May 22, 1928. 1,670,314

C. B. PEARSALL

SLOTTING MACHINE

Filed July 15, 1925 8 Sheets-Sheet 1

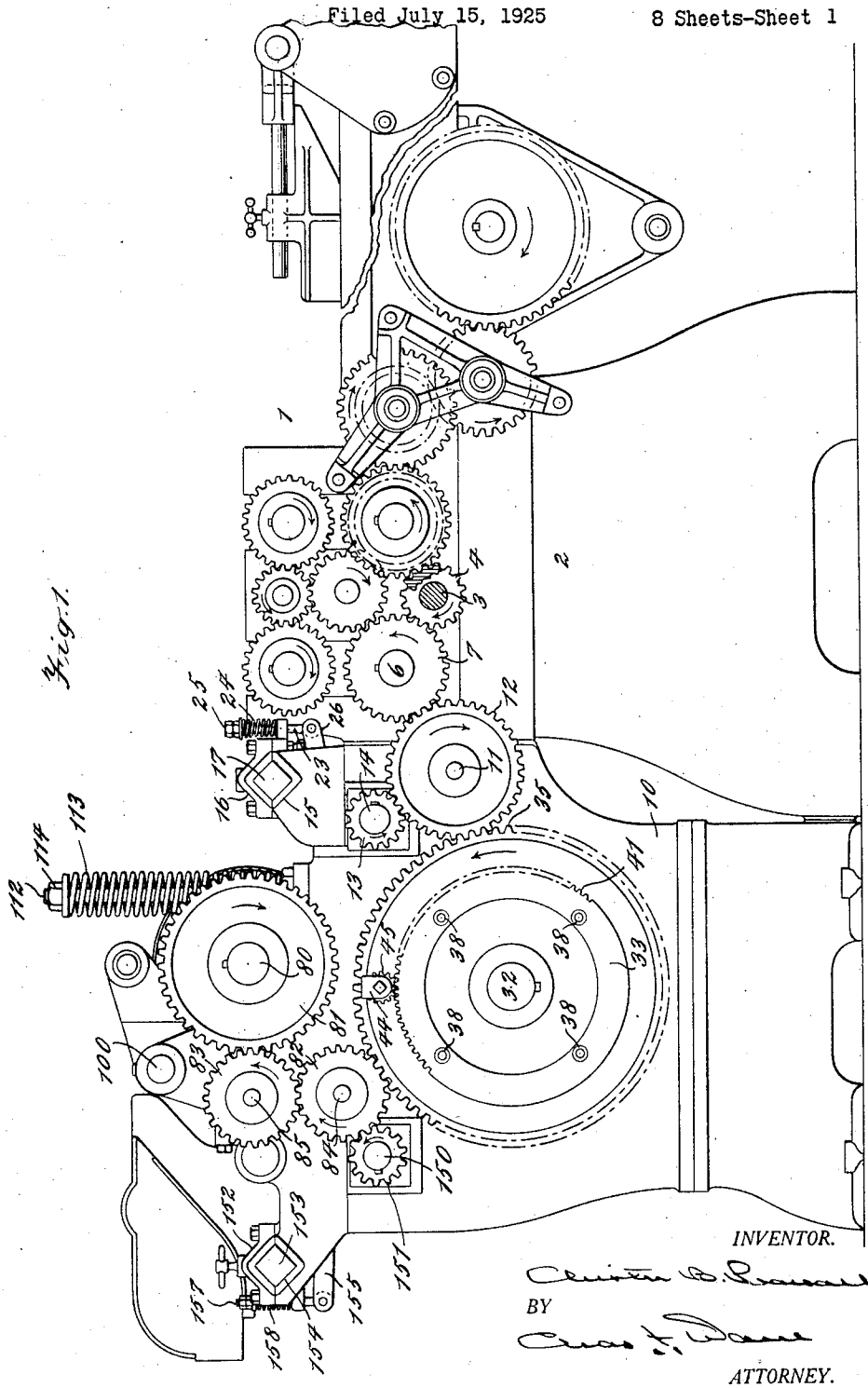


Fig. 1.

INVENTOR.

Christian B. Pearsall

BY

Chas. F. Dame

ATTORNEY.

May 22, 1928. 1,670,314

C. B. PEARSALL

SLOTTING MACHINE

Filed July 15, 1925 8 Sheets-Sheet 2

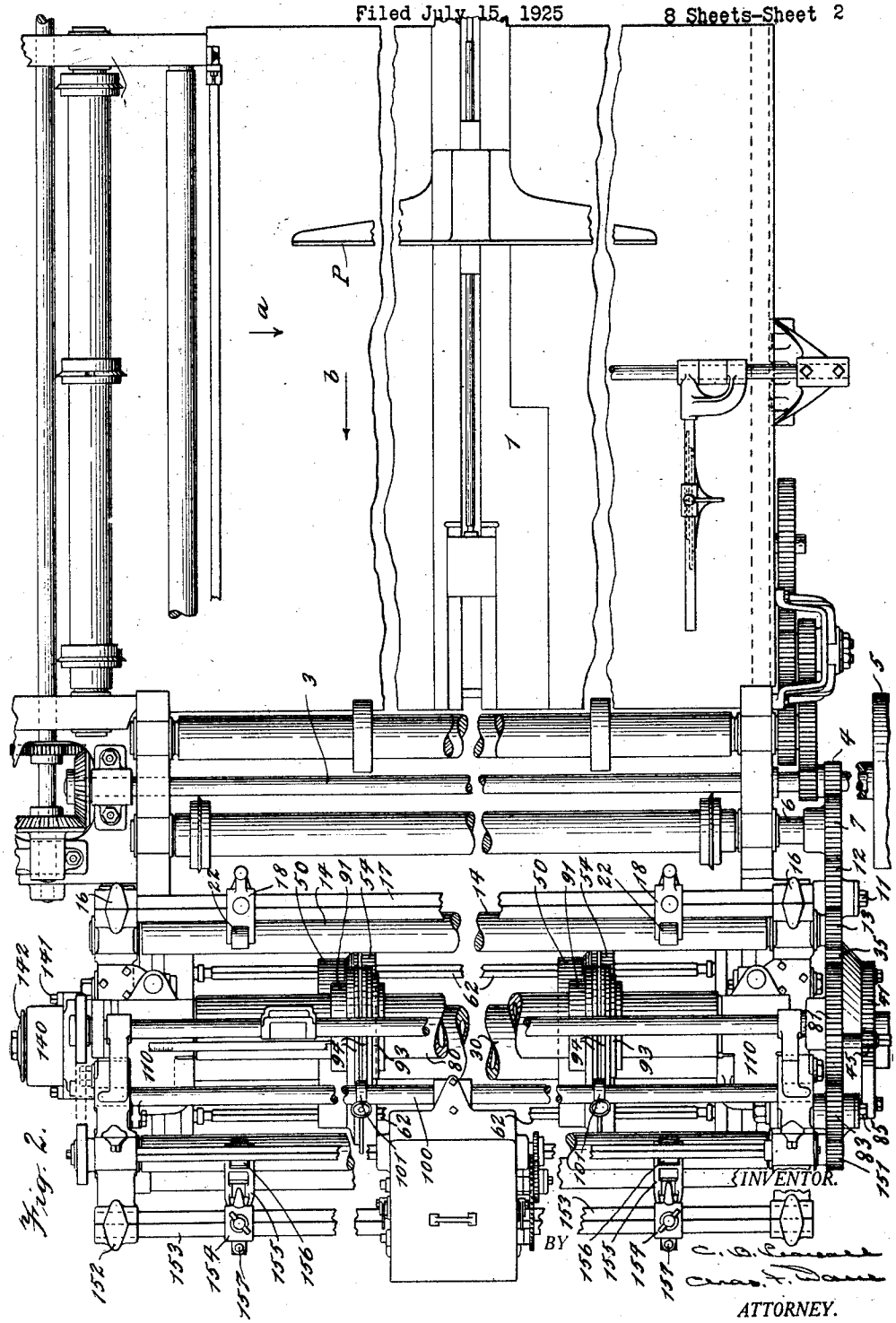


Fig. 2.

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ATTORNEY.

May 22, 1928. 1,670,314

C. B. PEARSALL

SLOTTING MACHINE

Filed July 15, 1925 8 Sheets-Sheet 3

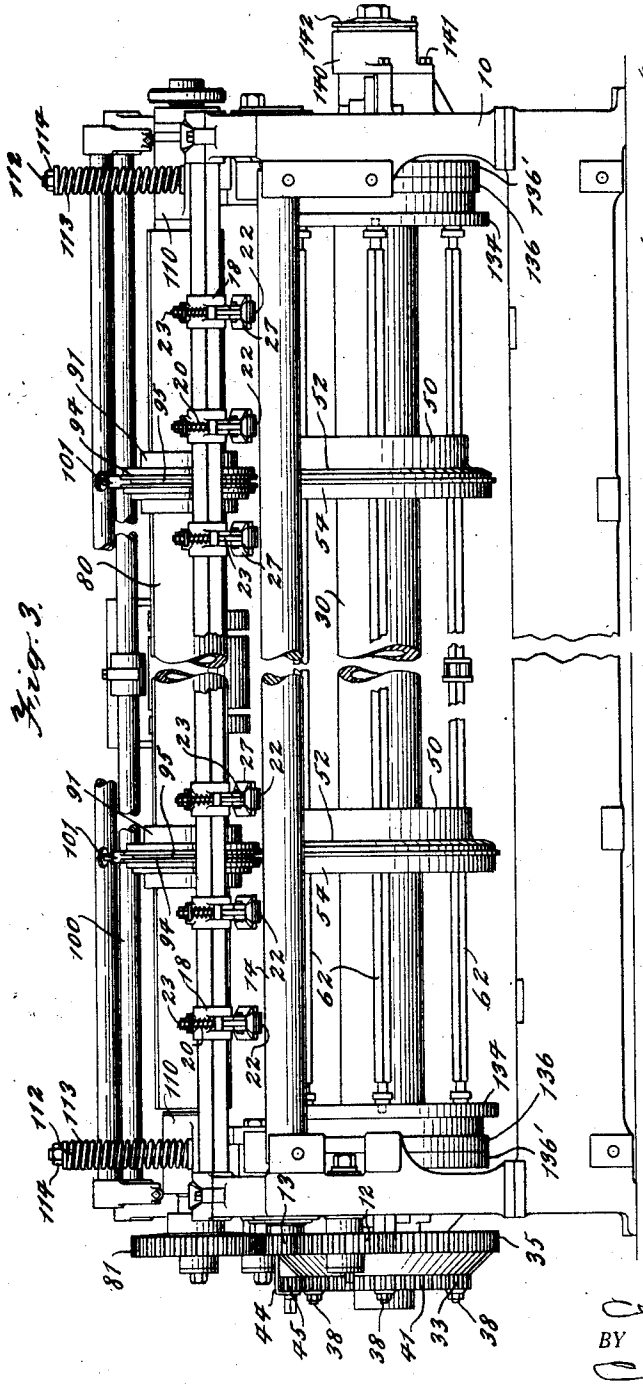


Fig. 3.

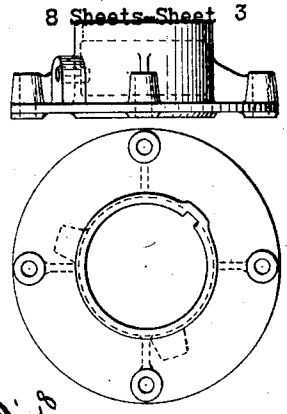


Fig. 16.

Fig. 15.

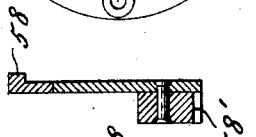


Fig. 9.

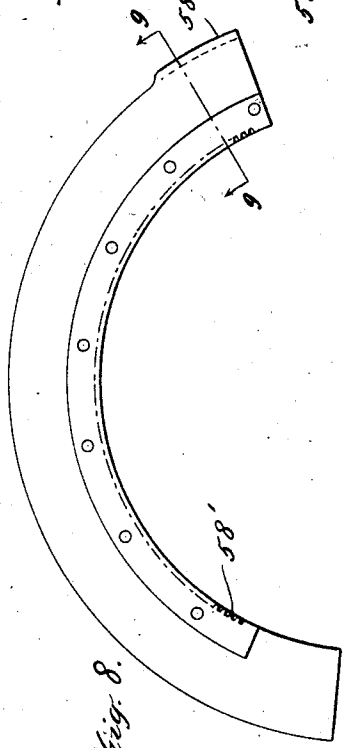


Fig. 8.

INVENTOR.

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May 22, 1928. 1,670,314

C. B. PEARSALL

SLOTTING MACHINE

Filed July 15, 1925 8 Sheets-Sheet 4

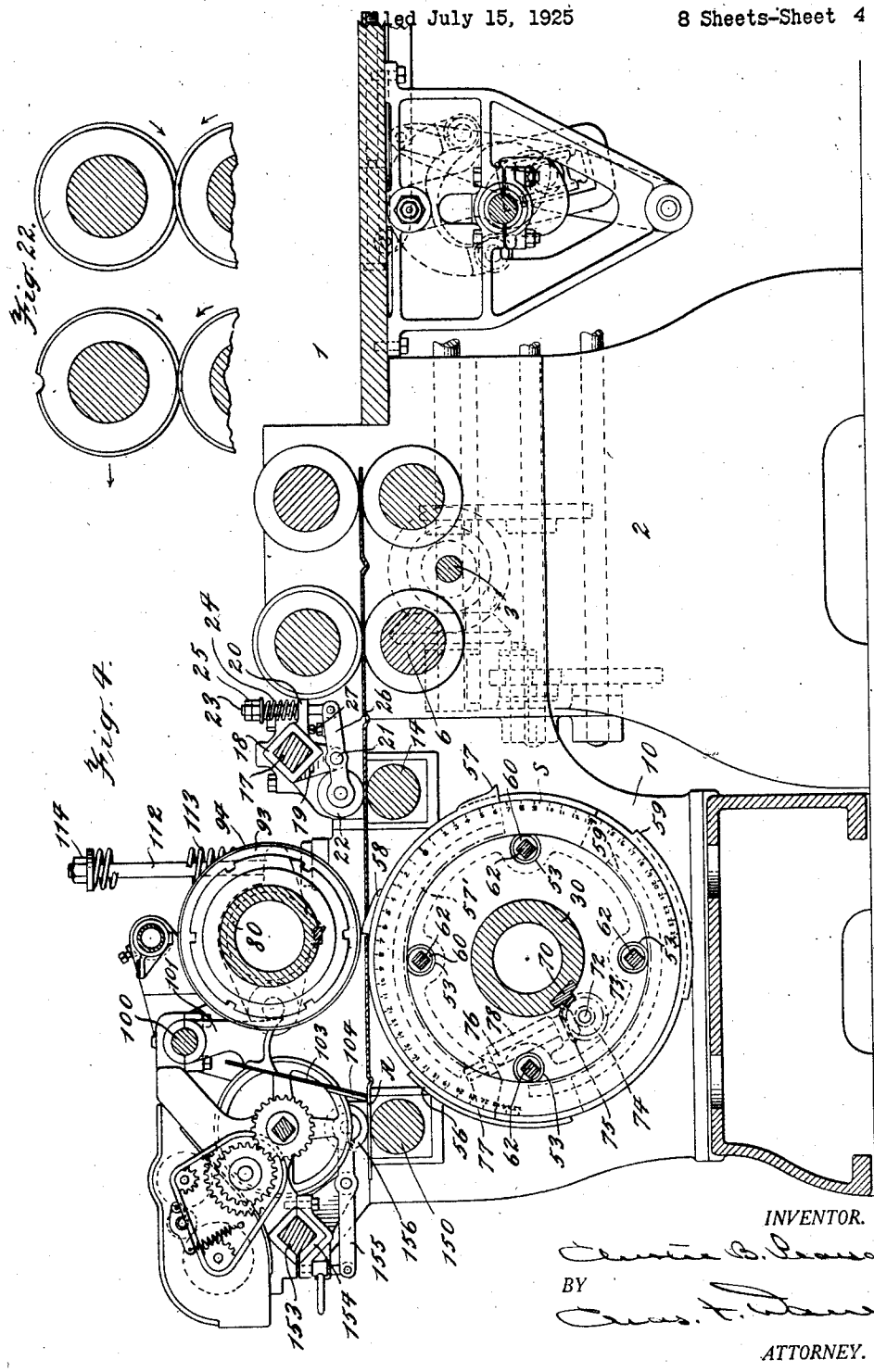


Fig. 22.

Fig. 4.

INVENTOR.

BY

ATTORNEY.

May 22, 1928. 1,670,314

C. B. PEARSALL

SLOTTING MACHINE

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Fig. 5.

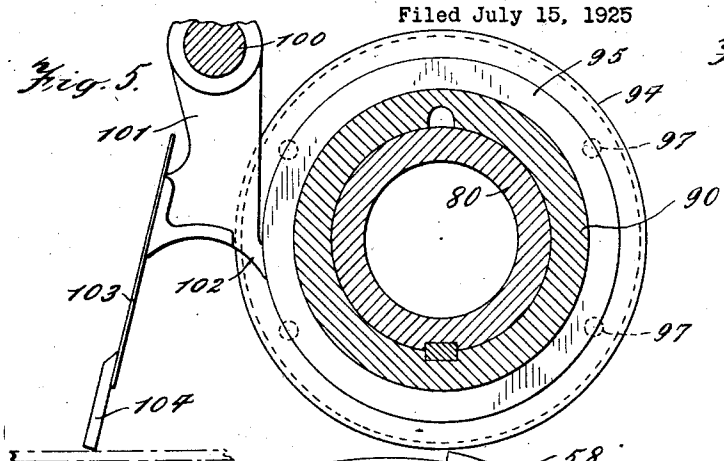
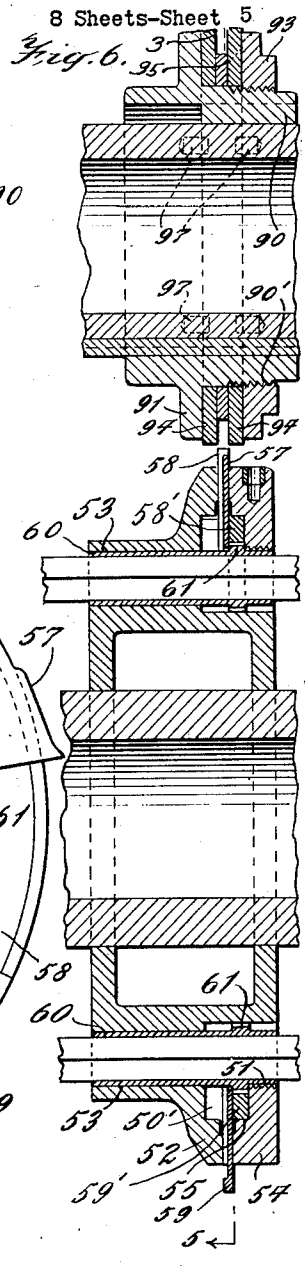


Fig. 6.



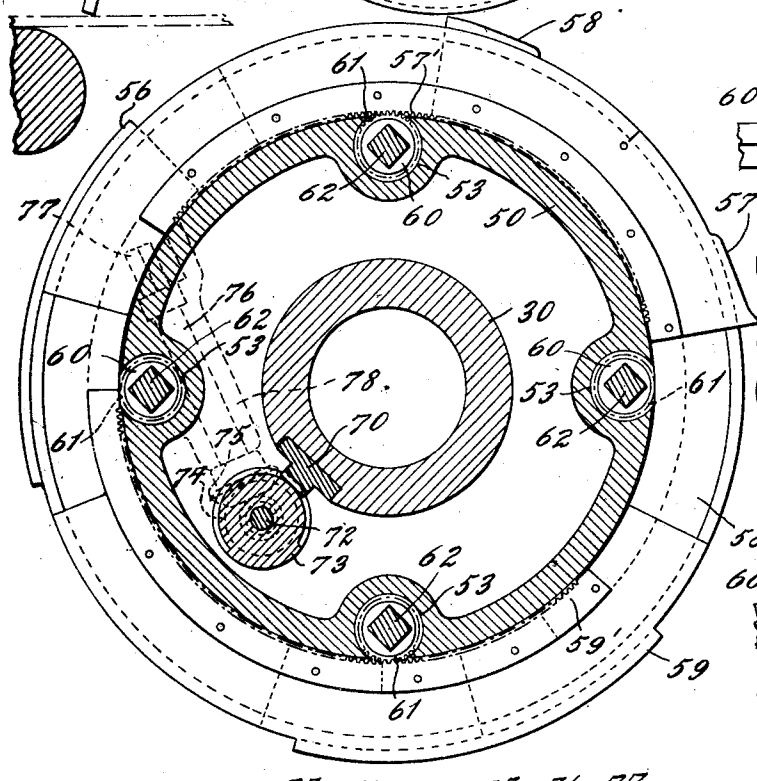
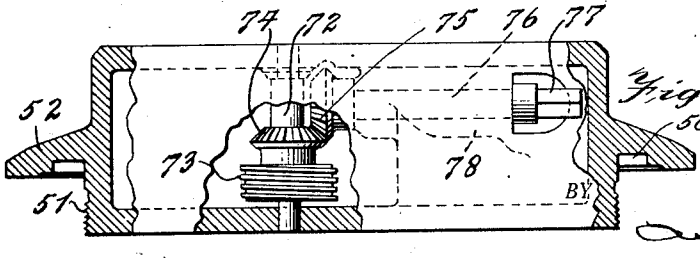


Fig. 7.



INVENTOR.

BY

ATTORNEY.

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C. B. PEARSALL

SLOTTING MACHINE

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Fig. 11.

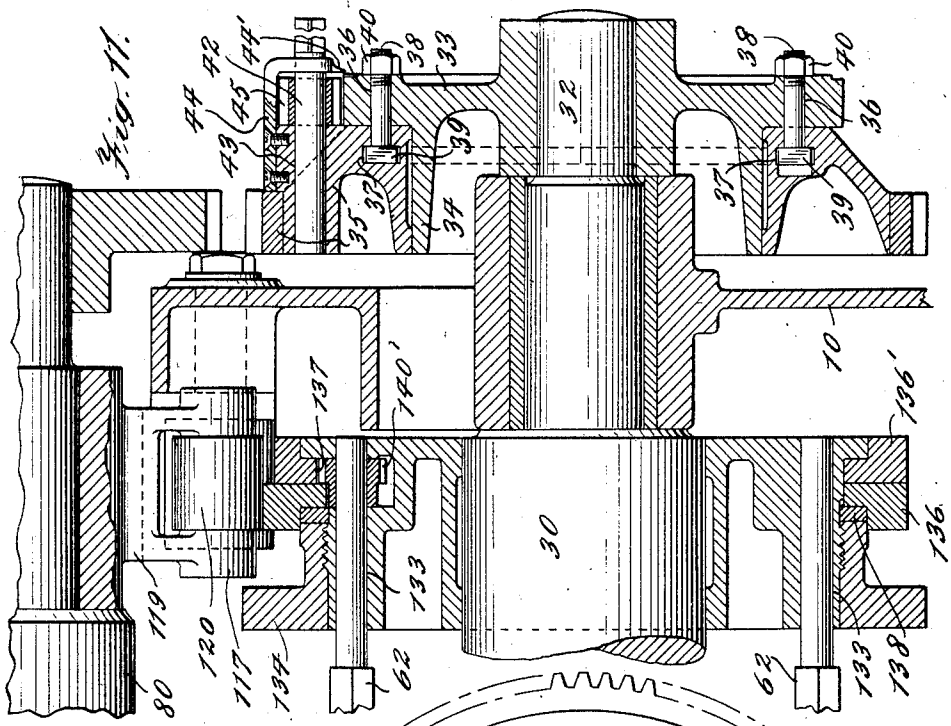
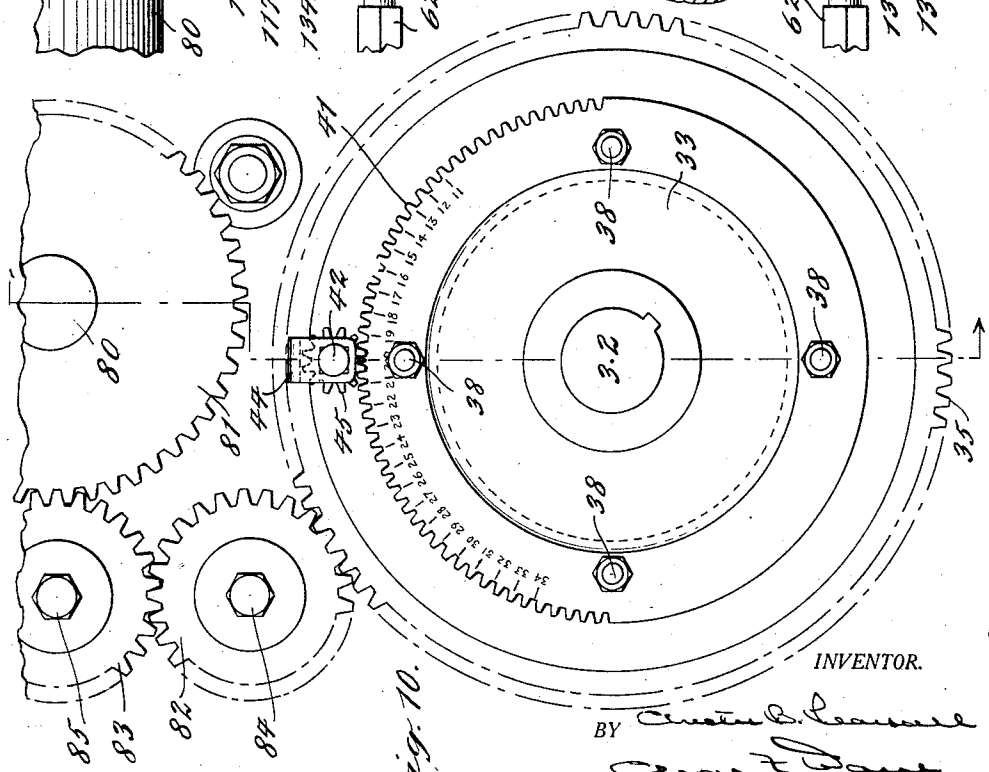


Fig. 10.



INVENTOR.

BY Austin B. Pearsall

Chas. F. Burns

ATTORNEY

May 22, 1928.

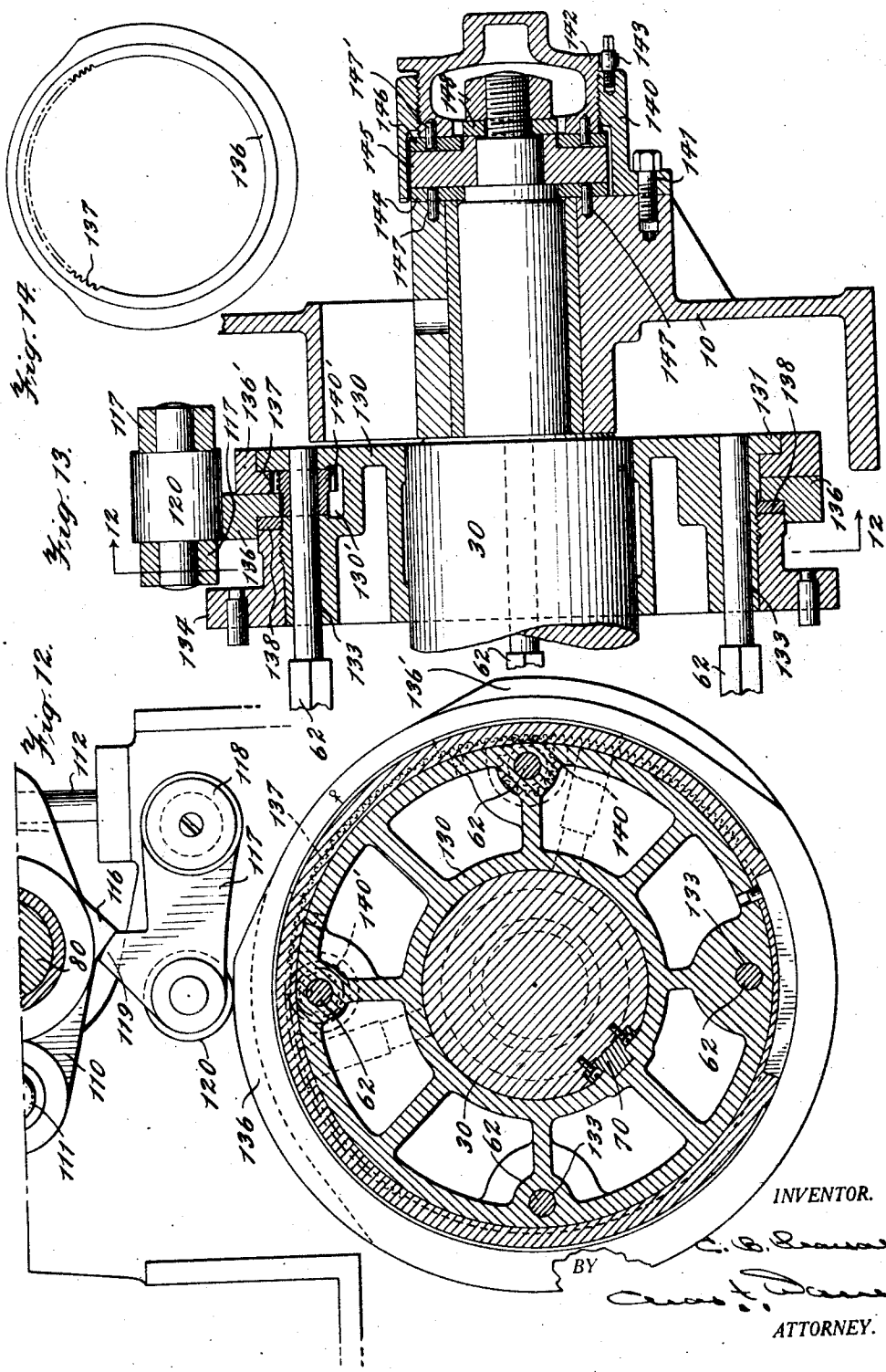
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C. B. PEARSALL

SLOTTING MACHINE

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C. B. PEARSALL

SLOTTING MACHINE

Filed July 15, 1925 8 Sheets-Sheet 8

Fig. 17.

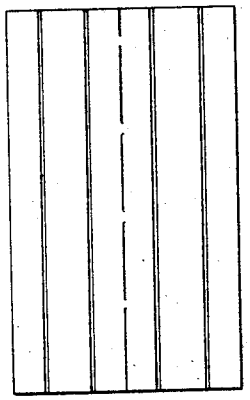


Fig. 20.

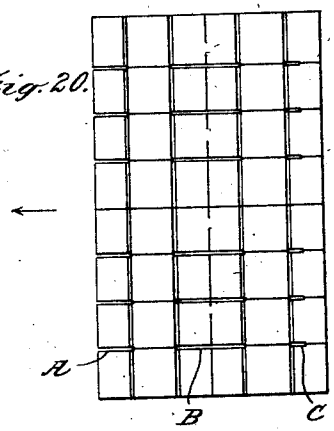


Fig. 18.

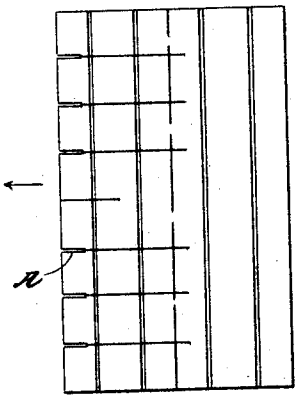


Fig. 21.

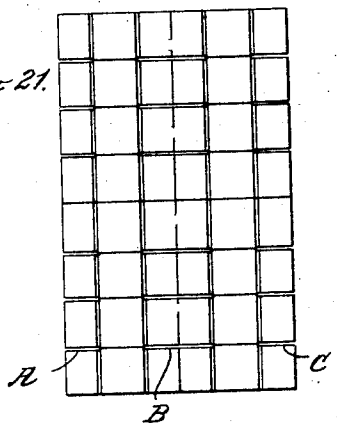
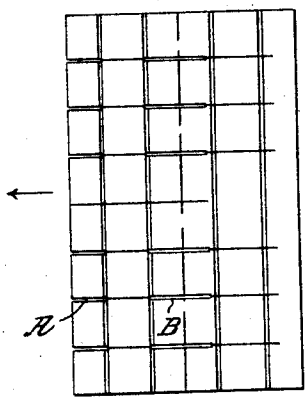


Fig. 19.



INVENTOR.

Custer B. Pearsall

BY

Chas. F. Davis

ATTORNEY.

Patented May 22, 1928. 1,670,314

UNITED STATES PATENT OFFICE.

CHESTER B. PEARSALL, OF ROCHESTER, NEW YORK, ASSIGNOR TO M. D. KNOWLTON COMPANY, OF ROCHESTER, NEW YORK, A CORPORATION OF NEW YORK.

SLOTTING MACHINE.

Application filed July 15, 1925. Serial No. 43,786.

The invention relates to a machine for slotting sheets of material, such as cardboard, corrugated board, and the like, for formation into boxes and similar containers after the sheets have been slitted and creased to define the extent of the blank or blanks included in the sheet; and the object of the invention is to provide a machine of the character indicated having multiple sets of coacting rotary slotting knives or cutters adapted to slot one or more blanks formed from a single sheet, the coacting pairs of cutters being adjustable transversely of the machine to accommodate blanks of different lengths, and the knives of one cutter of each pair being circumferentially adjustable in its rotary support to accommodate blanks of varying widths, so that the machine may be adjusted to slot box blanks of widely varying sizes and also to operate upon one or several blanks contained in a single sheet simultaneously, as the sheets having the slitted and creased blank or blanks defined thereon pass through the machine.

In the accompanying drawings:

Fig. 1 is a side elevation of a machine embodying the invention associated with a slitting and creasing machine.

Fig. 2 is a plan view of the same coordination.

Fig. 3 is a broken front elevation of the slotting machine.

Fig. 4 is a vertical longitudinal section of the two machines.

Fig. 5 is an enlarged sectional side elevation of two of the rotary cutters, on the line 5—5 of Fig. 6.

Fig. 6 is a vertical longitudinal section through the cutters.

Fig. 7 is a broken side view of the main member of the lower cutter.

Fig. 8 is a detail of one of the knives in side elevation.

Fig. 9 is a section on line 9—9 of Fig. 8.

Fig. 10 is an enlarged side elevation of the slip gear and its coacting parts.

Fig. 11 is a section on line 11—11 of Fig. 10.

Fig. 12 is a section on line 12—12 of Fig. 13, showing the cams for raising and lowering the upper cutter shaft.

Fig. 13 is a vertical longitudinal section showing the cam construction and the thrust bearing for the lower cutter shaft.

Fig. 14 is a detail of one of the cams.

Figs. 15 and 16 are front and side elevations of a support for the knife adjusting shafts of the lower cutters to be used when the machine is adjusted for operating upon single blanks.

Fig. 17 is a sheet comprising four blanks slitted and creased longitudinally by the slitting and creasing machine preparatory to entering the slotter.

Fig. 18 shows the sheet immediately after entering the slotter with the transverse creases and the left edge slots partly formed.

Fig. 19 shows the transvers creases nearly completed, the left edge slots finished and the center slots nearly finished.

Fig. 20 shows the sheets with the left edge slots and the center slots completed and the right edge slots started.

Fig. 21 shows the completely slotted sheet ready for breaking apart into four box blanks.

Fig. 22 is an enlarged sectional detail through a part of the slitting and creasing machine showing the means for slitting and creasing the blank longitudinally thereof as shown in Fig. 17.

Referring more particularly to Figs. 1, and 4 of the drawings, 1 indicates a slitting and creasing machine of standard type, through which the sheets of pasteboard, corrugated board, or the like are fed, first laterally and then longitudinally, said machine being equipped with rolls which slit and crease the sheet to define the margins of one or more blanks and to crease the sheet along the line of the folds or bends of the blank or blanks, as will be understood by those skilled in the art; the sheet being fed transversely of the table, in the direction indicated by the arrow *a* in Fig. 2, for scoring and creasing the sheet longitudinally, as shown in Fig. 17, and also, if necessary, trimming the longitudinal edges of the sheet, after which the sheet is fed longitudinally of the machine, in the direction indicated by the arrow *b* in Fig. 2, for the purpose of applying the transverse slots or scores and creases, if the latter are found necessary, the feed of the sheets longitudinally of the machine being effected by suitable cam actuated pusher mechanism P. This slitting and creasing machine forms no part of the instant invention, but, as a matter of economy and convenience, is associated with the slotting machine by bolting together the

frames of the two machines, as graphically illustrated in Figs. 1, 2 and 4.

The slotting machine comprises a base or standard 10 comprising side castings mounted upon a table-like base. As shown, the power for driving the slotting machine is derived from the main shaft 3 of the slitting and creasing machine, said shaft 3 being driven by a belt pulley 5, or equivalent means. Secured to the shaft 3 is a pinion 4, which meshes with a gear 7 on the shaft 6 of the last lower roll of the slitting and creasing machine, said gear 7 meshing with a gear 12 mounted upon a stud 11 secured to the frame of the slotting machine, the gear 12 meshing with a gear 13 on the outer end of the lower feed roller 14, which latter is journaled in bearings in the side members of the slotter frame. The gear 12 also drives a member 35 of a slip gear, which is effective in driving the shaft of the lower rotary cutters and the other rotary elements of the machine, as will be hereinafter explained.

Cooperating with the lower feed roll 14 is a series of upper feed rollers which are mounted upon a squared shaft 17 secured in position spanning the space between the side members of the slotter frame in right-angled seats 15 formed in the upper portions of the side members, in which seats the shaft is retained by caps 16 bolted to said side members. The individual upper rollers are adjustable longitudinally of the shaft 17 to accommodate sheets of varying lengths or widths, as said sheets are fed either transversely or longitudinally through the slotter. Each of the upper feed roller devices comprises a casting having a central sleeve portion 18, a pendent arm 19 and a forwardly extending arm 20, the central sleeve portion 18 embracing the shaft 17 and being adapted to be clamped thereto in adjusted position by a suitable set screw. Journaled on a stud 21 carried by the pendent arm 19 is a lever 26, in the forked rear end of which is mounted a roller 22 which is yieldingly held in operative relation to the bottom feed roller 14 by means of a helical spring 24 cooperating with a rod 23 which is pivoted to the forward end of the lever 26 with its free end passing upwardly through an opening in the arm 20 and provided with set nuts 25, the spring 24 expanding between the stationary arm 20 and the nuts 25 to cause the roller 22 to coact with the lower feed roll with the desired pressure. By adjusting the nuts 25 the tension of the spring 24 may be regulated as desired. Preferably the lever 26 is provided with an adjustable stud 27, which engages the lower side of the arm 20 and regulates the space between the feed roll 22 and the lower feed roller 14. By adjusting the pressure of the feed rolls 22 by means of the springs 24, and spacing the individual feed roller devices longitudinally of the shaft 17, an even and accurately regulated feed of the sheets through the slotting machine may be effected.

From the feeding mechanism as thus described, the sheet is passed directly to the rotary slotters, which latter are mounted upon shafts 30 and 80 in cooperating pairs and in groups of three, six or nine pairs, depending upon whether the machine is adjusted or equipped to slot one, two or three blanks extending lengthwise of the sheet, and each set of rolls being adapted to slot one or two blanks positioned transversely of the sheet, as will be hereinafter more particularly explained, so that the machine is adapted to slot one, two, four or six blanks at each complete operation of the rotary slotters.

The shaft 30, which supports the lower rotary slotters, is journaled in bearings in its side members of the frame 10 and has the lower rotary cutters secured thereto in sets of three for individual longitudinal adjustment with respect to the shaft. The structural and operative details of the lower rotary cutters are illustrated more particularly in Figs. 4, 5, 6, 7 and 9. The body portion of each cutter comprises a hollow hub-like casting 50 having a peripheral flange 52 and a threaded shoulder 51, with an annular recess 50′ formed in the face of the flange 52 adjacent the threaded shoulder 51. Cooperating with the threaded shoulder 51 is a clamping ring 54 having an annular recess 55 corresponding to recess 50′ in the member 50, and a flat face paralleling the inner face of flange 52 and serving to clamp the interposed knives rigidly in position, when ring 54 is set up. Mounted for peripheral adjustment on the shoulder 51 of the hub section 50 are four knives 56, 57, 58 and 59, which extend beyond the peripheral edge of the hub 50, said knives comprising relatively thin arc-shaped blades, as particularly shown in Figs. 8 and 9, the peripheral edges of which constitute the cutting or excising elements, the successive blades overlapping each other, as shown in Figs. 5 and 6, and being clamped firmly in adjusted relation between the flange 52 on hub section 50 and the clamping ring 54. The several arc-shaped knives are provided on their inner rims with arcuate racks 56′, 57′, 58′ and 59′, respectively, riveted thereto, the racks on overlapping knives being disposed on opposite sides, and operating in the recesses 50′ in the hub section and in the recesses 55 in the clamping ring. As indicated, the four knives are adjustable circumferentially of the supporting member 50 in order to operate upon sheets of different sizes, and to effect this circumferential adjustment simultaneously in all of the lower cutters, there are provided four shafts 62, which traverse corresponding openings 53 in

each member 50, the several shafts preferably being square in cross section and engaging similarly shaped bores of bushings 60 journaled in the openings 53, each bushing carrying a gear or pinion 61 which meshes with the rack of the corresponding arc-shaped knife. These parts are so coordinated that by rotating a given shaft 62 by means of a suitable wrench, the corresponding knife will be moved peripherally of the hub section to effect the desired adjustment of the knife. In order to facilitate this adjustment, the rim of flange 52 of the hub section is provided with a scale marked in inches and fractions thereof, as indicated at *s*, by means of which the exact position of the several knives may be determined.

The knives 56 and 59 are designed to cut the slots A and C in the forward and rear edges, respectively, of the sheet, as the latter is fed through the slotter, while the knives 58 and 57 operate to cut a single slot B in the middle of the sheet, and, as the width of the sheet is sufficient to form two blanks, each middle slot B, as indicated in Figs. 17 to 21, constitutes the slot in the right marginal edge of one blank and the slot in the left marginal edge of the adjacent blank. From the foregoing, it will be evident that the length of the center slots B will be determined by the distance between the points or ends of knives 58 and 57, as indicated in Fig. 4. In order to properly position the knives 58 and 57 to cut the proper length of slot B, the knives are adjusted so that their points or terminal edges lie equal distances from the zero point of the scale, as indicated in Fig. 4, and, as these distances are indicated in inches and fractions thereof on the scale, it is obvious that accurate settting of the knives to excise slot B of proper length may be effected readily. It will be apparent that the longitudinal center line of each sheet fed to the machine must register with the zero point of each of the lower cutters and special means are provided for effecting this relation for different widths of sheets, as will be hereinafter explained.

As knives 56 and 59 cut slots in the front and rear edges of the sheet, the setting of these knives to cut slots of the proper depth may be readily effected by reference to the scale on the peripheral edge of the hub 50, the scale reading in both directions from the zero point, as indicated in Fig. 4.

In order to adjust the lower cutters so that the zero points on the scales may be brought into coincidence with the longitudinal center lines of sheets of varying widths, the shaft 30 carrying the lower cutters is provided with a special slip gear connection shown in Figs. 1, 3, 10 and 11, which admits of the rotary adjustment of the shaft and the cutters independently of the driving mechanism. Secured to the reduced outer end 32 of shaft 30 is a hub 33 having an annular shoulder 34, upon which is mounted a gear ring 35, which meshes with gear 12 of the driving train. The ring 35 is normally locked to said hub 33 to drive the shaft 30 by means of bolts 38 passing through holes 36 in the hub section, said bolts having squared heads 39 engaging an annular T slot 37 formed in the ring 35. When the nuts 40 of the bolts 38 are set up, the gear ring 35 is clamped to the hub. When, however, the nuts are loosened, the head ends of the bolts slide freely in the T slot and the hub and shaft 30 may be freely rotated independently of the gear ring 35. Approximately one-half of the periphery of the hub 33 is provided with gear teeth 41, which are engaged by a pinion 45 fast to a shaft 42 journaled in an opening 43 formed in the ring 35, the outer end of the shaft being squared to receive an operating crank. An annular bracket 44 bolted to the gear ring 35 is provided with an opening through which the shaft 42 extends and with a pointer or index 44′, which registers with a scale (see Fig. 10) marked on the face of the hub 33 adjacent the teeth 41 thereon. By loosening the nuts 40 on the bolts 38, the gear ring and the hub may be independently rotated and by applying the crank to the squared end of shaft 42 and turning the latter in the appropriate direction, a relative rotatory adjustment between the hub 33 and the gear ring 35 may be effected to accommodate sheets of different widths, the proper adjustment being indicated by the pointer 44′ on the scale, so that the zero points of the lower cutters will be brought into coincidence with the center line of the sheets. The scale on the hub 33 being graduated in inches, it will be apparent that the necessary adjustment may be readily effected. Said scale on the hub is graduated for sheets varying in widths from twenty-two inches to sixty-eight inches, the scale indication denoting the width of half the sheet. After the adjustment of the shaft 30 and the lower cutters 50 to accommodate the particular sheets to be operated upon, the nuts 40 are set up and the gear ring 35 is clamped to hub 33 in proper relation to rotate shaft 30 and the lower cutters in the normal operation of the machine.

The upper cutters are mounted upon shaft 80, journaled in bearings formed in arms 110 pivoted on studs 111 fixed in the side members of the frame 10, the forward ends of the arms 110 being held down by springs 113 surrounding rods 112, which are fixed to the frame and pass through holes in the arms 110, as indicated in Figs. 4 and 12, the tension of the springs being regulated by nuts 114 on the ends of the rods 112. This mode of mounting the shaft 80 is to permit the

upper cutters to be moved toward and from the lower cutters in the slotting operations, as will be hereinafter explained. Shaft 80 has fixed to one end thereof a gear 81, which meshes with a pinion 83 journaled on a stud 85 and meshing with a pinion 82 on stud 84, said pinion 82 being driven by the gear ring 35 of the slip gear device.

The upper cutters correspond in number and relative position on shaft 80 with the lower cutters on shaft 30. Each of said upper cutters comprises a hub section 90, keyed to shaft 80 for adjustment longitudinally of said shaft, preferably by a split wedge clamp such as is ordinarily used for fastening scoring or slitting knives to their supporting shafts. The hub 90 has a peripheral flange 91, which constitutes a clamping jaw, and the cylindrical portion of the hub adjacent the flange is provided with a screw threaded section 90′ to receive a threaded ring 93, which formed the second member of the clamp, between which ring and flange 91 are securely locked two annular knives 94, 94, which are separated by a spacer ring 95 of less diameter than the knife rings and which leaves a space between the knives 94, 94 corresponding in width with the knives on the lower cutter. As indicated, the screw threaded ring 93 serves to clamp the knives 94, 94 and the interposed spacer ring 95 against the fixed flange 91 on the hub, and the knives are locked in position by pins 97, which engage openings in the flange 91 and the ring 93.

The space between the knives 94, 94 receives the chips cut from the sheet by the coaction of the lower and upper knives, and, in order to dislodge these chips, a stripper is provided for each upper cutter, said stripper comprising an arm 101 suspended from a cross rod 100 and adjustable longitudinally of said rod to accord with the adjustments of the corresponding cutter on shaft 80, said arm having a blade 102, which lies in the space between the knives 94, 94. Also carried by the arm 101 is a plate 103, to the lower end of which is fixed a wiper 104 of leather, or the like, which serves to sweep the falling chips off of the sheet.

Inasmuch as the knives 57 and 58 on each lower cutter, which cut the middle slot in the blank, are mutually overlapping and the tails of said knives also overlap portions of knives 56 and 59, respectively, it is necessary that the cutting edges of knives 56 and 59 be higher than the cutting edges of knives 57 and 58, as otherwise the knives 57 and 58 would cut a slot in the middle of the blank for the full length of their cutting edges instead of limiting the length of the center slot to the distance between the points of knives 57 and 58, and it is because of this fact that the shaft 80 carrying the upper knives is journaled in the swinging bearings 110 in order that the upper cutters may be lowered to permit only the effective lengths of knives 58 and 57 to operate in cutting the center slots in the blanks and to be raised out of cooperative engagement with said knives 58 and 57 after the center slot has been cut, so that the knives 94, 94 of the upper cutter will be in cooperative relation with the cutting edges of knives 56 and 59, which, as explained, cut the slots in the front and rear edges of the sheet. The raising and lowering of the shaft 80 carrying the upper cutters, is effected by the mechanism shown in detail in Figs. 11, 12, 13 and 14, which mechanism is as follows:

Keyed to each end of the shaft 30, adjacent the side members of frame 10, is a special cam device, which is effective in lowering and elevating the swinging bearings carrying shaft 80 upon which the upper cutters are fixed. Each of the cam devices comprises a spider 130 having openings 133 spaced at intervals of ninety degrees near the periphery of the spider to constitute bearings for the cylindrical ends of the shaft 62, which latter constitute the means for adjusting the knife elements of the lower cutters. One side of the spider is provided with a peripheral flange 131 and the opposite side has a cylindrical surface, screw threaded in part, to receive a ring 134, which is internally screw threaded. Clamped between the ring 134 and the flange 131 are two ring cams 136 and 136′ which are provided on a portion of their inner peripheries with teeth 137, which correspond in extent with the low portions of the cams. One of said cam rings is shown in Fig. 14. As shown, each of the cam rings is provided with an undercut shoulder, so that the cams project into the annular recess formed between the peripheral flange 131 of the spider and the inner face of the clamping ring 134. In order to prevent the cams being rotated, when the clamping ring 134 is set up, there are provided filler blocks 138, which are interposed between the inner rim of the ring 134 and the adjacent cam, which filler blocks are provided with tenons which enter recesses in the periphery of the spider to prevent circumferential movement of the filler blocks. The portions of the spider 130 which receive the ends of the shafts 62, 62, which control the adjustment of knives 58 and 57, are recessed, as at 130′ to receive pinions 140 and 140′, respectively, which are keyed to the corresponding shafts 62. One of these pinions engages the inner peripheral teeth of cam 136 and the other pinion engages the teeth of cam 136′, so that said cams are adjusted simultaneously with knives 58 and 57. Cooperating with this cam device is a dog 117 pivoted on a stud 118 projecting from

the inner face of the side frames, each of said pivoted dogs carrying a roller 120, which engages the peripheral faces of the corresponding cams 136 and 136′, each dog having an upwardly extending nose 119, which engages a boss 116 on the lower edge of the swinging bearing 110 in which shaft 80 is journaled, so that, when the rollers 120 of the two pivoted dogs engage the low portions of the cam, shaft 80 and the upper cutters are lowered, and, similarly, when the rollers 120 engage the high portions of the corresponding cams, the shaft 80 and upper cutters are elevated. As indicated in Fig. 12, the middle point of the low section of each cam device corresponds with the longitudinal center line of the blank, as the latter passes through the machine, and also with the zero point on each lower cutter, which is midway between the points of knives 58 and 57, so that the beginning of the high points of each cam device will be in alignment with the points of knives 58 and 57. By this arrangement, the upper shaft 80 and the cutters carried thereby are lowered by the cams as soon as the points of knives 58 on the lower cutters engage the blank, and, similarly, the upper shaft 80 is elevated as soon as the points of knives 57 finish the cutting operation and are disengaging the blank. The upper shaft is then held in its elevated position during the remainder of its rotation, so that the cutting edges of knives 56 and 59 will function to cut the slots in the front and rear edges of the sheet, but the tails of knives 57 and 58 will not be effective in that they are no longer in cooperative relation with the knives of the upper cutters.

Special means are provided for adjusting the upper and lower cutters longitudinally of their supporting shafts to bring the knives into alignment with the creases in the blanks, so that the slots will be properly positioned with respect to the creases. The adjusting means are carried by the individual lower cutter elements, so that, when the upper cutters are unlocked from clamping engagement with their supporting shaft 80 and the latter is lowered to bring the knives of the upper and lower shafts into interlocking engagement, the two sets of cutters may be simultaneously adjusted along their shafts. The adjusting means is illustrated in Figs. 4, 5 and 7 and comprises the following instrumentalities:

Fitted in a seat in the shaft 30, which supports the lower cutters, is a key 70 which has an outwardly extending rib which engages a similar seat in the hub member 50, the outer face of said rib being provided with gear teeth which are properly fashioned to mesh with a worm wheel 73 journaled on a shaft 72 mounted transversely of the hub casting 50, the worm 73 having connected therewith a bevel-gear 74 which meshes with a bevel-gear 75 on the end of a shaft 76 mounted in a sleeve 78 formed integrally with the hub section, the end of the shaft 76 projecting through an opening in the hub section and being provided with a squared wrench engaging portion 77, by means of which the shaft may be rotated, either by a hand wrench or by an electrically driven wrench. By rotating the shaft 76 in one direction or the other, the corresponding lower knife will be adjusted longitudinally of its supporting shaft 30 by the engagement of the worm 73 with the rack 71 and the adjusting movement of the lower cutter will effect the corresponding adjustment of the cooperating upper cutter, by reason of the engagement of the knives of the two cutters. After the desired adjustment of the several sets of cutters have been effected, the upper cutters are again locked in position on their supporting shaft and the machine is again ready for operation.

The machine is also equipped with a lower feed roll 150 located at the rear of the cutters, which feed roll is driven by a gear 151 meshing with the pinion 82. Cooperating with the feed roll 150 are individual feed rollers generally similar in construction and operation to those mounted on the front part of the machine, said feed rollers being supported upon and separately adjustable longitudinally of a squared shaft 153, which is secured in bracket extensions of the side frames by means of caps 152. Each feed roll device comprises a squared collar 154 surrounding the shaft 153 and locked thereto by a suitable set screw, to which collar is pivoted a lever 155 carrying a roller 156 in its forward forked end for cooperation with the lower feed roll 150, the rear end of the lever being engaged by a bolt 157, surrounded by a spring 158 to apply the desired pressure to the roller 156 in the same manner as hereinbefore described in respect of the upper feed rollers at the front of the machine.

Suitable end thrust bearings are provided for the shafts 30 and 80 in order to prevent endwise movement of said shafts, and a typical bearing of this character is illustrated in Fig. 13 as applied to shaft 30, said bearing including an outer shell 140, which is connected to the side frame 10 by bolts 141, and is adapted to receive a threaded cap 142 which is locked in adjusted position on the shell by a key 143 engaging one of a series of peripheral notches in the cap and a threaded opening in the shell. Keyed to the reduced end of the shaft 30 is a disk 145, which is engaged by rings 144 and 146, the former being secured to the frame 10 by pins 147 and the latter being similarly secured to the cap 142 by pins 147′. A lock

nut and washer 148 is secured to the extreme outer screw threaded end of the shaft 30. By the arrangement shown, the end thrust of the shaft is taken up by the abutment of the cap 142 against the disk 145, the frictional resistance and wear between these parts being largely reduced by the rings 144 and 146 between which the disk 145 rotates.

A suitable device for printing the blanks, as the latter are delivered from the machine, may be coordinated with the slotter to advantage and a typical printing apparatus is shown in Figs. 1, 2 and 4, but, as no claim to the printing mechanism is made, specific description of the same will not be necessary and the illustration therefor is intended merely to show a convenient mode of coordinating and operating the printer with the slotting machine.

From the foregoing description and illustration, it will be apparent that the machine is adapted to operate upon sheets of varying lengths and widths for slotting multiple blanks comprised within a single sheet, the cutters of each set being adjusted to operate upon blanks of varying sizes by adjusting the cutters of each set longitudinally of their supporting shafts and by adjusting the knives of the lower cutters circumferentially of the hub-like holders therefor to cut the marginal slots of two blanks disposed transversely of the sheet at one operation, the intermediate knives of each lower cutter excising a slot in the mid section of the sheet, which slot, when the sheet is divided along its median line, constitutes edge slots of adjacent blanks and the terminal knives of each lower cutter forming the slots in the front and rear edge of the sheet, which slots are complementary to the single slots formed by the intermediate knives. It will be seen, therefore, that a single machine is particularly adapted to accurately slot two, four or six blanks defined within the area of the sheet by the slitting and creasing machine and to deliver the slitted, creased and slotted sheets in condition to be broken apart into individual blanks, which are ready for immediate folding and staying to constitute complete boxes or containers.

What I claim is:

1. A box blank slotting machine comprising co-operating pairs of rotary cutters, one cutter of each pair having knives arranged to cut unitary slots in two blanks included within the width of a sheet, and other knives for cutting single slots in the marginal edges of the respective blanks.

2. A box blank slotting machine comprising cooperating pairs of rotary cutters, one cutter of each pair having circumferentially adjustable knives arranged to cut unitary slots in two blanks included within the width of a sheet, and other knives for cutting single slots in the marginal edges of the respective blanks.

3. A box blank slotting machine comprising upper and lower shafts, cooperating pairs of rotary cutters adjustable longitudinally of said shafts, one cutter of each pair having circumferentially adjustable knives arranged to cut unitary slots in two blanks included within the width of a sheet, and other knives for cutting single slots in the marginal edges of the respective blanks.

4. A blank slotting machine comprising upper and lower shafts, cooperating pairs of rotary cutters adjustable longitudinally of said shafts, one cutter of each pair having circumferentially adjustable knives arranged to cut slots in two blanks included within the width of a sheet, and means for simultaneously adjusting said knives circumferentially.

5. A blank slotting machine comprising upper and lower shafts, cutters having laterally spaced knives on the upper shaft, and cooperating cutters having circumferentially adjustable knives on the lower shaft.

6. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, and cooperating cutters on the lower shaft each having arc-shaped knives adjustable circumferentially thereof and adapted to enter between the annular knives of the corresponding upper cutter.

7. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having arc-shaped knives adjustable circumferentially thereof and adapted to enter between the annular knives of the corresponding upper cutter, and means for simultaneously adjusting said arc-shaped knives circumferentially.

8. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, co-operating cutters on the lower shaft each having arc-shaped knives adjustable circumferentially thereof and adapted to enter between the annular knives of the corresponding upper cutter, and means for adjusting the pair of cutters longitudinally of their shafts.

9. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, co-operating cutters on the lower shaft each having arc-shaped knives adjustable circumferentially thereof and adapted to enter between the annular knives of the corresponding up-

per cutter, means for adjusting the pairs of cutters longitudinally of their shafts, and separate means for simultaneously adjusting said arc-shaped knives circumferentially.

10. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, and cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and adjustable circumferentially thereon to cooperate with the knives of the upper cutters to cut slots in two blanks included within the width of a sheet.

11. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cooperate with the knives of the upper cutters to cut slots in two blanks included within the width of a sheet, and means for adjusting the arc-shaped knives circumferentially on their supports to slot sheets of different widths.

12. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cooperate with the knives of the upper cutters to cut slots in two blanks included within the width of a sheet, and means for simultaneously adjusting the arc-shaped knives circumferentially on their supports to slot sheets of different widths.

13. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cooperate with the knives of the upper cutters to cut slots in two blanks included within the width of a sheet, means for adjusting the arc-shaped knives circumferentially on their supports to slot sheets of different widths, and means for adjusting each cooperating pair of cutters longitudinally of their shafts to operate on sheets of different lengths.

14. A blank slotting machine comprising upper and lower shafts, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cut marginal and center slots in a sheet including two blanks within its width, the intermediate knives being of less height than the terminal knives, and means for decreasing the distance between the shafts while the intermediate knives are cutting and restoring the normal separation of the shafts when the terminal knives are cutting.

15. A blank slotting machine comprising a frame, a lower shaft journaled in said frame, an upper shaft, means supporting said upper shaft for movement toward and from the lower one, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cut marginal and center slots in a sheet including two blanks within its width, the intermediate knives being of less height than the terminal knives, and means to lower the upper shaft when the intermediate knives are cutting and to raise said shaft when the terminal knives are cutting.

16. A blank slotting machine comprising a frame, a lower shaft journaled in said frame, an upper shaft, pivoted arms in which said upper shaft is journaled, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cut marginal and center slots in a sheet including two blanks within its width, the intermediate knives being of less height than the terminal knives, and cams on the lower shaft cooperating with said pivoted arms to lower the upper shaft when the intermediate knives are cutting and to raise said shaft when the terminal knives are cutting.

17. A blank slotting machine comprising a frame, a lower shaft journaled in said frame, an upper shaft, pivoted arms in which said upper shaft is journaled, cutters on the upper shaft each having a pair of laterally spaced annular knives secured thereto, cooperating cutters on the lower shaft each having four arc-shaped knives disposed radially and circumferentially thereon to cut marginal and center slots in a sheet including two blanks within its width, the intermediate knives being of less height than the terminal knives, cams on the lower shaft cooperating with said pivoted arms to lower the upper shaft when the intermediate knives are cutting and to raise said shaft when the terminal knives are cutting, and separate means for simultaneously adjusting the corresponding knives of the lower cutters circumferentially, the adjusting means for the intermediate knives including mechanism for coincidentally and commensurately adjusting said cams.

18. A blank slotting machine comprising an upper shaft journaled in swinging bearings; a lower shaft journaled in fixed bear-

ings; gearing for driving said shafts; cutters on the upper shaft including laterally spaced annular knives; cooperating cutters on the lower shaft each including a plurality of arc-shaped knives circumferentially adjustable about said shaft, said knives having racks on their inner edges; a plurality of shafts traversing aligning bearings in the several lower cutters; gears on said shafts engaging the racks on said knives; cams on the lower shaft for raising and lowering the upper shaft, each cam including two cam rings, the latter engaging the swinging bearings of the upper roll and provided with gear teeth on their inner rims, and gears on the adjusting shafts of the intermediate arc-shaped knives engaging the gear teeth on the cam rings to adjust said cam rings simultaneously with the adjustment of the intermediate knives.

19. A blank slotting machine comprising an upper shaft journaled in swinging bearings; a lower shaft journaled in fixed bearings; gearing for driving said shafts; cutters on the upper shaft including a hub, a clamping ring and laterally spaced annular knives; cooperating cutters on the lower shaft each including a hub, a clamping ring and four arc-shaped knives circumferentially adjustable on said hub, said knives having racks on their inner edges; four shafts traversing aligning bearings in the hubs of the several lower cutters; gears on said shafts engaging the racks on said knives; cams on the lower shaft for raising and lowering the upper shaft, each cam including a hub, a clamping ring and two cam rings, the latter engaging the swinging bearings of the upper roll and provided with gear teeth on their inner rims, and gears on the adjusting shafts of the intermediate arc-shaped knives engaging the gear teeth on the cam rings to adjust said cam rings simultaneously with the adjustment of the intermediate knives.

20. In a blank slotting machine, in combination, a pair of cooperating cutters, one of said cutters comprising a hub having a radial clamping flange, a clamping ring in threaded engagement with the hub, arcuate knives mounted on the hub and clamped between the flange and ring, and means carried by the hub for adjusting the knives circumferentially of the hub.

21. In a blank slotting machine, in combination, a pair of cooperating cutters, one of said cutters comprising a hub having a radial clamping flange, a clamping ring in threaded engagement with the hub, arcuate knives mounted on the hub and clamped between the flange and ring, racks on the inner edges of said knives, and gears mounted in the hub engaging said racks for separately adjusting said knives circumferentially of the hub.

22. In a blank slotting machine, in combination, a pair of cooperating cutters, one of said cutters comprising a hub having a radial clamping flange, a clamping ring in threaded engagement with the hub, a plurality of arcuate knives having racks on their inner edges and adapted to be clamped between the flange and ring, the intermediate knives being overlapping and oppositely disposed, and gears mounted in the hub engaging said racks for separately adjusting the knives circumferentially of the hub.

23. A box blank slotting machine comprising cooperating pairs of cutters, one cutter of each pair having knives arranged to cut unitary slots in two blanks included within the width of a sheet, and other knives for cutting single slots in the marginal edges of the respective blanks.

In testimony whereof I affix my signature.

CHESTER B. PEARSALL.