rails 32 and 33, actuating bars 61 are provided which are arranged to be moved to the right (Fig. 2) to cause the rails to move to the left and to be withdrawn from under the edges of the sheet as will be apparent. The bars 61 are actuated by a lever 62 which is operatively connected to a cam 65 on the control shaft 48 by arms 63 and 64. The arm 64 extends vertically and is moved to the right by the projecting part of the cam 65 when the shaft 48 is rotated. Springs 59 connected between certain of the arms 60 and the frame structure hold the rails 32 and 33 in the normal position for supporting the strip 20. As illustrated in Fig. 1, a flat truck 68 can be positioned under the rail structure 12 so that as the movable rails 32 and 33 are retracted the sheet which is cut off can be dropped thereon. Suitable guiding structures such as illustrated at 69 can be secured to the frame 14 so that the sheets are stacked in an even pile by the cutting machine.

Referring now to Fig. 3, the details of the stop mechanism 13 will be described. The stop mechanism includes a base portion 70 which is adjustably supported on the frame member 35. This adjustment can be provided by making the base 70 of a channel-shaped configuration which fits on the edge of the member 35 and providing a thumb screw 71 for holding the base in position. The stop is adjustably positioned along the support 35 so that sheets can be cut to any desired length as will be described. The stop includes a vertical portion 72 and a movable arm 73. The movable arm includes a plate 74 thereon which is positioned to be engaged by the end of the strip 20 as it is fed along the rail structure. A switch 75 is provided on the vertical portion 72 having a movable contact member 76 adapted

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to be operated by the movable arm 73. A pair of springs 77 and 77a are provided on the contact member 76, the spring 77 being positioned between the movable arm 73 and a rim 78 on the movable contact 76 and the spring 77a being positioned between the rim 78 and the portion 72 of the stop. The spring 77 is stiffer than the spring 77a so that as the arm 73 is engaged by the strip 20 the initial movement of the arm will be transmitted through the spring 77 to the contact 76 causing the switch 75 to be closed. Further movement of the arm 73 is then absorbed by the spring 77a. The movement of arm 73 is limited by screw 79 adjustably positioned on the portion 72 of the stop which acts as a positive stop to prevent further movement of the arm 73.

Considering now the over-all operation of the machine, the strip 20 is fed along the rails 32 and 33 and is bowed by action of the rail 34. When the end of the strip engages the arm 73 the switch 75 is closed which provides a closed circuit through battery 80 and solenoid 81 (Fig. 2). The solenoid is arranged to operate the clutch 49 which connects the control shaft 48 to the driving mechanism. Cam 82 is, therefore, rotated and operates through lever 83 to cause the clutch 46 to be disengaged thereby disengaging the feeding roll. The lever 83 also acts to engage brake 84 for stopping the feeding mechanism. As the feeding mechanism has considerable momentum, it cannot be stopped instantaneously by the brake and the feeding of the strip 20 will not stop immediately but will continue and the end of the strip will move the arm 73 until it engages the screw 79 which acts as a positive stop. As the portion of the strip 20 between the cutting means 11 and the stop 13 is bowed across its width, it is relatively rigid lengthwise and the stop 13 is, therefore, effective to prevent the feeding of additional material past the cutting means. Any additional material which is fed by the feeding mechanism after the strip 20 engages the positive stop will accumulate between the feeding roll 28 and the cutting means 11 causing the strip to buckle in this space. This action is shown in Fig. 4 in which the strip 20 is shown buckled upwardly in the region designated as 85.

After the feeding of the strip 20 has stopped, the continued movement of the control shaft 48 causes the cam 86 thereon to operate lever 87 which is effective to engage clutch 47 for connecting the cutting mechanism to the driving means. As previously stated, rotation of the cams 51 causes the blade 31 to be moved downwardly to shear the strip 20 as shown in Fig. 4. Further rotation of the control shaft 48 causes the cam 65 to engage the arm 64 which acts through arm 63, lever 62 and bars 61 to retract the rails 32 and 33 causing the strip which is cut off to be dropped. As soon as the sheet is dropped, the arm 73 of the stop mechanism will be released causing the solenoid to be deenergized and the control mechanism restored to condition for cutting another sheet. The feeding mechanism operates to feed the strip on to the rail structure again and the entire operation is automatically repeated.

It is apparent, therefore, that the length of the sheet cut off is accurately determined by the position of the screw 79, which forms a positive stop with respect to the cutting means 11. This distance can be altered by adjusting the position of the stop along the support 35, and fine adjustment can be obtained by adjustment of the

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screw 79 in the arm 72. The position of the rail 34 on the support 35 may also be adjusted to provide the required bowing of the strip depending on the length of the sheet being cut and the material of the strip. When using relatively heavy material, it is not necessary to bow the strip as much as when using lighter material and, therefore, the rail 34 would be positioned differently with respect to the rails 32 and 33. When making a very short cut it would be necessary to provide a shorter rail 34 and likewise in making a very long cut, a longer rail might be required. As the rail 34 is adjustably positioned on the support 35 by bolts 90 and nuts 91, it is obvious that by providing a plurality of holes in the support 35, the position of the rail can be easily changed and longer or shorter rails can be very easily substituted.

In Figs. 1 and 3 there is illustrated a counter 93 which may be used with the stop mechanism 13. This counter includes an arm 94 connected through spring 96 to an arm 95 on the movable arm 73 of the stop mechanism. Movement of the arm 73 will be transmitted through the spring 96 to cause movement of arm 94 which actuates the counting mechanism. Such a counter may be of any standard type having an actuating arm which can be coupled to the moving arm 73 of the stop. It is apparent that such a counter would indicate the number of sheets which are cut from the strip 20. As the machine is fully automatic and cuts sheets rapidly with very little attention, the use of such a counter may be very desirable to keep account of the sheets cut.

It is, therefore, seen that there is provided an improved method for cutting sheets from strips of material which is effective to cut sheets to very accurate lengths. A new cutting machine for practicing this method is also provided. Although the machine has been described as suitable for cutting an aluminum strip provided on a roll, it is apparent that it would be suitable for cutting sheets from strips of other material whether metallic or not as long as the material is sufficiently stiff that bowing of the same tends to make it rigid thereby permitting the movement of the strip to be positively stopped when the end thereof moves the arm 73 in engagement with the positive stop 79.

Cutting machines in accordance with the invention have been constructed and have been found very satisfactory in actual use. When cutting sheets from an aluminum strip, the machines have been found to cut sheets in lengths up to 12 feet with an error of only $\frac{1}{16}$ of an inch. This is more accurate than other machines available including the much more complicated machines such as the "flying shears." The machine cuts the sheets rapidly and requires practically no attention, one operator being able to operate a plurality of machines at the same time. As the machine stacks the cut sheets on a truck they can be easily moved for shipping or further processing.

While I have described one embodiment which is illustrative of my invention, it is obvious that various changes and modifications can be made therein without departing from the intended scope of the invention as defined in the appended claims.

I claim:

1. A machine for close tolerance cutting of sheets from a strip of material comprising, rail means for supporting said strip, cutting means positioned at one end of said rail means, a stop

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mechanism positioned at the other end of said rail means, and a feeding mechanism for feeding said strip past said cutting means and along said rail means, said rail means including a pair of side rails for supporting the edges of the strip on the under side thereof and a center rail positioned to engage the top surface of said strip, said center rail having a bottom surface extending below the level of the top surfaces of said side rails to bow said strip downward across its width so that the portion of said strip between said cutting means and said stop mechanism is relatively rigid.

2. A machine for close tolerance cutting of sheets from a strip of material comprising, rail means for supporting said strip, cutting means positioned at one end of said rail means, a stop mechanism positioned at the other end of said rail means, a feeding mechanism including driving means for feeding said strip past said cutting means and along said rail means, said rail means including retractable side rails for supporting the under surface of said strip and an intermediate rail engaging the upper side of said strip and including a surface extending below the level of the top surfaces of said side rail to bow said strip across the width thereof to stiffen the same, and a control system associated with said stop mechanism and arranged to stop said feeding mechanism, actuate said cutting means and retract said rail means so that a sheet of the desired length is cut off and dropped by said machine.

3. A machine for close tolerance cutting of sheets from a strip of material including in combination, rail means extending longitudinally of said strip, cutting means positioned at one end of said rail means, a feeding mechanism including disengageable driving means for feeding said strip past said cutting means and along said rail means, said rail means including portions positioned to engage upper and lower sides of said strip with the portions engaging the upper side of said strip extending below the portions engaging the lower side thereof, to bow said strip across the width thereof during the cutting operation to thereby stiffen the same, a stop mechanism including a movable arm positioned at the other end of said rail means in the path of said strip and a positive stop which limits the movement of said arm to stop the movement of said strip past said cutting means, and a control system for disengaging said driving means from said feeding mechanism when the end of said strip engages said movable arm, said control system being effective to actuate said cutting means when the movement of said strip has stopped.

4. A machine for close tolerance cutting of sheets from flat strip material comprising, rail means extending longitudinally of said strip, cutting means positioned at one end of said rail means, a stop mechanism including a movable arm positioned at the other end of said rail means, a feeding mechanism spaced from said cutting means for feeding said strip past said cutting means and along said rail means, said feeding mechanism including driving means and a brake and having considerable momentum so that an interval of time is required for stopping the same after said driving means is disengaged therefrom and said brake is applied, said rail means including portions positioned to engage upper and lower sides of said strip with the portions engaging the upper side of said strip extending below the portions engaging the lower side thereof, to bow said strip across the width

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thereof to make the portion of the strip extending between said cutting means and said stop mechanism substantially rigid, during the cutting operation, and a control system for disengaging said driving means from said feeding mechanism and for applying said brake when the end of said strip engages said movable arm, said stop mechanism including a positive stop which limits the movement of said arm and thereby stops the movement of said end of said strip at a predetermined position so that any additional strip material which is fed before said feeding mechanism stops accumulates between said feeding mechanism and said cutting means, said control system being adapted to actuate said cutting means when movement of said strip is stopped.

5. A machine for close tolerance cutting of sheets from flat strip material having relatively wide face surfaces including in combination, first and second elongated rail means extending longitudinally of said strip material on either side thereof, cutting means positioned at one end of said rail means, a stop mechanism including a movable arm positioned at the other end of said rail means, a feeding mechanism spaced from said cutting means and including disengageable driving means for feeding said strip material past said cutting means and along said rail means, said feeding mechanism having considerable momentum so that an interval of time is required for stopping the same after said driving means is disengaged therefrom, said first rail means having surface portions engaging said strip material on one side thereof, said second rail means having surface portions engaging said strip material on the other side thereof and extending beyond said surface portions of said first rail means to bow said strip material across the width thereof along the entire longitudinal portion thereof extending between said cutting means and said stop mechanism to make the same substantially rigid during the cutting operation, and a control system for disengaging said driving means from said feeding mechanism when the end of said strip material engages said movable arm, said stop mechanism including a positive stop which limits the movement of said arm and thereby stops the movement of said end of said strip material at a predetermined position so that any additional strip material which is fed before said feeding mechanism stops accumulates between said feeding and said cutting means.

6. A machine for close tolerance cutting of sheets from flat strip material having relatively wide face surfaces including in combination, first and second elongated rail means extending longitudinally of said strip material for supporting the same, cutting means positioned at one end of said rail means, a stop mechanism positioned at the other end of said rail means, a feeding mechanism spaced from said cutting means and including disengageable driving means for feeding said strip material past said cutting means and along said rail means, said feeding mechanism having considerable momentum so that an interval of time is required for stopping the same after said driving means is disengaged therefrom, said first rail means including a pair of rails positioned longitudinally of said strip material having surfaces defining a plane which engage one face surface of said strip, said second rail means having surface portions engaging the other face surface of said strip material and extending from said plane in the direction of

said pair of rails and in the space therebetween, said rail means bowing said strip material across the width thereof along the entire portion thereof extending between said cutting means and said stop mechanism to make the same substantially rigid during the cutting operation, and a control system for disengaging said driving means from said feeding mechanism when the end of said strip material engages said stop mechanism, said stop mechanism including a positive stop which limits the movement of said strip material at a predetermined position so that any additional strip material which is fed before said feeding mechanism stops accumulates between said feeding means and said cutting means.

7. A machine for close tolerance cutting of sheets from flat strip material having relatively wide face surface including in combination, rail means extending longitudinally of said strip material for supporting the same, cutting means positioned at one end of said rail means, a stop mechanism positioned at the other end of said rail means and spaced with respect to said cutting means to establish the length of the cut sheets, a feeding mechanism spaced from said cutting means for feeding said strip material to said cutting means and past said cutting means along said rail means to said stop mechanism, said feeding mechanism together with the strip material having considerable momentum so that an interval of time is required for stopping the same, said rail means including a plurality of rails positioned longitudinally of said strip material and having portions interposed between each other with surfaces thereof engaging opposite face surfaces of said strip to bow the same across the width thereof throughout the entire length of the portion of said strip material extending between said cutting means and said stop mechanism to render the said portion substantially rigid longitudinally during the cutting operation, and a control system for said feeding mechanism rendered operative when the end of said strip material engages said stop mechanism to stop said feeding mechanism, said stop mechanism including means for positively stopping the end of said strip material when said end reaches a predetermined position, the portion of said strip material between said feeding mechanism and said cutting means being freely supported allowing the same to bow longitudinally so that any strip material which is fed after said end thereof has reached said predetermined position accumulates between said feeding mechanism and said cutting means.

8. A machine for close tolerance cutting of sheets from flat strip material having relatively wide face surfaces including in combination, rail

means extending longitudinally of said strip material for supporting the same, cutting means positioned at one end of said rail means, a stop mechanism positioned at the other end of said rail means and spaced with respect to said cutting means to establish the length of the cut sheets, a feeding mechanism spaced from said cutting means for feeding said strip material to said cutting means and past said cutting means along said rail means to said stop mechanism, said feeding mechanism together with the strip material having considerable momentum so that an interval of time is required for stopping the same, said rail means including spaced lower rails having top surfaces engaging one face surface of said strip material and an upper rail positioned between said lower rails and having a bottom surface extending below the top surfaces of said lower rails and engaging the other face surface of said strip material, to bow said strip material across the width thereof throughout the entire length of the portion thereof extending between said cutting means and said stop mechanism to render the said portion substantially rigid longitudinally during the cutting operation, and a control system for said feeding mechanism rendered operative when the end of said strip material engages said stop mechanism to stop said feeding mechanism, said stop mechanism including means for positively stopping the end of said strip material when said end reaches a predetermined position, the portion of said strip material between said feeding mechanism and said cutting means being freely supported allowing the same to bow longitudinally so that any strip material which is fed after the end of said strip has reached said predetermined position accumulates between said feeding mechanism and said cutting means, said control system actuating said cutting means when movement of said strip material has stopped and thereafter causing said feeding mechanism to feed said strip material for the next sheet.

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