May 22, 1934. E. M. HAWKINS 1,959,424

SLITTING AND CREASING MECHANISM

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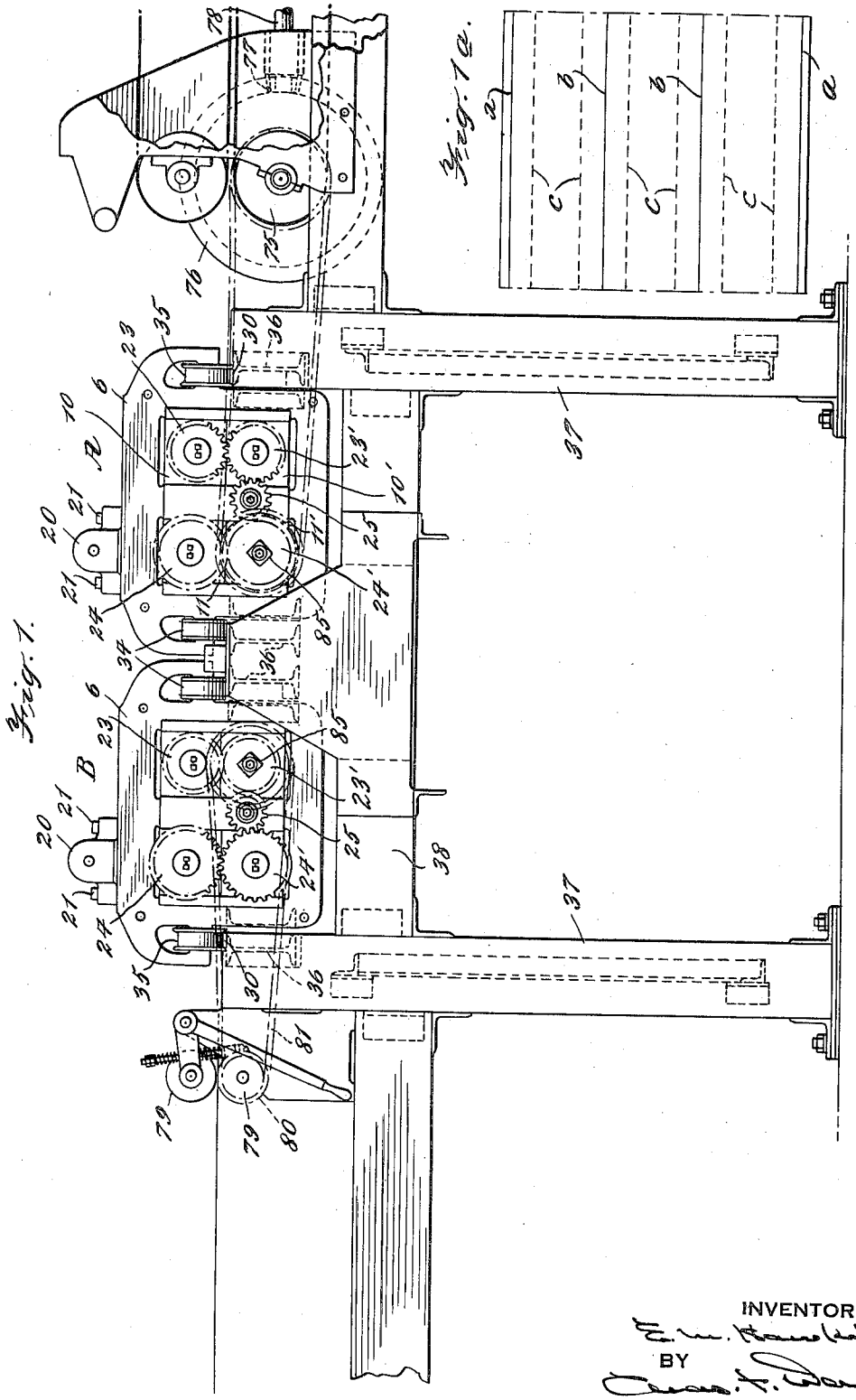


Fig. 1.



Fig. 1a.

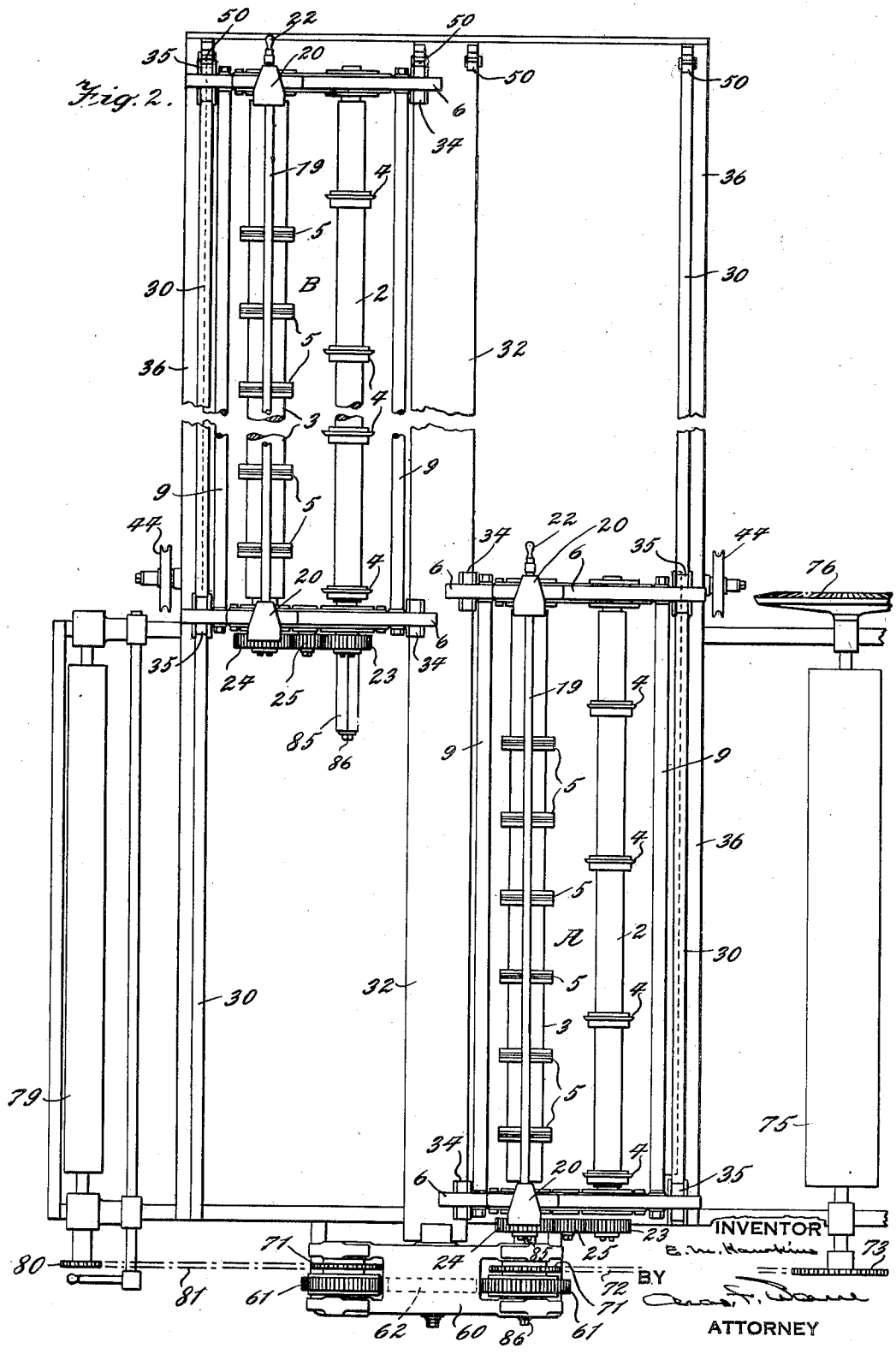
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Fig. 2.



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Fig. 3.

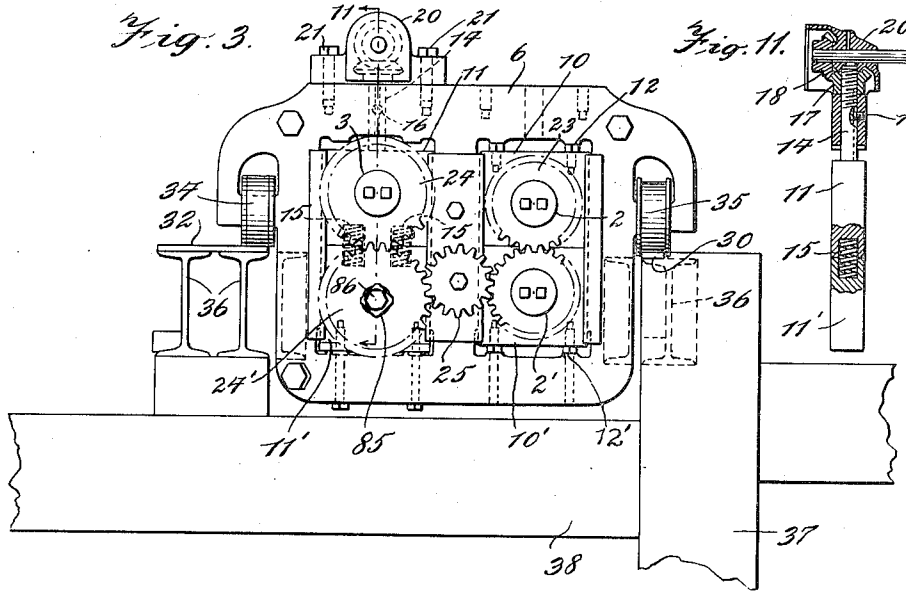
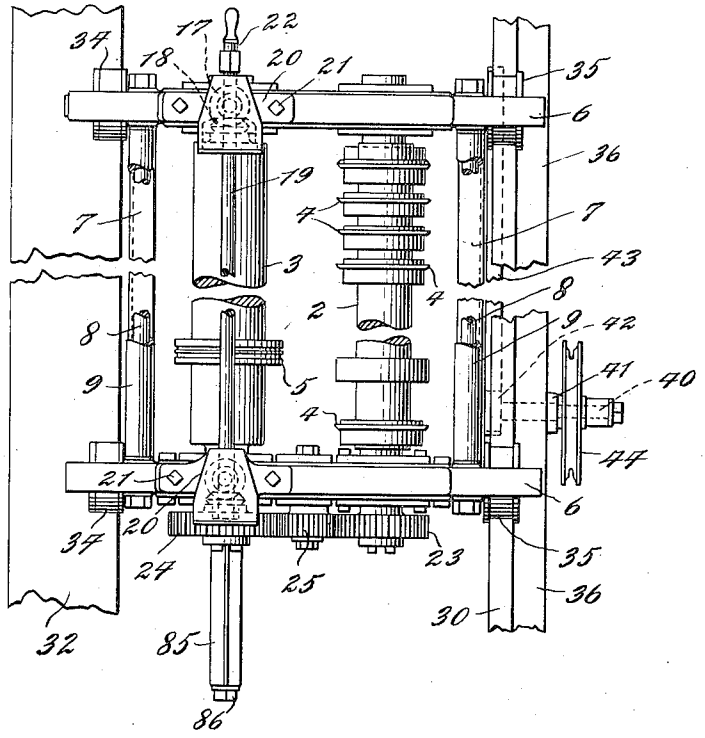



Fig. 11.




Fig. 4.




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Fig. 5.

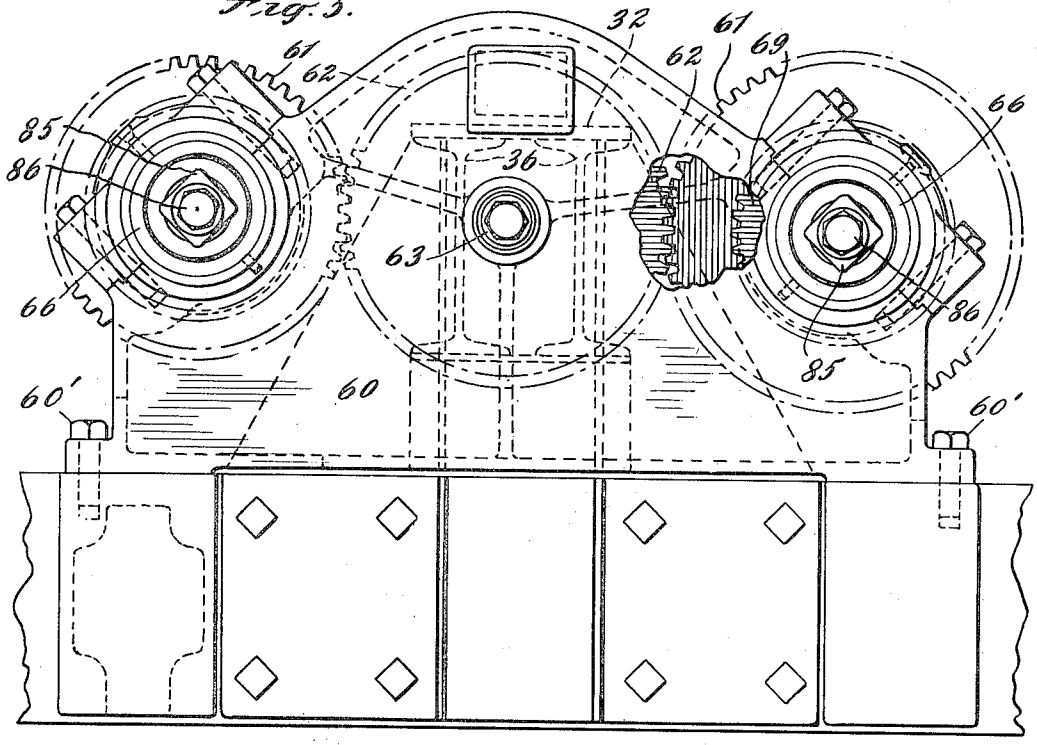
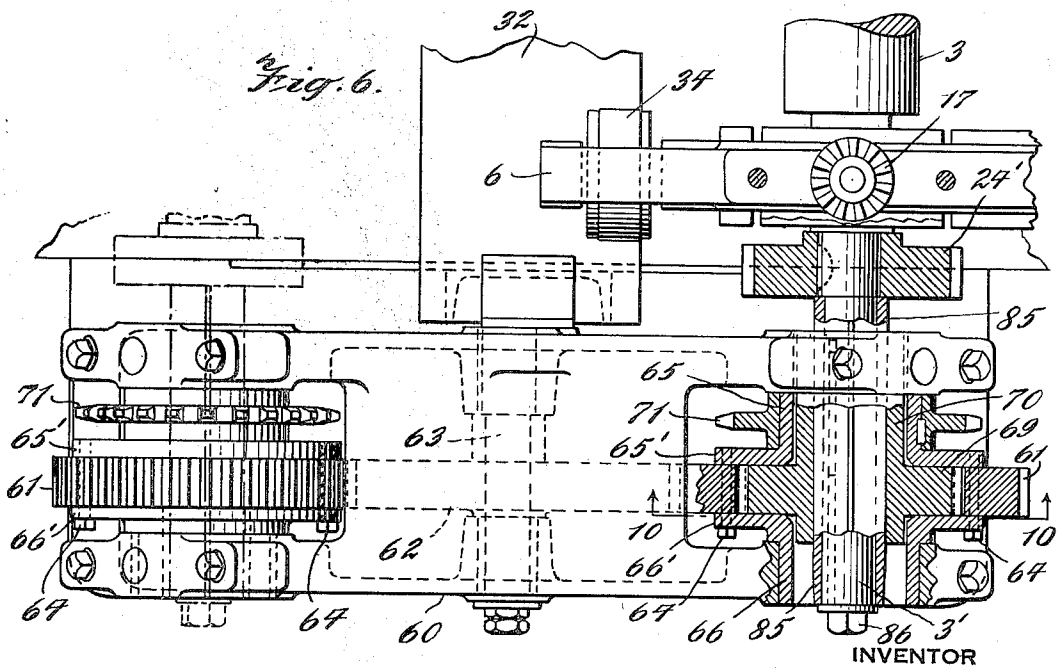



Fig. 6.




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Fig. 7.

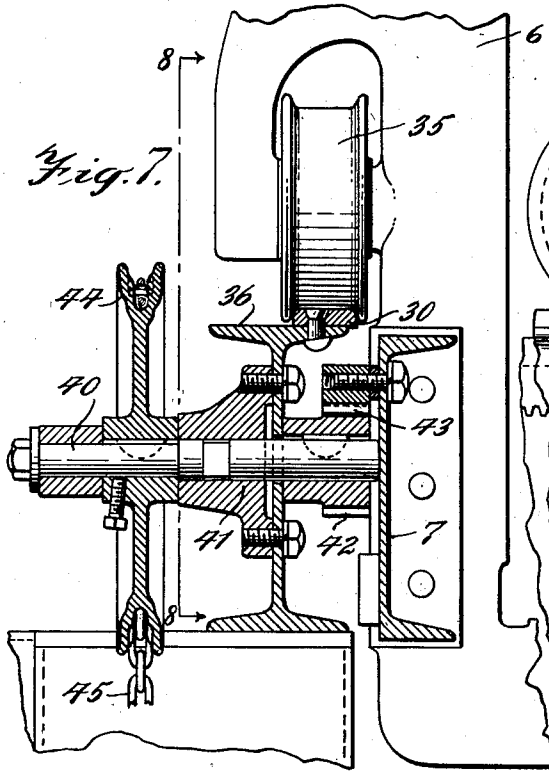



Fig. 8.

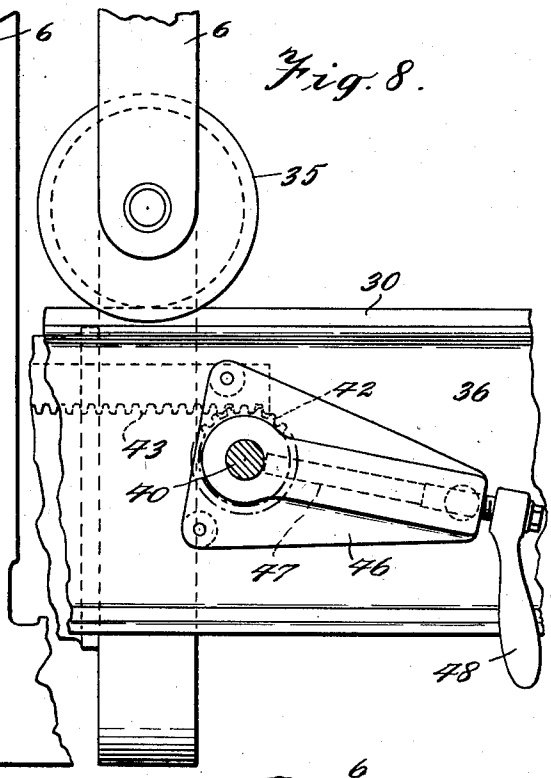



Fig. 10.

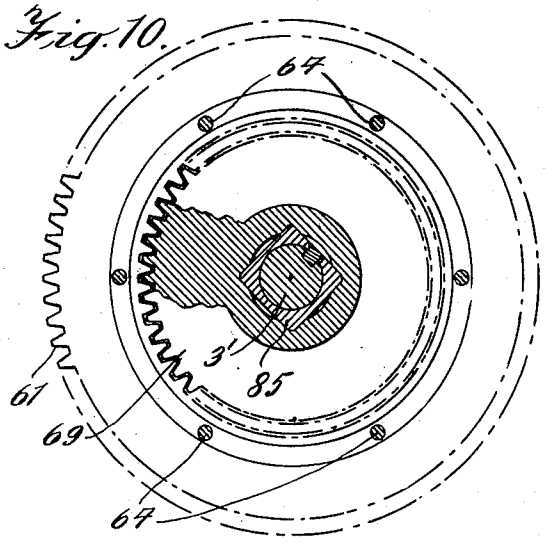
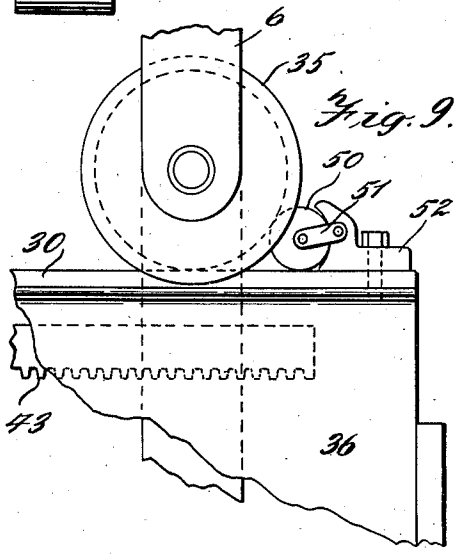



Fig. 9.




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Patented May 22, 1934 1,959,424

# UNITED STATES PATENT OFFICE

1,959,424

## SLITTING AND CREASING MECHANISM

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Application July 8, 1930, Serial No. 466,434

10 Claims. (Cl. 164—61)

The present invention relates to mechanism of the type shown in Letters Patent No. 1,278,-766 of Sept. 10, 1918, for operating upon a web of material, such as lined corrugated board, paper-board for making box blanks, or other similar material.

The mechanism of the aforesaid patent includes creasing and cutting tools for providing the web with a plurality of longitudinal creases and for slitting and trimming the web longitudinally, the creasing and cutting tools being rotary ones mounted upon two pairs of mandrels or shafts, which, in turn, are arranged in a vertical series. Mechanism is provided for raising and lowering the entire series of shafts to bring either pair into operative relation with the web of material so that the latter will pass between the shafts of such pair and hence between the cooperating creasing and cutting tools on these shafts. While one pair of shafts and the creasing and cutting tools thereon are being utilized for operating upon the web of material, the other pair of shafts are in their inoperative position. While two of the shafts with the creasing and cutting tools thereon are in their operative position and operating upon the web of material, the creasing and cutting tools on the two shafts in the inoperative position may then be adjusted for the succeeding order, that is, for the manufacture of a creased and slitted web having the creases and slits formed in the web along other lines.

These duplex two-shaft units, each composed of a pair of shafts with both creasing and cutting tools on each shaft, were found to do satisfactory work when the distance between the tools was considerable, but were found not to do as satisfactory work when the tools were relatively close together, particularly when operating upon "green" lined corrugated board, that is, board coming from the corrugator before the adhesive bond between the corrugated sheet and its liners has become fully set, in which case it was found that the board, when put under all the stresses resulting from working on it with both the creasing and cutting tools at the same time, did not always have enough strength in the bond to prevent a loosening of the liners from the corrugated sheet.

Because of such objection to the use of a two-shaft slitting and creasing unit, I have provided an improved mechanism having duplex four-shaft slitting and creasing units, in which each unit comprises two pairs of shafts arranged with one pair in advance of the other in the direction of movement of the web and with one pair carrying the slitting tools and the second pair carrying the creasing tools. With this arrangement, whereby the slitting and creasing operations are performed on the web at different points in its path of movement, the objectionable stresses, such as resulted from the action of the two-shaft unit, are so reduced as to be negligible in their effect on the web.

This improved mechanism, with its duplex four-shaft units, each being adapted for independent movement from an operative position for acting upon the web to an inoperative position for the setting or adjustment of its tools, comprises certain novel features in the construction, arrangement and adjustment of parts, as hereinafter described and claimed and as illustrated in the accompanying drawings, in which—

Fig. 1 is a side elevation of a slitting and creasing mechanism embodying the invention.

Fig. 1*a* is a section of the web showing the relative arrangement of the trimming, slitting and creasing lines.

Fig. 2 is a top plan of the mechanism with one of the slitting and creasing units in its operative position for acting on the web and the other unit withdrawn laterally to its inoperative tool adjusting position.

Fig. 3 is an enlarged side or end view of one of the slitting and creasing units.

Fig. 4 is a top plan of the same.

Fig. 5 is an enlarged side view of the driving unit for operating the slitting and creasing units.

Fig. 6 is a top plan of the same, partly in section, and showing it in driving connection with one of the slitting and creasing units.

Fig. 7 is an enlarged sectional detail showing the means for shifting the slitting and creasing units to and away from their operative positions.

Fig. 8 is a section on the line 8—8 of Fig. 7, looking in the direction indicated by the arrows.

Fig. 9 is an enlarged detail showing one of the stop devices for limiting the movement of the slitting and creasing units when moved laterally to their inoperative positions.

Fig. 10 is an enlarged section on the line 10—10 of Fig. 6.

Fig. 11 is a section through line 11—11 of Fig. 3.

The present mechanism was designed primarily for operating upon lined corrugated board and especially for use in combination with a corrugated board forming machine, usually

termed a "corrugator", to directly receive the board coming from the latter and trim, slit and crease the same as a preliminary operation to its being made up into box forming blanks. It will be understood however that the slitting and creasing mechanism herein disclosed is not limited to use in combination with a corrugator, but may be used as a unit by itself or in combination with any other mechanism for performing other operations upon the web.

Referring to the drawings, the duplex slitting and creasing units are indicated generally at A and B, each comprising two pairs of shafts, 2 and 2' and 3 and 3', carrying the tools or elements for performing the desired operations upon the web, these tools in the present case including cooperating slitting knives 4 on the shafts 2 and 2' and cooperating creasing blades 5 on the shafts 3 and 3'. In the present case, the tools on the lower shafts are not shown, but these are or may be of usual construction. The number of pairs of slitting knives and creasing blades will depend upon the number of places at which the web is to be slitted and the number of creases with which the web is to be provided. As here shown, the pairs of knives at the extreme ends of the slitter shafts are for the purpose of trimming the edge portions of the web, on the lines *a*—*a* of Fig. 1*a*, and the intermediate pairs of knives are for the purpose of dividing the web longitudinally, on the lines *b*—*b* of Fig. 1*a*, into three strips or sections. The creasing blades, as shown, are provided in sufficient number to provide each longitudinal strip with two creases *c*—*c* adjacent the edges of each strip, also as shown in Fig. 1*a*. It is of course obvious that the exact arrangement of these tools upon the shafts is immaterial and the number thereof may be decreased or increased as desired. Furthermore, it is not even essential that the elements or tools take the form of creasing and slitting blades, because so far as the broad aspect of certain features of the invention are concerned, it is immaterial what the specific character of the tools upon the shafts happen to be. After the web has been trimmed, slitted and creased in the way described, it usually passes to a shear which cuts it transversely into desired sheet lengths.

The slitting and creasing shafts of each unit are carried in a suitable frame which, as here shown, comprises two side members 6, 6 connected by cross members, these latter being in the form of channels 7, 7 adjacent the bottom of the frame and tie-rods 8, 8 carrying sleeve spacers 9, 9 at the top of the frame. Supported in the side members 6, 6 of the frame are boxes or housings carrying roller bearings (not shown) in which the journal ends of the slitting and creasing shafts are mounted, the boxes for the slitting shafts being indicated at 10 and 10' and those for the creasing shafts at 11 and 11'. The boxes for the slitting shafts are held in fixed position with their adjacent sides abutting each other by means of screws 12 and 12' engaging the same on top and bottom, since no adjustment is required between these shafts. The boxes for the creasing shafts however are mounted in a manner to permit of an adjustment of the cooperating creasing tools whereby to obtain the proper degree of crease in the board according to the thickness and kind of material being operated upon. In providing for this adjustment, the boxes 11 for the upper creaser shaft, which are mounted for vertical sliding movement within their openings in the end frames, are yieldingly held with their upper sides in engagement with the ends of adjusting screws 14 by means of a pair of springs 15 interposed between the upper and lower boxes with their ends seated within oppositely located pockets in the adjacent walls of said boxes, as shown in Figs. 3 and 11. With this arrangement of parts, vertical adjustment of the screws 14 in the opposite end frames will effect a raising or lowering of the upper creaser shaft with its tools relative to the lower creaser shaft with its cooperating tools in a manner to readily effect the desired degree of crease in the board.

As a means for operating the adjusting screws 14 in the opposite end frames in unison whereby to effect a corresponding adjustment of the creaser shaft 3 at its opposite ends, the screws 14 each have a vertically arranged key-way engaged by the end of a screw pin 16 to prevent rotation of the screws while permitting of their longitudinal movement, and each of said adjusting screws is threaded into a miter gear 17 at the top of the end frames which meshes with a second miter gear 18 keyed to a horizontal shaft 19 journaled adjacent its opposite ends in housings 20 which are secured on the top of the end frames by fastening screws 21, as clearly shown in Figs. 3 and 4. By rotating the shaft 19 by means of a crank-handle 22 at one end thereof, it will effect rotation of the intermeshing pairs of gears at opposite ends of the shaft and thereby operate to raise or lower the screws 14 and effect a like adjustment of the upper creaser shaft relatively to the lower one.

The slitter and creaser shafts of each unit are preferably connected at one end by a train of gearing for operation in unison, the slitter shafts being provided with intermeshing gears 23—23', the creaser shafts by intermeshing gears 24—24', and the lower gears 23' and 24' of the two pairs being connected by an idle gear 25; this arrangement of gearing causing both pairs of shafts to rotate in the same direction when being driven. The driving means for the shafts of each unit will be hereinafter described.

The slitting and creasing units A and B, which, as described, are of like construction and operation, are supported in a manner whereby they may be moved independently of each other either to an operative position in the path of the web to act upon the latter, as shown by the position of unit A in Fig. 2, or to an inoperative position at one side of the path of the web, as shown by the position of unit B in Fig. 2, to permit of the convenient adjustment or set-up of the slitting and creasing tools for the next order. To provide for such adjustment of the unit, suitable tracks are provided on which the units are movably mounted, these tracks being arranged transversely of the machine, that is, transversely of the path of the web through the machine, and which extend from a point at the driving side of the machine to a point beyond the opposite side thereof a sufficient distance to carry the units beyond or out of the way of the moving web, as will be clear by reference to Fig. 2. Said tracks, as here shown, comprise two relatively narrow outer rails 30, 30, and an intermediate broad one 32, the latter being engaged by rolls 34, 34, mounted on the side frames 6, 6, of the respective units at their adjacent sides, and the outer rails being engaged by flanged rolls 35, 35 mounted on the side frames of the respective

units at their opposite or outer sides, these flanged rolls serving to hold the units against lateral movement on the rails when being shifted. The several track rails, which may be supported in any suitable way, are here shown as being mounted on I-beams 36 which are carried by the frame of the machine including the uprights 37 and connecting girders 38.

The slitting and creasing units may of course be shifted to and from their operative or inoperative positions in any desired way. In the present case, I have provided an operating means for each unit, which, as shown in Figs. 2, 7 and 8, comprises a shaft 40 journalled in a bearing block 41 attached to one of the beams 36, which shaft at its inner end carries an attached pinion 42 meshing with a rack 43 secured to one of the tie members 7 forming part of the frame of the adjacent slitting and creasing unit, and at its outer end has keyed thereto a chain sheave 44 engaged by an operating chain 45. Turning of this sheave by its chain will rotate the shaft 40 and, through the engagement of its pinion with the rack 42 on the frame of the slitting and creasing unit, cause the desired movement of the latter on its supporting tracks to either operative or inoperative position. As a means for locking the units in their adjusted positions, each block 41 is formed with an extension 46 having an opening in which is supported a clamp screw 47 with its inner end adapted for engagement with the shaft 40 and with its outer end carrying an operating handle 48 in threaded engagement therewith. By setting this clamp screw into clamping engagement with the shaft 40 to lock the latter against rotation, it will be understood that the slitting and creasing units, through the pinion and rack connection between said shaft and the unit, may be locked in either their operating or tool-adjusting positions. At the outer end of the track rails are bumpers for limiting the movement of the slitting and creasing units in such direction; these bumpers as here shown (see Fig. 9) comprising a rubber roll 50 connected by links 51 with a block 52 bolted to the track supporting beam 36.

I will now describe the driving means for the slitting and creasing units, an important feature of which is the provision of means for effecting a ready connection and disconnection between the same and said units as the latter are moved to and from their operative positions. This driving means, as most clearly shown in Figs. 2, 5 and 6, comprises a housing 60 located at one side of the machine, as shown in Fig. 2, and suitably secured on a part of the main frame, as by means of the bolts 60'. Supported within this housing adjacent the opposite ends thereof are two driving units for driving connection with the two slitting and creasing units, each including a gear 61 which meshes with an intermediate idle gear 62 whereby the two units are operatively connected, this idle gear being mounted on a shaft 63 supported within the housing. As these driving units are of like construction a description of one will suffice for both.

The gear 61 is a compound gear, being in the form of a ring having both external and internal teeth, and is connected by bolts 64 to the flanges 65', 66' of two sleeves 65, 66, which sleeves are rotatably mounted in bearings in the housing. Supported between the flanges 65' and 66' is a gear 69 in mesh with the internal teeth of the gear 61 and having a hub sleeve 70 loosely fitting within the sleeves 65 and 66 and extending at one end to the inner side of the housing to receive an extension of one of the shafts of the opposite slitting and creasing unit for effecting driving connection therewith in a manner to be presently described.

The gear 61 may be operated by any suitable means for driving the intermeshing gear 69 and thereby the connecting slitting and creasing unit. As here shown, a sprocket 71 is keyed on the sleeve 65 connecting with said gear 61, and is driven by a chain 72 from a sprocket 73 on one of a pair of belt driving rolls, indicated at 75, which at its opposite end is operatively connected through a gear 76 and pinion 77 with a drive shaft 78. When the gear 61 of the right-hand drive unit, as viewed in Figs. 5 and 6, is thus driven, the corresponding gear 61 of the second unit is likewise driven through the intermediate idle gear 62, and a corresponding sprocket 71 of this second unit is here shown as being utilized to drive a pair of pull rolls 79 at the rear of the machine through a sprocket 80 on one of said rolls and a connecting chain 81.

As a means for effecting a drive connection between the drive units and the slitting and creasing units, one of the shafts of each set comprising the latter units is provided with a squared extension 85 in alignment with the openings in the hubs of the inner gear 69 of the drive units, whereby they may be entered into said openings for effecting drive connection with the gears; the squared extensions 85, as best shown in Fig. 6, being formed by exteriorly squared sleeves keyed on the shaft extensions and held in place by nuts 86. As shown in Fig. 2, the adjacent lower shafts of the slitting and creasing units are provided with these extensions 85, which constitute drive members, in order that the driving units may be brought close together and rendered as compact as possible.

With the slitting and creasing units mounted on tracks for movement to and from their operating positions in connection with the drive units, it will be evident that it would be very difficult to obtain exact alignment of parts in a gear drive such as here employed. It therefore became necessary to make provision for any variations or inaccuracies that might result from such conditions. This I do by providing a sufficiently loose mesh between the teeth of the inner drive gear 69 and its driving gear 61 (see Fig. 10) as to permit of a substantial movement of the inner gear relatively to the outer one, the pitch diameter of the internal teeth of the outer gear 61, in practice, being approximately 1/8" greater than the pitch diameter of the teeth on the inner gear 69. With this difference in the pitch diameter of the two gears, which renders the inner one a "floating" gear, when a slitting and creasing unit is shifted to its operating position, the end of the drive member 85 enters its opening in the hub of the gear 69, and, in the event of any variation in the normal position of the engaging parts, this will be compensated for and cramping of the parts avoided by the floating action of the gear 69. To facilitate the entry of the drive members 85 into the opening in the drive gears, the said members are preferably tapered at their ends as shown in Fig. 6.

In the operation of the machine, the moving web of corrugated board or other material is brought in from the corrugator or other machine by suitable feeding means, such as the feed belts 90, 90, and then passes on through the

machine to be trimmed, slitted and creased in a desired way, such for example as shown in Fig. 1*a*. Following such operation the web may be carried from the machine by the pull rolls 79 and passed on to a shear which cuts it in the desired sheet lengths, or, if the web is of a kind to be wound up into rolls, it may be passed on to a re-winding machine. The character of the subsequent operations to be performed on the web is of course immaterial to the present invention.

Ordinarily one of the slitting and creasing units will be in place for acting upon the web, while the other unit will be in its inoperative position at one side of the path of the moving web for the purpose of having its slitting and creasing tools adjusted to meet the requirements of the next order, in which the spacing between the tools will be different from that of the preceding order. If desired however both units may be in operating position, as when the slits and creases are of such number and spacing as to warrant the use of both units at the same time.

The slitting and creasing tools are or may be of usual construction and operation and are slidably mounted on their respective shafts for longitudinal adjustment, the same being adapted to be secured in their adjusted position by any usual fastening means.

The arrangement of the slitting and creasing units of the present machine, whereby they are movable laterally to a position at one side and out of the way of the moving web for the purpose of adjusting the tools, is obviously a much more desirable one for the operator making the adjustment than that of previous machines of the same type in which the inoperative units are positioned either above or below the moving web. The operators of these machines in most cases work in a poorly lighted space, subject more or less to heat, steam and dust, and these conditions, when attending the setting or adjusting of the tools in a position either above or below the moving web, seriously interferes with the proper setting of the tools which must be accurately done in order to have the finished boxes of the required sizes. By having the units movable to a position at one side of the moving web and with the tools in a convenient and readily accessible position to the operator, the setting of the tools obviously may be more readily and accurately done. Furthermore, the position of the inoperative unit at one side of the moving web and in substantially the same plane as the operating unit, enables the operator to make a new set-up or adjustment of tools without interference from the trimmed edges of the web, which edges, in the form of relatively narrow ribbons, do interfere with the work of the operator when adjusting tools on a unit located directly below the moving web.

One of the main objections resulting from the use of a two-shaft slitting and creasing unit when operating upon lined corrugated board, as hereinbefore referred to, is the liability of the bond between the center corrugated sheet and its liner or liners becoming loosened under the stresses placed on the board by the tools, particularly when the distances between slits and creases is below a certain established minimum. Such objection however is avoided by the use of the four-shaft unit herein described in which the slitting tools are on one pair of shafts and the creasing tools on a second pair of shafts. For example, if a web or board is being divided into five strips, it goes through the slitter first and is divided into five separate strips, each one of which is subsequently acted upon by its group of creasers. In this way the accumulative effect of both the slitting and creasing tools on a single web is avoided because of the subdivision of the web into five strips preliminary to the action of the creasing tools. As a matter of fact, it has been found in actual practice that any narrow spacing desired in commercial work can be satisfactorily done without damage to the board, when the slitting operation comes first and the creasing operation follows, as with the four-shaft unit of the present machine.

Another important advantage of the four-shaft unit over the two-shaft unit lies in its greater range of adjustment in the spacing of the tools. Every holder for a slitting or creasing tool must be substantial. Its hub must have a definite width. These hubs limit the distance between tools when they are placed adjacent one another on the same shafts as in a two-shaft unit. The set-up for a thin box requires that some of the adjacent creasing tools be very close together and that a slitter be very close to a creaser. With the four-shaft unit of the present machine, a creased line can be produced zero distance from a slitted line, or any distance greater.

What I claim is:

1. Mechanism for operating upon webs of material, comprising a plurality of sets of rotary elements for performing the desired operations on the web, said sets when in operative position being arranged one in advance of the other in the path of movement of the web and each being mounted for independent movement transversely of the path of the web from an operative position in said path to an inoperative position at one side thereof, driving means for rotating the elements of each set, and means for effecting automatic connection and disconnection of the sets with said driving means upon the shifting of the sets to and from their operative positions.

2. Mechanism for operating upon webs of material, comprising a plurality of sets of rotary elements for performing the desired operations on the web, and each set including a supporting frame carrying a plurality of cooperating rotary elements operatively connected for rotary movement in unison, tracks arranged transversely of the path of the web and extending laterally beyond said path on which tracks the sets are mounted for independent movement from an operative position in said path to an inoperative position at one side thereof, driving means for rotating the elements of each set, and means for effecting automatic connection and disconnection of the sets with said driving means upon the shifting of the sets to and from their operative positions.

3. Mechanism for operating upon webs of material, comprising a plurality of units, each including a frame, and a plurality of pairs of shafts mounted in said frame with one pair arranged in advance of another and one pair carrying cooperating cutting elements and a second pair carrying cooperating creasing elements, each of said units being mounted for movement transversely of the path of the web from an operative position in said path to an inoperative position to one side of said path.

4. Mechanism for operating upon webs of ma-

terial, comprising a plurality of units, each including a frame, a plurality of pairs of shafts mounted in said frame with one pair arranged in advance of another and one pair carrying cooperating cutting elements and a second pair carrying cooperating creasing elements, and means operatively connecting the several shafts for effecting their rotary movement in unison; tracks arranged transversely of the path of the web and extending laterally beyond said path on which the frames of the respective units are mounted for effecting movement of the units from an operative position in the path of the web to an inoperative position at one side thereof.

5. Mechanism for operating upon webs of material, comprising a set of rotary elements for performing the desired operations upon the web, means operatively connecting said elements and having a drive member, driving means including a gear having a socket opening to receive said drive member, and means supporting and guiding said set of rotary elements whereby it may be moved to and from an operating position in the path of the web with its drive member moved into and out of engagement with the socket opening of the drive gear.

6. Mechanism for operating upon webs of material, comprising a set of rotary elements for performing the desired operations upon the web, means operatively connecting said elements and having a drive member, driving means including a gear having a socket opening to receive said drive member, and means supporting and guiding said set of rotary elements whereby it may be moved to and from an operating position in the path of the web with its drive member moved into and out of engagement with the socket opening of the drive gear, said drive gear being loosely supported in relation to its driving means whereby it may adapt its position to conform to any variations in the position of the engaging drive member.

7. Mechanism for operating upon webs of material, comprising a set of rotary elements for performing the desired operations upon the web, means operatively connecting said elements and having a drive member, driving means including a gear having a socket opening to receive said drive member, means supporting and guiding said set of rotary elements whereby it may be moved to and from an operating position in the path of the web with its drive member engaging the drive gear within its socket opening, and operating means for said drive gear including a ring gear supporting the latter and having internal teeth in driving mesh therewith.

8. Mechanism for operating upon webs of material, comprising a set of rotary elements for performing the desired operations upon the web, means operatively connecting said elements and having a drive member, driving means including a gear having a socket opening to receive said drive member, means supporting and guiding said set of rotary elements whereby it may be moved to and from an operating position in the path of the web with its drive member engaging the drive gear within its socket opening, and operating means for said drive gear including a ring gear supporting the latter and having internal teeth in driving mesh therewith, the pitch diameter of the internal teeth of the outer supporting ring gear being substantially greater than that of the intermeshing teeth of the inner drive gear whereby the latter becomes a floating gear to conform to any variations in the position of the engaging drive member.

9. Mechanism for operating upon webs of material, comprising a frame, a plurality of pairs of shafts mounted in said frame with one pair arranged in advance of another and one pair carrying cooperating cutting elements and a second pair carrying cooperating creasing elements, and means carried by the frame for adjusting the position of one of the creaser shafts relatively to its cooperating one.

10. In a machine for trimming and creasing sheet material, a bed over which the material is fed, a plurality of machine units each including trimming and creasing rolls, means for selectively shifting any desired selection of units bodily in the direction of the roll axes into position to operate on the sheet, and means for driving each unit only when it has been thus shifted.

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