July 1, 1930. S. M. LANGSTON 1,769,883

SHEET SCORING AND SLOTTING MECHANISM

Filed July 24, 1923 4 Sheets-Sheet 1

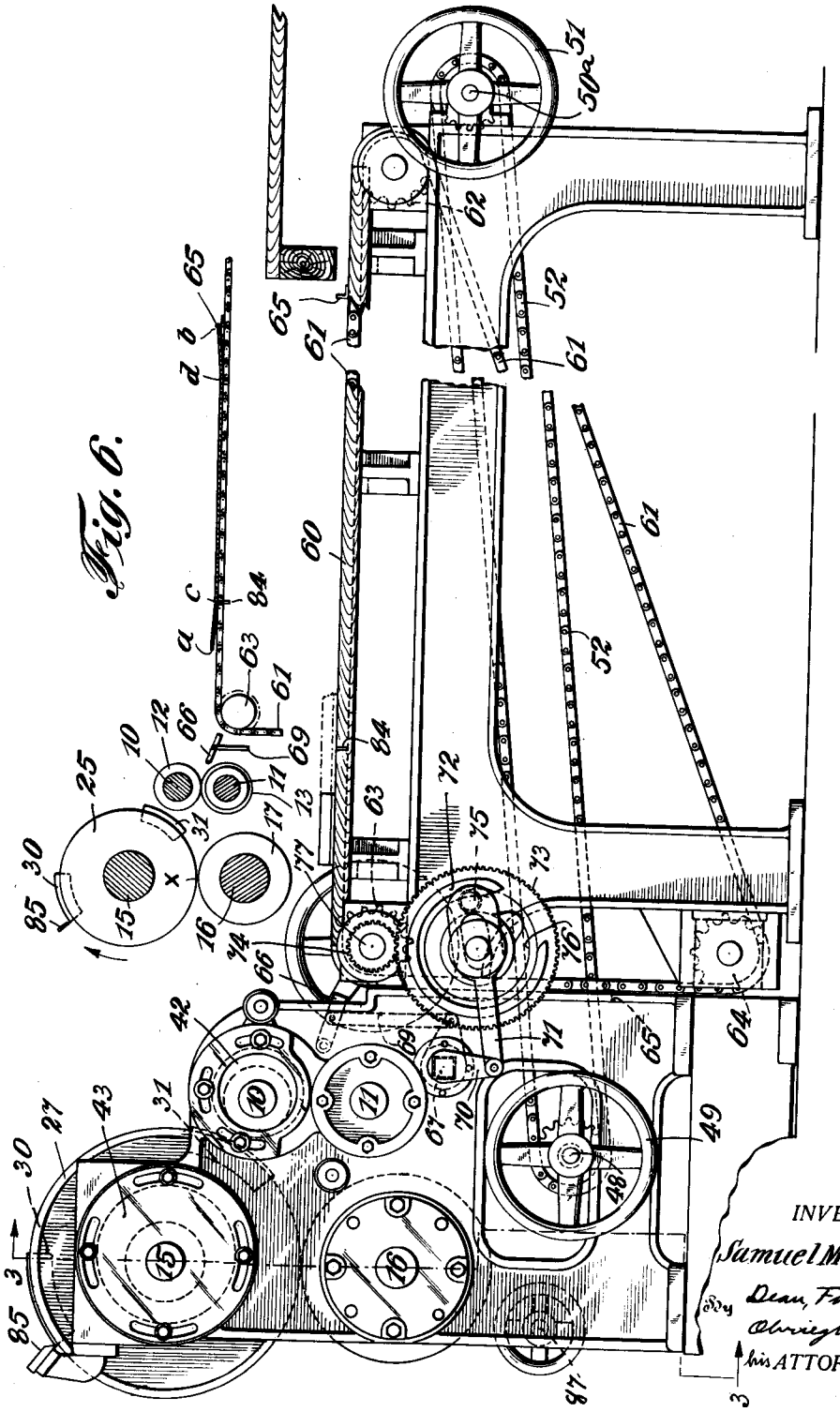


Fig. 6.

Fig. 1.

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SHEET SCORING AND SLOTTING MECHANISM

Filed July 24, 1923 4 Sheets-Sheet 2

Fig. 1.

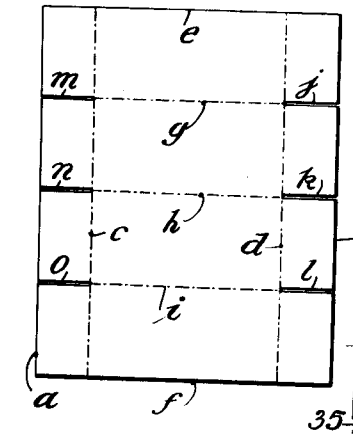


Fig. 2.

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SHEET SCORING AND SLOTTING MECHANISM

Filed July 24, 1923 4 Sheets-Sheet 3

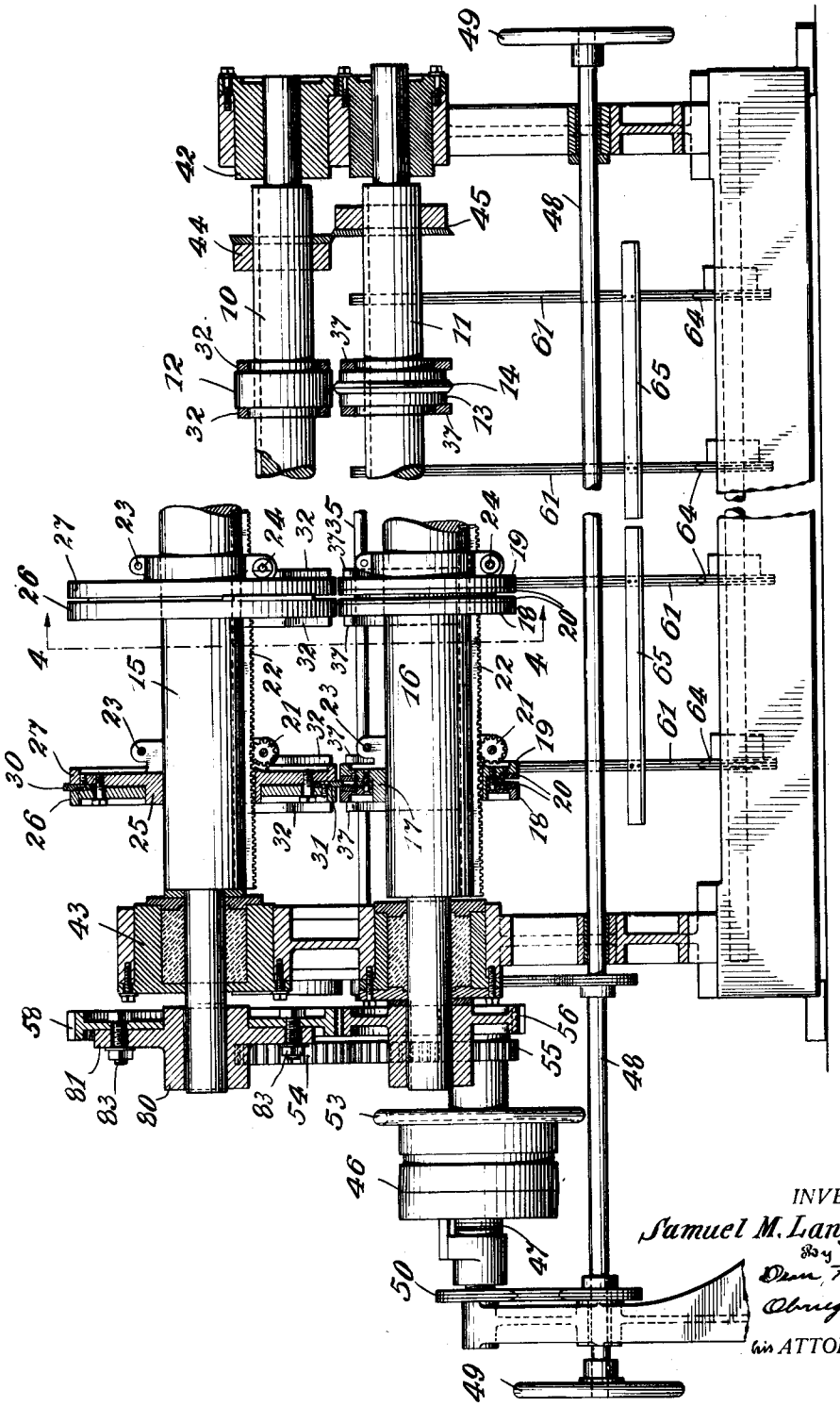


Fig. 3.

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SHEET SCORING AND SLOTTING MECHANISM

Filed July 24, 1923 4 Sheets-Sheet 4

Fig. 4.

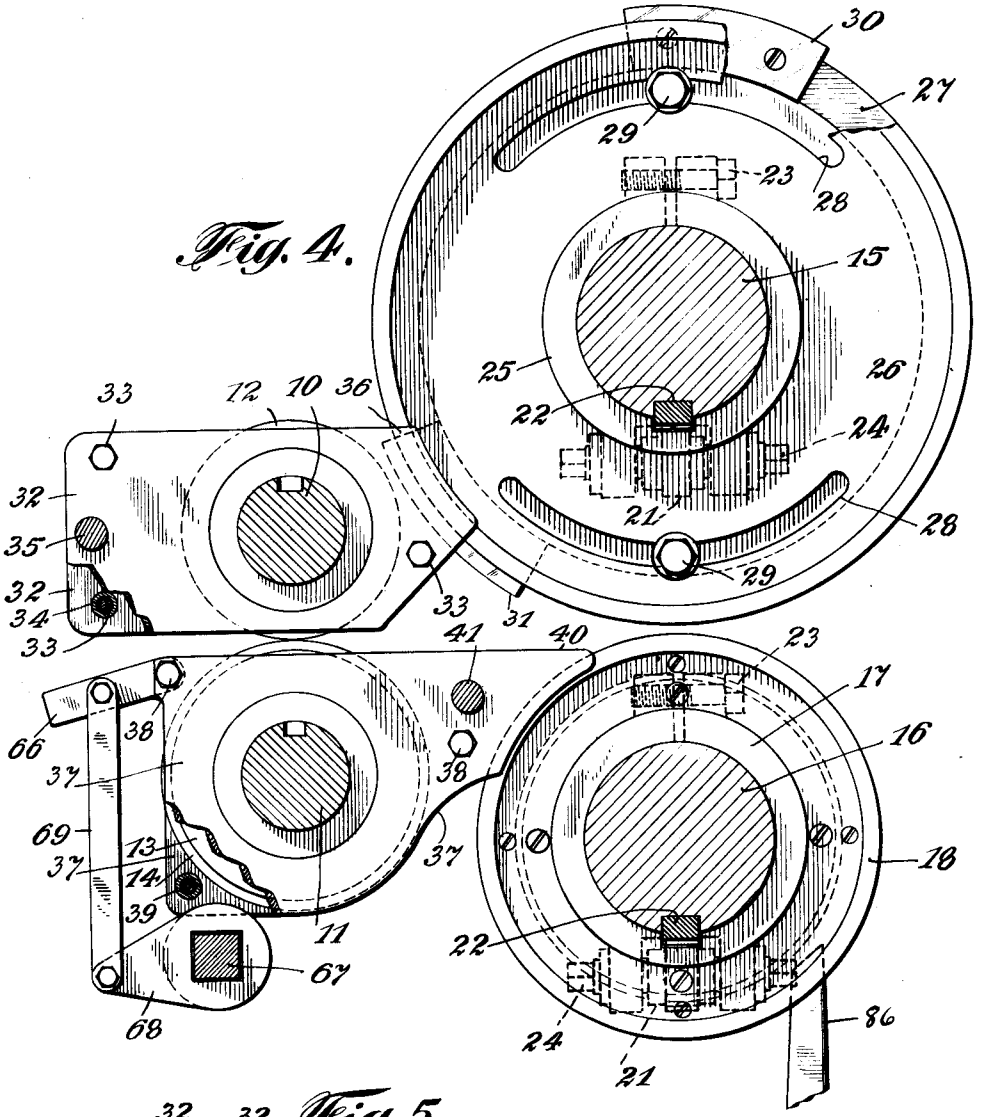
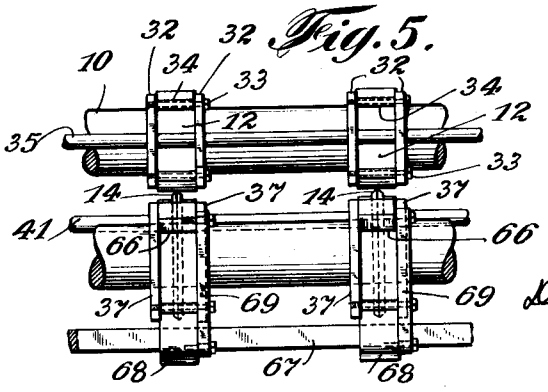


Fig. 5.



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Patented July 1, 1930

1,769,883

UNITED STATES PATENT OFFICE

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SHEET SCORING AND SLOTTING MECHANISM

Application filed July 24, 1923. Serial No. 653,431.

This invention is an improvement in mechanism for slotting, scoring, trimming or otherwise acting upon sheet material. The main features of the invention relate to the mechanism for scoring and slotting a sheet, as for instance in forming box blanks.

In machines of this general character it is common to provide a pair of coacting rotary members between which the sheet passes to score or crease the sheet along a fold line, and a second pair of coacting rotary members between which the sheet also passes to slot the sheet at one or both ends of the crease to separate adjacent portions which may be later folded to form the ends or end flaps of the boxes. The position of each slot must bear a definite relationship to the position of a crease or score line in the sheet, and therefore, in most machines when it is desired to adjust the machine for forming a blank for a different size or shape of box, both the scoring and slitting members must be independently adjusted to their new positions, and valuable time is required in getting them in proper registry with each other.

One object of my invention is to save time in making adjustments and insure greater accuracy in adjustments by providing interengaging parts connecting the scoring and slotting mechanism, whereby independent axial movement is prevented, simultaneous and equal adjustment is assured, and only one pair of members rather than both pair need be directly moved and accurately positioned.

A further object is to provide a simple and easily operated mechanism for moving the parts axially in either direction, and to any extent.

A further object is to provide a simple and improved mechanism for disengaging the sheet from the slat, lugs or other sheet advancing part of the endless belt or chain feed mechanism before said slat or the like passes out of the plane of travel of the sheet. Thus I avoid injury to or bending of the edge of the sheet by said part when the latter leaves its straight line feeding run.

A further object is to provide means for automatically positioning the sheet lifting mechanism in proper relationship to the scoring and slotting members, irrespective of the particular axial adjustment of the latter.

A further object is to provide a simple and improved means for facilitating the relative adjustment of the slotting and feeding mechanism, whereby the operator may insure such feeding of the sheet that the slots will be formed of the desired length, or in the desired position in respect to a particular part of the sheet.

In the accompanying drawings I have illustrated one embodiment of my invention. In these drawings:

Fig. 1 is a side elevation.

Fig. 2 is a side elevation of a portion of the machine showing the opposite side from that appearing in Fig. 1.

Fig. 3 is a vertical section on the line 3—3 of Fig. 1.

Fig. 4 is a vertical section on the line 4—4 of Fig. 3, but on a larger scale.

Fig. 5 is an elevation of certain of the parts taken on the line 5—5 of Fig. 2.

Fig. 6 is a somewhat diagrammatic view of certain of the parts shown in Fig. 1, and

Fig. 7 is a plan view of a box blank of the general character which may be produced by the machine illustrated.

A type of blank which may be scored and slotted by my improved machine is illustrated in Fig. 7. The blank may previously have the opposite edges *a* and *b* trimmed to give the blank the proper width, and the fold lines *c* and *d* may also have been previously formed in the blank, and by other mechanism. The machine illustrated is designed to trim the edges *e* and *f* to give the blank the desired length, to form the score lines *g*, *h* and *i*, along which the body of the blank may be folded to form the four sides of the box, and to form the slots *j*, *k*, *l*, *m*, *n* and *o* from the fold lines *c* and *d* to the ends of the blank, and in alignment with the score lines *g*, *h* and *i*. It will be evident that the trimming of the edges *a*, *b* and the forming of the score lines *c*, *d*, may be accomplished after the blank leaves my im-

proved machine, or before it reaches the machine or the machine may be provided with an attachment for performing these operations.

For scoring or creasing the blank to form the lines *g*, *h* and *i*, the machine is provided with a pair of parallel shafts 10 and 11 bearing a plurality of pairs of rotary coacting scoring members. I do not wish to be limited to any particular type of scoring members, but as shown, the upper shaft 10 has a rotary member 12 provided with a hardened cylindrical face, and the lower shaft 11 has a rotary member 13 having an annular V-edge scoring blade 14 adapted to coact with the surface of the member 12 to form the crease as the sheet passes between the two members. The number of pairs of coacting scoring members corresponds to the number of score lines which it is desired to form in the sheet. For forming the blank shown in Fig. 7, there would be three of these pairs. Each member is held against rotation in respect to its shaft, but all of the members are axially adjustable along their respective shafts to bring the score lines to the desired distance apart.

For forming the slots *j*, *k*, *l*, *m*, *n*, and *o*, there are provided a pair of parallel shafts 15 and 16 having rotary coacting members for effecting the slotting action. The member 17 on the lower shaft 16 is illustrated as having two annular spaced flange portions 18 and 19 detachably connected, and having spaced annular blades 20 on their opposed faces so as to leave an annular groove therebetween of a width corresponding to the width of the slot to be formed in the sheet. The hub of the member 17 is provided with bearings for a pinion 21 which meshes with a rack bar 22 on the shaft 16. Preferably this rack bar is the spline or key which prevents relative movement of the shaft 16 and the member 17 and its outer edge is provided with teeth for meshing with the pinion. Thus by rotating the pinion the member 17 may be moved along the shaft to any desired extent, and in either direction. The hub of the member has a portion provided with a longitudinal slit in a radial plane so that the opposed faces at the slit may be drawn together by a clamp bolt 23 and tightly clamp the member against axial movement on the shaft. Any suitable means may be provided for rotating the pinion. For instance the pinion shaft may have its opposite ends extend through the bearings on the hub and present square terminal portions 24 with which a wrench may be engaged.

The upper shaft 15 is provided with a member 25 having a pair of spaced annular flange members 26 and 27 corresponding in a general way to the flange members 18 and 19 of the lower member. One of these, for instance the flange 27, may be integral with the hub of the member, while the other flange 26 is provided with curved slots 28 to receive clamping bolts 29 extending from the other flange. Thus the two flanges may be rotatably adjusted in respect to each other. The slotting of the sheet is performed by a pair of blades 30 and 31 which lie between the two flanges 26 and 27, and extend out radially beyond the peripheries of said flanges so as to enter the annular groove between the annular shear blades 20 of the lower member. One of these blades, for instance the blade 30, is rigidly secured to the flange 27 which is integral with the hub of the member 25. The other blade 31 is rigidly secured to the flange 26 which is rotatably adjustable in respect to the hub of the member. Thus by rotating the flange 26 in respect to the flange 27 the two blades 30 and 31 may be adjusted to leave any desired angular or circumferential distance between them. The upper member 25 is provided with a similar pinion, rack bar and clamping means for securing the axial adjustment of the upper member along its shaft.

In operation it is essential that the slots formed by the blades 30 and 31 come in alignment with the fold lines formed by the creasing or scoring members 12 and 13. Thus in adjusting the machine for a different size blank, I desire to insure the simultaneous and equal axial adjustment of the scoring members and the slotting members. To accomplish this result in a very simple manner, means are provided for interconnecting each scoring member with a corresponding slotting member so as to normally prevent any independent axial movement of one in respect to the other. As shown, each upper scoring member 12 has a pair of spaced plates 32 provided with apertures receiving hub portions of the scoring member, the two plates being rigidly connected and spaced by clamping bolts 33 and spacing collars or tubes 34. The two connecting plates are held against rotation with the shaft 10 and the scoring member 12 by means of a guide rod 35 which extends through the plates, and parallel to the shaft. The two plates have projecting terminal portions or flanges 36 which engage with the opposite sides of the flanges 26 and 27 of the corresponding slotting member 25. The scoring member 12 is not clamped to its shaft, and is freely slidable along the latter but is held from rotation in respect thereto. By reason of the engagement of the flange portions 36 of the plates 32 with the opposite faces of the slotting member, it will be seen that any axial adjustment of the slotting member resulting from rotation of its pinion will move the corresponding scoring member to an equal extent and in the same direction, so that the scoring member and the slotting member will always remain in proper registry.

Similar means are employed for adjusting the lower scoring member along with the lower slotting member. As shown, there are two plates 37 which are rigidly connected by clamping bolts 38 and spaced by collars or sleeves 39 on these clamping bolts. The two plates have flanges or journal portions 40 for engaging with opposite sides of the two flanges 18 and 19 of the lower slotting member, and are held against rotation by a guide rod 41. Thus the lower scoring member is moved axially with the lower slotting member.

The shafts 10, 11, 15 and 16 are mounted in a suitable frame and are driven from a common source of power. The upper shafts 10 and 15 may be mounted in eccentric bushings 42 and 43 whereby each upper shaft may be adjusted toward or from the lower one to give the proper coaction or engagement of the operating members thereon. The shafts 10 and 11 are also preferably provided with rotary coacting shearing members 44, 45 of any suitable character which act to trim the edges *e*, *f*, of the blank, while the lines *g*, *h* and *i* are being scored. These trimming members or knives are of course axially adjustable to adapt the machine for different widths of blanks, but the details thereof are not important so far as my present invention is concerned.

The drive of the machine is illustrated as including a drive pulley 46 mounted on a counter-shaft 47 and connected thereto by a suitable clutch for stopping and starting the machine without stopping the drive pulley. To enable the operator to quickly stop or start the machine, irrespective of which side of the machine he may be standing on, I provide a transverse shaft 48 having hand wheels 49 on opposite sides of the machine and connected by a chain drive 50 to the clutch operating mechanism. At the opposite end of the machine there may be provided a second transverse shaft 50ª having hand wheels 51 upon opposite ends thereof, and the two shafts may be connected by sprockets and a chain 52. The drive shaft 47 is provided with a hand wheel 53 whereby the machine may be turned by hand when the clutch is open, particularly in connection with the relative adjusting of the blades and feed hereinafter referred to. The drive shaft has a pinion 54 meshing with gears 55 and 56 on the shafts 11 and 16, and these gears mesh with gears 57 and 58 on the upper shafts 10 and 15. Thus the upper slotting and scoring members rotate in one direction, and the lower slotting and scoring members rotate in the opposite direction.

For feeding the sheets to the scoring and slotting mechanism there is provided a sheet supporting table 60 having grooves therein receiving a plurality of endless chains 61 forming a part of the feed mechanism. The endless chains travel over sprockets 62 and 63 at opposite ends of the table and sprockets 64 beneath the table. This gives to each chain a straight line feeding run along the table toward the line of tangency of the scoring members. Preferably the upper surface of the table is in a slightly lower plane than the plane defined by the lines of tangency of the scoring and slotting members.

The feed chains are provided with sheet engaging parts which engage the rear edge of the sheet lying on the table 60 and advance said sheet along the table and between the scoring members. Any suitable sheet engaging parts may be employed, but preferably these are in the form of transverse slats or bars 65, each of which is connected to all of the endless chains 61. There may be any desired number of these sheet feeding slats, but the machine illustrated is so proportioned and designed as to permit of the use of three such bars.

As the sheet feeding bar 65 reaches the end of the table nearest to the scoring members, it moves out of its straight line feeding run and over the sprockets 63. It is desirable that the rear edge of the sheet be lifted out of engagement with this feed part before such downward movement of the feeding part begins. This prevents bending or injury of the rear edge of the sheet. To guide the sheet from the table to the scoring members and for raising the rear edge of each sheet when said edge reaches a predetermined position, I provide a plurality of pivoted fingers 66 normally disposed in an inclined position and guiding the advancing end of the sheet upwardly from the table to the line of tangency of the scoring members. Each of these guiding and lifting fingers is preferably pivotally mounted on one of the bolts 38 which connect the two plates 37 of a corresponding scoring member. Thus as each scoring member is adjusted axially, that is, transversely of the machine, its guiding and lifting finger will be carried along with it and will always be in proper registry with the scoring member.

For intermittently lifting these guiding members there is provided a rock shaft 67 which is provided with a plurality of arms 68 each connected by a link 69 to the corresponding lifting finger 66. The arms 68 are held against rotation in respect to the rock shaft but are freely movable along the latter. As shown, the rock shaft is square in cross section, and is positioned closely adjacent to the lower edge of the plates 37 so that the hub portion of the arm 68 may be held between the two plates 37 and will be moved transversely of the machine with said plates and the scoring member.

For oscillating the rock shaft, the latter is provided with an arm 70 at one end connected by a link 71 to a cam 72. The cam is connected to or integral with a gear 73 mesh-

ing with a pinion 74 on the same shaft 77 which supports the sprockets 63. The gear 73 is of such size in respect to the pinion that it will make one revolution for each sheet engaging slat 65 on the endless chain, and the cam is so formed that the rock shaft will be oscillated and the fingers raised as each slat 65 reaches the end of the table nearest to the scoring mechanism. As shown the link 71 has a yoke portion encircling the shaft 77 of the gear 73, and is provided with a roller 75 movable in a cam groove 76. The major portion of this groove is circular so as to hold the fingers 66 stationary, but at one point in the groove there is a sharp outward bend which causes the desired quick upward movement of the fingers 66 and the rear edge of the sheet. The cam drops the fingers before the next sheet approaches so that the fingers come below the sheet and guide it to the scorers.

In the operation of the machine, it is important that the proper portions of the sheet reach the slotting members as each of the blades 30 and 31 comes into operation, and therefore the sheet feeding parts 65 and the blades 30, 31, must be adjusted in respect to each other to take care of blanks of different size. The shaft 77 which carries the sprockets 63 and the pinion 74 is provided with a pinion 78 meshing with an intermediate pinion 79 which latter meshes with the pinion 55 of the shaft 11. By means of the gearing above described, the slotting, scoring and feeding mechanism are all operated from the same drive shaft, and the gear ratio is such that the speed of the sheet feeding parts 65 is substantially equal to the surface speed of the slotting and scoring members. In order to effect a relative adjustment of the blade 30 and the sheet feeding members 65, clutch connections are provided between the drive shaft and one of these members. Merely as an example of such clutch connections I have shown the gear 58 of the shaft 15 rotatably adjustable in respect to a hub 80 keyed to the shaft 15. The hub is shown as having a flange 81 provided with curved slots 82 receiving locking bolts 83 carried by the gear 58. By loosening these bolts the shaft 15 and its connected parts may be rotated in respect to the remainder of the machine.

As one important feature of my invention I provide a pair of adjusting guides, one for the feeding member 65 and the other for the blade 30. One of these adjusting guides is shown as a narrow transversely extending insert 84 in the table 60, and the other is shown as a transversely extending bar or blade 85 supported at opposite sides of the machine and extending transversely thereof closely adjacent to the path of the periphery of the blades 30 and 31. These two adjusting guides are so positioned that they are at equal operative distance from the common line of tangency of the slotting members. In other words, the distance from the member 84 to the point x in Fig. 6 is equal to the distance from the member 85 clockwise around the member 25 to said point x. In adjusting the parts for slotting a blank such as that shown in Fig. 7, the blank is placed on the table and the feed mechanism is slowly operated until one of the sheet feeding members 65 advances the sheet and until the score line c exactly registers with the guide 84. The feed mechanism is held in this position and the bolts 83 are loosened so that the shaft 15 may be rotated until the rear end of the blade 30 which is rigidly connected to the hub of the member 25, exactly registers with the guide 85. The bolts 83 are then tightened to insure this positive and definite relationship of the blade 30 with the feed member 65. The flange 26 of the slotting member 25 is loosened and the blade 31 is adjusted until its forward or advancing end is spaced from the guide 85 to a distance exactly equal to the distance between the score lines c and d of the blank. The bolts 29 are then tightened and the parts are in the proper adjusted position. By means of this mechanism slots of any desired length may be made with the standard length of blades 30 and 31, and the blades will cut slots which extend in from the edges a and b to exactly the desired distance. This will be evident as the rate of travel of the feeding member 65 is equal to the peripheral speed of the blades 30 and 31. Thus, starting with the parts in the position shown in Fig. 6, the score line c will reach the point x at the same time as the rear edge of the blade 30. If the blade 30 be longer than the desired slot, it will be evident that the advancing edge of the blade will reach the point x before the advancing edge a of the sheet, but this will insure the proper length of cut from the edge a to the score line c. As the sheet continues to advance and the member 25 continues to rotate, the advancing end of the blade 31 will register with the score line d and the blade will cut the slot and ordinarily extend beyond the rear edge b of the sheet. This registry is insured by the fact that the distance between the rear end of the blade 30 and the advancing end of the blade 31 is equal to the distance between the score lines c and d. By positioning the two guide members 84 and 85, as indicated, the cooperating parts may be very quickly brought to the desired relative adjustment to insure the length and endwise spacing of the slots.

As it is not necessary to adjust the scoring members, and as the slotting members may be quickly and accurately adjusted by the pinions 21, it will be apparent that the minimum amount of time is required in setting up the

machine for making any desired form or size of box blank.

It will of course be evident that I do not wish to be limited to the specific construction illustrated. Various changes and rearrangements of the parts may be made without departing from the scope of my invention as defined in the appended claims. For instance, the scoring members may be placed on the opposite side of the slotting members so that the sheet is slotted before it is scored; the rack bar may extend along the shafts 10 and 11 so as to positively feed the scoring members and carry along the slotting members, the rack bar may be on the rock shaft 67 or the guide rods 35, 41, and the same result accomplished. The adjustment guide 84 is shown as a narrow slot or insert in the table 60 but it might be merely a line scratched or painted across the support in the desired position. These are only a few of the possible changes which may be made within the scope of my invention. The sheet engaging part is shown as a slat 65 which is connected to all of the endless chains. It will of course be evident that this slat might be subdivided into sections or replaced by mere lugs on the chains. In connection with the lower slotter members I have shown stripper fingers 86 mounted on a transverse shaft 87 and adjustable along the length of the shaft with the slotter members. These serve to remove from the lower slotter members pieces cut out in forming the slots. On the table 60 I have indicated in Fig. 1 a side guide 88 which may engage with one edge of the sheet and insure the proper positioning of the sheet transversely of the table for feeding to the trimming, scoring and slotting members.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A slotting and scoring mechanism including a pair of shafts having coacting slotter members thereon, a second pair of shafts having coacting scoring members thereon, and means for automatically moving one pair of members axially upon an axial movement of the other pair of members.

2. A slotting and scoring mechanism including a pair of shafts having coacting slotter members slidable thereon, a second pair of shafts having coacting scoring members slidable thereon, means connecting the members of one pair of shafts with those on the other pair of shafts for insuring simultaneous and equal axial movement.

3. A slotting and scoring mechanism including a scoring member and a slotting member rotatable about spaced parallel axes, a pair of plates engaging with opposite sides of one member and movable with said member upon the axial adjustment of the latter, and engaging with opposite sides of the other member for insuring simultaneous and equal axial adjustment of said other member.

4. A slotting and scoring mechanism including a scoring member, a slotting member, a pair of plates engaging with opposite sides of one member and movable with said member upon axial adjustment of the latter and engaging with the opposite sides of the other member for insuring simultaneous and equal adjustment of the latter, and means for preventing rotation of the plates about the axis of either member.

5. A slotting and scoring mechanism including a scoring member, a slotting member, a pair of plates engaging with opposite sides of one member and movable with said member upon axial adjustment of the latter and engaging with the opposite sides of the other member for insuring simultaneous and equal adjustment of the latter, and a guide rod engaging said plates and extending parallel to the axis of said members.

6. A slotting and scoring mechanism including two parallel spaced shafts, separate members on said shafts for acting in succession on a sheet of material, a guide parallel to said shafts, and means movable along said guide and engaging both of said members for insuring simultaneous and equal axial adjustment of said members.

7. A slotting and scoring mechanism including two parallel spaced shafts, separate members on said shafts for acting in succession on a sheet of material, means connecting said members to prevent independent axial adjustment, a rack bar parallel to said shafts, a pinion meshing with and movable along said rack bar for moving said members and said connecting means simultaneously axially of said shafts.

8. A slotting and scoring mechanism including a pair of parallel spaced shafts, slotting mechanism including a slotting member on one of said shafts, scoring mechanism including a scoring member on the other of said shafts, one of said shafts having a rack bar portion, and the member on said shaft having a pinion, and means connecting said members whereby both are adjusted axially along their respective shafts upon rotation of said pinion.

9. A slotting and scoring mechanism including a pair of shafts, a slotting member on one shaft, a scoring member on the other, means connecting said members for preventing independent axial adjustment, a rack bar parallel to said shafts, and a pinion meshing with said rack bar and rotatable to move along said rack bar and move said members along their respective shafts.

10. In combination a pair of rotary coacting members, one having a blade for acting on a sheet passing between said members, a feed mechanism including an endless member having a run toward the line of tangency

between said rotary members, and having a sheet engaging part, drive means for said rotary members and said endless member and permitting relative adjustments, and a pair of adjustment guides, one adjacent to the path of the blade and the other adjacent to the path of said part.

11. In combination a pair of rotary coacting members, one having a blade for acting on a sheet passing between said members, a feed mechanism including an endless member having a run toward the line of tangency between said rotary members, and having a sheet engaging part, drive means for said rotary members and said endless member, and permitting relative adjustments, and a pair of adjustment guides, one adjacent to the path of the blade and the other adjacent to the path of said part, said guides being at equal distances from the line of tangency of said rotary members, measured in the direction of travel of the blade and the sheet engaging part.

12. In combination a pair of rotary coacting members, one having a blade for acting on a sheet passing between said members, a sheet support, a sheet feeding member movable along said support toward the line of tangency between said rotary members, drive means for said rotary members and said feeding member and permitting relative adjustment, and a pair of adjustment guides, one adjacent to the path of movement of the blade and the other adjacent to the path of said feeding member, the distance of the first mentioned guide from the line of tangency measured along the path of movement of the blade being equal to the distance of the other guide from the line of tangency measured along the path of movement of the sheet.

13. A machine for making box blanks including the combination of a pair of cooperating rotary heads for slotting a blank, a scoring wheel rotatable about a separate axis from either of said heads for scoring said blank, means for positively driving said scoring wheel, whereby it acts as a feeder to said slotting heads, and means whereby said scoring wheel and one of said heads are connected to move in unison along their respective axes.

14. A machine for making box blanks, including the combination of a pair of cooperating rotary heads for slotting a blank, one of said heads having a pair of blades projecting from the periphery thereof and relatively adjustable peripherally, and the other having a groove, one of said heads being axially adjustable with the other when one of said blades is in said groove, a pair of coacting members for scoring said blank, one of said members presenting a cylindrical surface and the other including a shaft and a scoring wheel slidable on said shaft with a scoring edge juxtaposed to said surface, means for positively driving at least one of said members, whereby said members act as a feeder to said slotting heads, and means whereby said scoring wheel and one of said heads are connected to move axially in unison along their respective axes.

15. A slotting and scoring mechanism including a pair of parallel spaced shafts, coacting slotting members carried by said shafts and axially adjustable thereon, scoring mechanism including a separate shaft and a scoring member axially adjustable thereon, and means connecting said members to prevent independent axial adjustment.

16. A slotting and scoring mechanism including a pair of parallel spaced shafts, coacting slotting members carried by said shafts and axially adjustable thereon, scoring mechanism including a separate shaft and a scoring member axially adjustable thereon, and means carried axially by one of said first mentioned members and engaging with the scoring member to move the latter axially upon an axial movement of the former.

Signed at Camden in the county of Camden and State of New Jersey this 21st day of July, A. D. 1923.

SAMUEL M. LANGSTON.