

J. F. JONES, L. P. REXFORD & H. N. GORES.
MACHINE FOR MAKING CORRUGATED PAPER BOX BLANKS.
APPLICATION FILED JUNE 2, 1913.

1,123,885.

Patented Jan. 5, 1915.

4 SHEETS—SHEET 1.

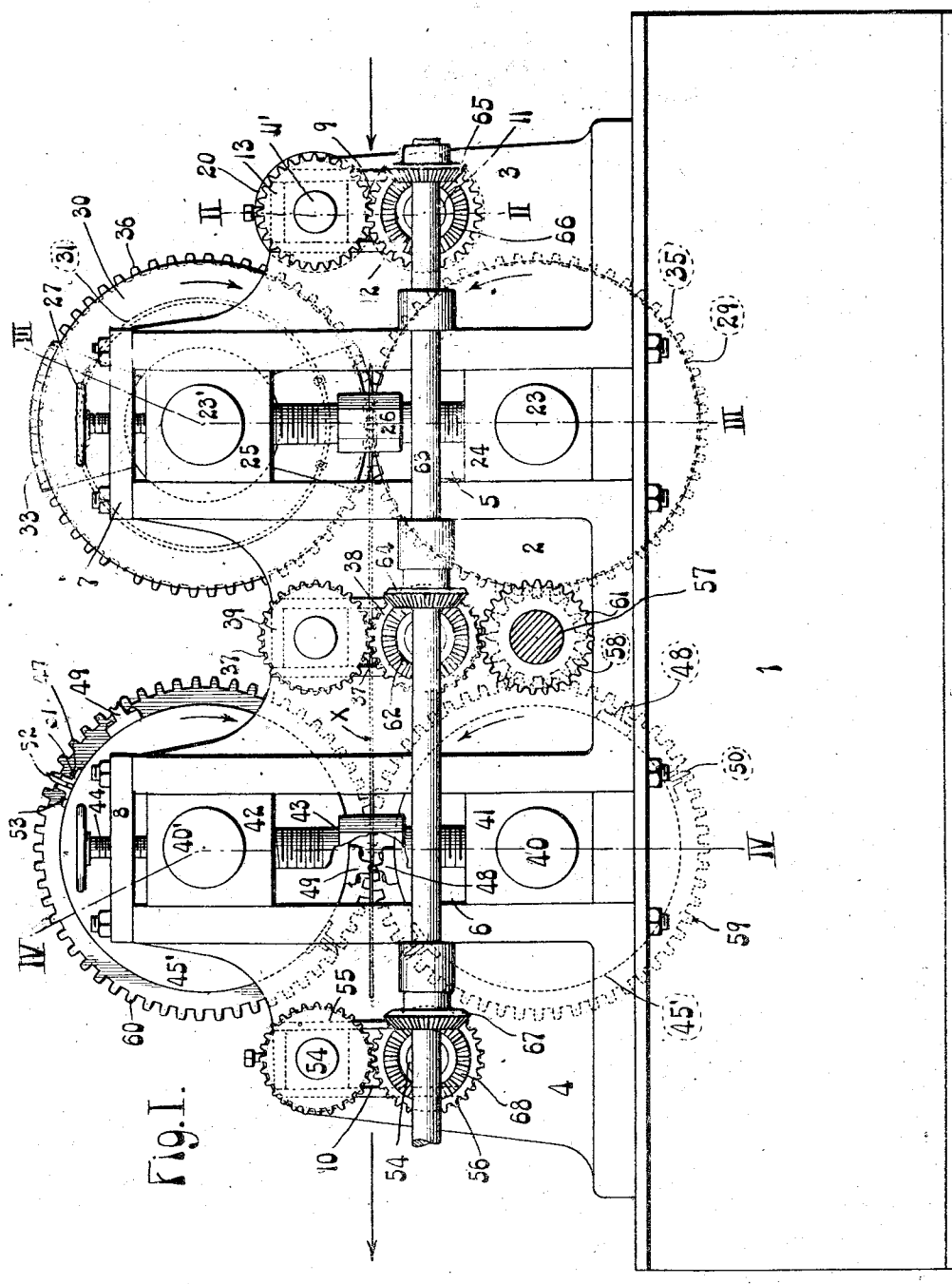


Fig. I.

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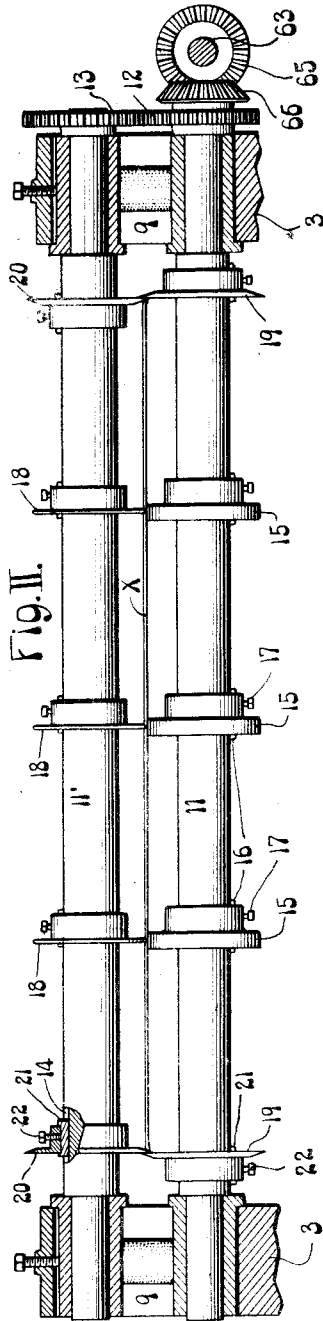
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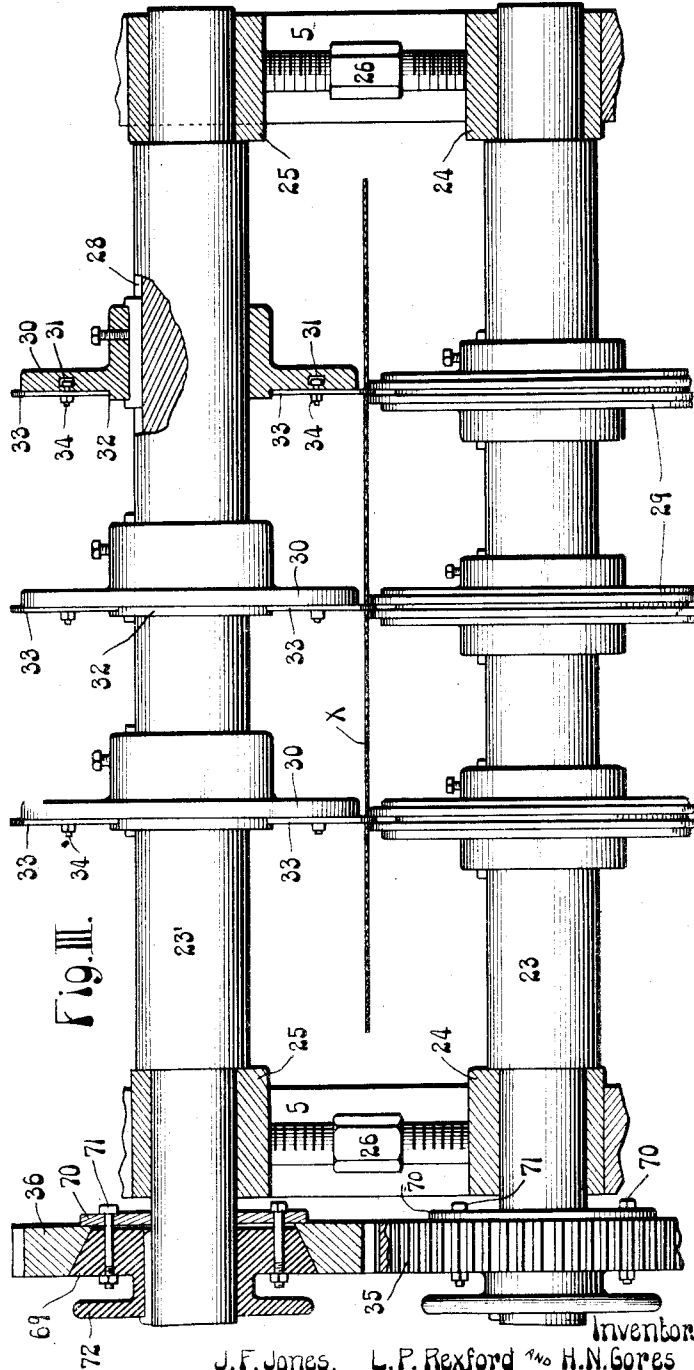
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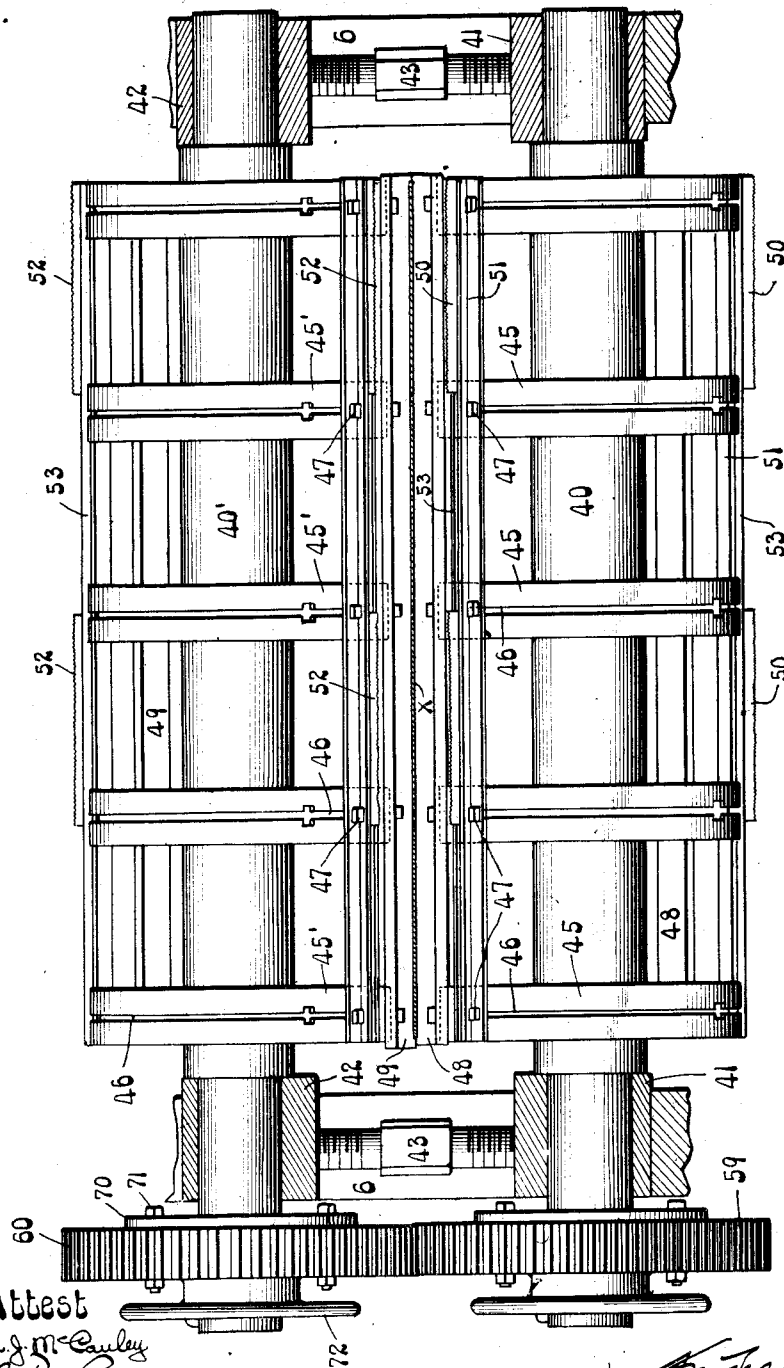


Fig. IV.

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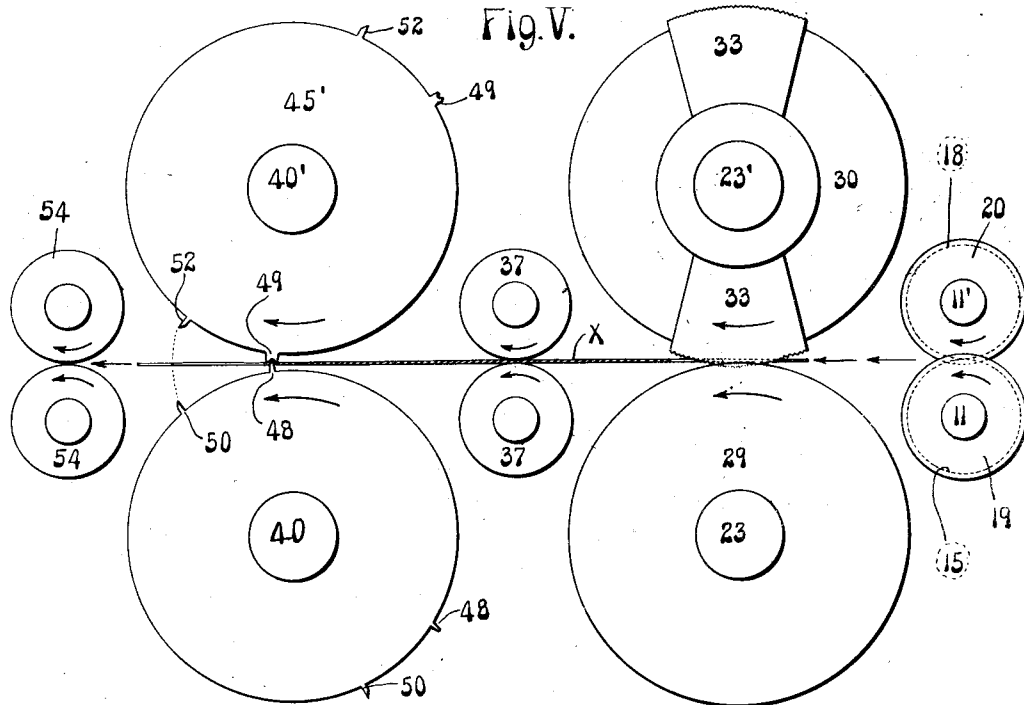
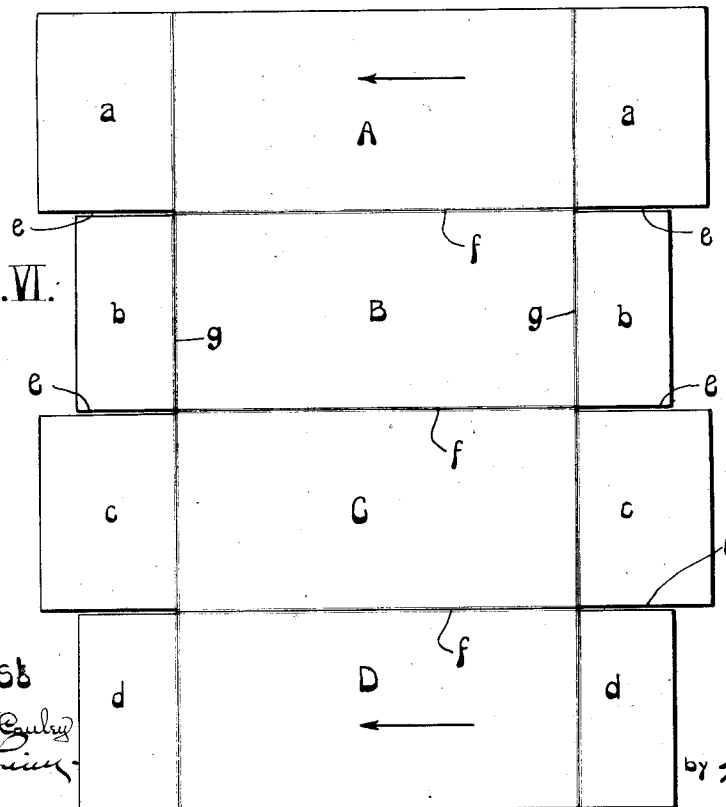


Fig. VI.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR MAKING CORRUGATED-PAPER BOX-BLANKS.

1,123,885.

Specification of Letters Patent.

Patented Jan. 5, 1915.

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To all whom it may concern:

Be it known that we, JAMES F. JONES, LEY P. REXFORD, and HENRY N. GORES, citizens of the United States of America, and residents of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Machines for Making Corrugated-Paper Box-Blanks, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

Our invention relates to a machine for use in making box blanks from sheets of corrugated paper board, and, briefly stated, the invention has for its object to furnish a machine of this kind in which the several operations incident to making blanks of the kind referred to may be successively performed and carried out in a manner to produce corrugated paper board box blanks of superior quality and absolutely uniform in all particulars.

With this in view, our machine includes mechanism, uniformly driven and timed, for performing the operations of trimming the side edges of sheets of corrugated paper board, producing longitudinal scores to subdivide the corrugated sheet into box wall sections, slitting the sheet to produce closure flaps at the ends of the wall sections, scoring the sheet transversely to form flexible hinges for the closure flaps, and cutting or trimming the flap ends of the sheet so as to produce closure flaps of the desired dimensions.

Figure I is a side elevation of our box blank making machine. Fig. II is in part an elevation of the companion shafts at the front end of our machine, with the trimming and scoring devices thereon, and in part a section on line II—II, Fig. I, through the supports and bearings for such shafts. Fig. III is in part an elevation of the blank slitting devices and the companion shafts by which they are carried, one of the cutter wheels being shown in cross section, and in part a section on line III—III, Fig. I, through the supports for the slitting member shafts and one of the shaft driving gears. Fig. IV is in part an elevation of the transverse scoring devices, the flap cutters, the carriers for these parts, and the companion shafts supporting said carriers.

the view being part a section on line 55 IV—IV, Fig. I, through the supports for said shafts. Fig. V is a diagrammatical view illustrating the relative positions of parts and the operations in the use of our machine. Fig. VI is a top or plan view of a corrugated paper box blank of the kind produced in our machine.

Before proceeding to a description of our machine, we will, to facilitate such description, describe the corrugated paper board box blank illustrated in Fig. VI. This illustration is of a blank such as would be produced by passing a sheet of corrugated paper board through our machine. The blank comprises four box body wall sections A, B, C, and D, at the ends of which are, respectively, closure flaps *a*, *b*, *c*, and *d* separated by slits *e*. Extending longitudinally of the blanks are scores *f*, which subdivide the blank in the wall sections A, B, C, and D, and extending transversely of the blank are the scores *g* produced for the purpose of forming hinges for the closure flaps.

We desire to make particular mention with reference to box blanks of the kind our machine is intended to make that while the longitudinal scores *f* which subdivide a sheet of corrugated paper board into box body wall sections need be only such as to crease the corrugated paper board sufficiently to permit of the wall sections partaking of a folding movement relative to each other, without requiring any high degree of flexibility at the junctions of said sections, it is highly essential that the transverse scores *g* which provide hinges for the closure flaps of the blank be creased so effectually as to destroy the corrugated structure in such joints. In acquiring this result it is necessary that the corrugated paper in the blank be flattened out and lie compactly between the facings of the corrugated paper board and, when this is accomplished, the closure flap hinges will bend or flex without breaking. Our machine provides for the production of hinges of this kind.

Referring now to our machine, 1 designates the base of the machine which may be of any desired form. The base is surmounted by a pair of central standards 2 aligned with each other transversely of the machine, a pair of front standards 3, and a pair of

rear standards 4, the standards 3 and the standards 4 being alined transversely of the machine and being alined longitudinally of the machine with the central standards 2.

5 The standards 3 and 4 are spaced from the central standard to provide bearing box ways 5 and 6, closed at their upper ends by caps 7 and 8, which join the standards to each other. The standards 3 are provided with journal box ways 9, and the standards 4 are provided with journal box ways 10.

10 11 and 11' designate vertically alined horizontal shafts parallel with each other at the front end of our machine, the said shafts being mounted in journal boxes arranged in the ways 9 of the standards 3, as seen in Fig. II. These shafts are geared to each other by spur wheels 12 and 13, to which power is communicated in a manner to be hereinafter explained. The shafts are provided with longitudinal grooves, one of which is seen at 14, (Fig. II).

15 15 designates feed wheels arranged on the shafts 11, these wheels being adjustable longitudinally of the said shaft and being held from rotation relative to the shaft by keys 16 seated in the wheels and also in the longitudinal groove in the shaft. The wheels are held from longitudinal displacement on the shaft by set screws 17 which bear against the keys 16.

On the shaft 11' are scoring wheels 18, which are positioned to correspond to the feed wheels 15 and are adjustably held to said shaft by means similar to the means for holding the feed wheels to the shaft 11.

19 and 20 designate, respectively, circular cutters adjustably arranged on the shafts 11 and 11', respectively, these cutters being held in adjusted positions by keys 21 in the grooves in the shafts, and set screws 22 in the hubs of the cutters bearing against said keys, these structural features being similar to those utilized for holding the feed wheels 15 and scoring wheels 18 in fixed positions after they have been adjusted. The circular cutters 19 and 20 are paired together so that each cutter 19 will cooperate with a cutter 20 during the rotation of the shafts 11 and 11' in opposite directions.

When a sheet of corrugated paper board, as indicated by the letter X, from which a box blank is to be produced is initially presented to our machine, the wheels 15 and 18 all act as feeding wheels between which the paper board is passed and the scoring wheels 18 act to score said sheet longitudinally with the feeding wheels serving as resistance members during the production of the scores. Simultaneously with the feeding and scoring actions, the sheet of corrugated paper board is trimmed at its sides by the circular cutters 19 and 20. It will, therefore, be apparent that the passage of the paper board between the shafts 11

and 11' results in the partial production of a blank such as shown in Fig. VI, to the extent of trimming the board at its sides and the formation of the longitudinal scores f. The feed wheels and scoring wheels and the circular cutters on the shafts 11 and 11', being adjustably arranged on these shafts, may be shifted into any desired positions and, therefore, the scoring and trimming operations may be performed to suit varying requirements according to different sizes of box blanks to be made, and requirements for locating the scores at increased or lessened distances from each other.

After the sheet of corrugated paper board X is subjected to the action of the scoring wheels 18 and the trimming cutters 19 and 20, it passes to slitting mechanism, which will be next described, this slitting mechanism being most clearly shown in Fig. III. 23 and 23' are vertically alined parallel shafts mounted in suitable journal boxes 24 and 25, located in the ways 5 between the standards 2 and 3, the upper journal boxes being adjustable relative to the lower journal boxes by suitable means, such, for example, as adjusting screws 26 between the journal boxes, and top screws 27 extending through the caps 7 into engagement with the top journal boxes.

The shafts 23 and 23' are provided with longitudinal grooves, one of the grooves being seen at 28, Fig. III. 29 are female cutter wheels, adjustable on said shaft to positions proper for the slitting of the sheet X of corrugated paper board to produce the slits e in forming the flaps of the paper board box blank. The means for holding the female cutter wheels in adjusted positions and from rotation relative to the shaft 23 comprise members similar to those previously described for molding the adjustable elements on the shafts 11 and 11', and, such means being apparent from the drawings, detailed description thereof is deemed unnecessary.

30 designates male cutter wheels adjustably secured to the grooved shaft 23' and adapted to be set upon said shaft into positions correlative with the female cutter wheels 29 on the shaft 23. Each male cutter wheel 30 is provided at one of its sides with a circular groove 31 of T-shape, and with an annular abutment 32 at its hub. 33 are slitting blades fitted to the sides of the male cutter wheels 30, each slitting blade being of such length as to rest at its inner end against an annular abutment 32, with its other end protruding beyond the periphery of the male cutter wheel. The slitting blades are adjustably secured to the male cutter wheels by clamping bolts 34, the heads of which are arranged in the enlargements of the T-shaped grooves 31, the nuts on said bolts pressing against the outer faces of the slitting blades as clearly seen in Fig. III.

The shafts 23 and 23' are geared to each other by spur wheels 35 and 36, so that the shafts will be rotated in opposite directions, and the operation of these shafts is so timed relative to the operation of the shafts 11 and 11' as to cause one set of the slitting blades 33 to enter the grooves in the companion female cutter wheels 29 and cut into the corrugated paper board X as it reaches the female and male cutter wheels, the slitting blades being of such width that they will slit said board to a length corresponding exactly to that necessary to produce the slits *e* of uniform lengths.

The corrugated board X from which a box blank is produced passes, after being slit at one of its ends to produce the end flaps at that end, between feed rollers 37, which are geared to each other by spur wheels 38 and 39, (see Fig. I), the journal boxes for the spindles of these rollers being mounted in the central standards 2.

The feeding rollers 37 deliver the corrugated board to means for scoring the board transversely and means for cutting the flaps at the ends of the board, which means will next be described.

40 and 40' designate shafts, (see Figs. I and IV), mounted in lower and upper journal boxes 41 and 42 arranged in the journal box ways 6, the upper journal boxes being adjustable relative to the lower journal boxes by adjusting screws 43 between the boxes and adjusting screws 44 above the upper boxes, the latter screws being arranged in the caps 8 connecting the standards 2 and 4.

The shafts 40 and 40' are parallel with each other and in vertical alinement. The shaft 40 has secured to it a plurality of carrier rings 45 and the shaft 40' has secured to it a plurality of carrier rings 45'. At the peripheries of these carrier rings are T-shaped grooves 46, which receive the heads or nuts of bolts 47 serving as adjustable fastening means for parts about to be described, through the medium of which the sheet X of corrugated paper board is scored transversely to produce the scores *g* of the box blank shown in Fig. VI.

48 designates transverse scoring bars, (see Figs. I and IV) extending longitudinally of the shaft 40 and held in set positions at the circumference of the carrier rings 45 by series of the bolts 47 adjustable in the T-shaped grooves 46. 49 are transverse scoring bars secured to the carrier rings 45' by series of the bolts 47 adjustable in the T-shaped grooves in said carrier rings, thereby providing for adjustment of the scoring bars 49 similar to the adjustment of the scoring bars 48. As seen most clearly in Fig. I, the scoring bars 49 are grooved longitudinally, and the scoring bars 48 are provided with tongues which

enter the grooves in the bars 49 when said bars 48 and 49 are brought into registration to score the board X transverse while it is moving between said transverse scoring bars during rotation of the shafts 40 and 40'. The co-acting transverse scoring bars 48 and 49 are adapted to come into correlative positions with their score producing edges closely presented to each other, and, as a consequence, transverse creases *g* in the paper box blank are produced due to a very positive and severe pressure upon the corrugated paper board, the pressure being such as to destroy the corrugation in the paper board where it is scored or creased. Hinges for the flaps of the box are therefore produced which are flexible or pliable to avoid breaking of hinges, a feature that is highly desirable for the reason hereinbefore pointed out.

50 and 52 designate transverse cutter blades secured between clamping bars 51 and 53 adjustably attached to the carrier rings 45 and 45' by series of the bolts 47. These cutter blades are adapted to be so positioned around the circumference of the carrier rings 45 and 45' as to provide for the blades 50 and 52 being brought together at proper intervals during rotation of the shafts 40 and 40', to cut or trim the closure flaps of the paper box blank as the sheet X continues its forward movement through the machine after being acted upon by the transverse scoring blades 48 and 49. The flap cutting blades shown in the drawings, (see Fig. IV), are so positioned as to cut only two of the closure flaps; that is, the flaps *b* and *d* of the box blank, shown in Fig. VI, to render these flaps shorter than the remaining flaps. It will be obvious, however, that cutter blades 50 and 52 may be utilized in sufficient number or of a sufficient length to cut or trim all of the flaps of the blank, if cutting to this extent is desired.

54 designates a pair of feed rollers mounted in journal boxes arranged in the journal box ways 10 in the rear standards 4, these feed rollers being adapted to receive the sheet X of corrugated paper board and assist in the movement of said sheet during its travel through the machine, the said rollers being more particularly of service after the feed rollers 37 have ceased to be operative upon the sheet. The feed rollers 54 are geared to each other by spur wheels 55 and 56.

Explanation, as hereinbefore given, of the operations performed upon a sheet of corrugated paper board in the passage of the board through our machine, has included, in the main, the slitting of the paper board at its end first presented to the machine and the production of one transverse score nearest the foremost end of said sheet. It

is, therefore, to be noted further that there are two slitting blades 33 on each male cutter wheel 30 adapted to be brought into co-action with the female cutter wheels 29 at different times. These slitting blades are so located relative to each other that one series of the blades will cut slits *e* at one end of the sheet X when the sheet is first presented to the cutter wheels 29 and 30, and the other series of slitting blades will cut slits *e* at the other end of the sheet when the sheet has been advanced through the machine to the proper degree. Further, that there are two sets of the transverse scoring bars 48 and 49 and two sets of the transverse flap cutting blades 50 and 52. The sets of scoring bars 48 and 49 are so positioned, relative to each other on the carrier rings 45 and 45', that one set of the scoring bars will operate to produce the first transverse score *g*, and the other set of scoring bars will act later to produce the second transverse score *g*. Similarly one set transverse of flap cutting blades 50, 52 cuts the flaps at the foremost end of the sheet, and the other set of blades later cuts the flaps at the rear end of the sheet, as said sheet travels into proper position for the cutting action.

The various shafts and rollers of our machine are operated at a uniform speed and rotate at all times in absolute unison so that all operations of the machine are carried out with uniformity upon every sheet of corrugated paper board passed through the machine. This is accomplished by driving mechanism part of which has been described and the remainder of which will now be described.

57 designates the main drive shaft of the machine. This shaft is provided with a pinion 58 which meshes with the spur wheel 35 and, therefore, transmits power to said spur wheel 35 and the spur wheel 36 in mesh therewith to drive the shafts 23 and 23' which carry the slitting wheels 29 and 30. The pinion 58 is also in mesh with a spur wheel 59 fixed to the shaft 40, the latter being in mesh with a spur wheel 60 fixed to the shaft 40', and the last two mentioned wheels are, therefore, driven directly by the main drive shaft to rotate the shafts 40 and 40' by which the transverse scoring bars and the transverse cutter blades are carried. The main drive shaft has fixed to it, in addition to the pinion 58, a pinion 61, which meshes with the spur wheel 38 on the lower feed roller 37. The lower feed roller 37 being rendered coöperable with the upper feed roller 37 by a spur wheel 39, both of said feed rollers are rotated by the main drive shaft. On the shaft of the lower feed roller 37 is a bevel gear wheel 62.

63 designates a line shaft extending longitudinally of the machine, and having there-

on a bevel gear wheel 64 in mesh with the bevel gear wheel 62 driven directly by the main drive shaft. The line shaft carries bevel gear wheels 65 and 67 which mesh with bevel gear wheels 66 and 68 fixed to the shaft 11 and lower feed roller 54 respectively. The shaft 11' being geared to the shaft 11 rotates in unison with the latter, and the upper feed roller 54; being geared to the lower feed roller, these two rollers are rotated in unison.

To facilitate the adjustment of the shafts 23, 23', and 40 and 40', for the purpose of disposing the box blank producing members in proper correlative position, we use on each of these shafts a device constructed as follows: This device, shown most clearly in Fig. III, is one by which each shaft may be separately rotated, irrespective of the driving gear provided therefor, and a description of one of the devices will apply to the remainder of them, irrespective of the wheels and shafts they are associated with. The device comprises a bushing 69 keyed to the shaft and tapered to fit into a tapering hole in the shaft driving gear wheel. A plate 70 fits against the inside face of the gear wheel, and bolts 71 passing through said plate and the bushing are of service in forcing the gear wheel onto the tapered bushing to a degree of tightness of fit that will prevent rotation of the wheel on the bushing. It will be apparent that upon loosening the nuts on the bolts 71, the gear wheel is loosened and the shaft may be rotated by grasping the knob 72 of the bushing, while the gear wheel remains stationary.

We claim:—

1. In a box blank making machine, a rotatable scoring device for scoring a box blank sheet longitudinally, a rotatable slitting device for slitting said sheet to produce closure flaps, a rotatable trimming device for trimming the side edges of said sheet, and means for rotating all of said devices in unison, each of said devices being adjustable relative to the other devices and in a direction parallel with its axis.

2. In a box blank making machine, rotatable scoring wheels for scoring a box blank sheet longitudinally, rotatable scoring bars for scoring said sheet transversely, rotatable slitting devices for slitting said sheet longitudinally to produce closure flaps, rotatable trimming wheels for trimming the side edges of said sheet, rotatable cutter blades arranged transversely of said sheet for trimming the ends of said closure flaps, and means for rotating all of said elements in unison.

3. In a box blank making machine, rotatable scoring wheels for scoring a box blank sheet longitudinally, rotatable scoring bars for scoring said sheet transversely, ro-

tatable slitting devices for slitting said sheet longitudinally to produce closure flaps, rotatable trimming wheels for trimming the side edges of said sheet, rotatable cutter blades arranged transversely of said sheet for trimming the ends of said closure flaps, and means for rotating all of said elements in unison, said rotatable cutter blades and said rotatable scoring bars being adjustable about their axes, the scoring wheels, the slitting devices, and the trimming wheels being adjustable relative to each other and in a direction parallel with their axes.

4. In a box blank making machine, means for scoring a box blank sheet longitudinally, and a slitting device for slitting said sheet at the ends of the longitudinal scores to produce closure flaps, said slitting device comprising cutter wheels each of which is provided with a circular groove in its side face, segmental slitting blades fitted to the sides of said wheels, and bolts arranged partly within said circular slots and serving as means for adjustably connecting said segmental slitting blades to said cutter wheels.

5. In a box blank making machine, means for scoring a box blank sheet longitudinally, and a slitting device for slitting said sheet at the ends of the longitudinal scores to produce closure flaps, said slitting device comprising cutter wheels each of which is provided with a circular groove in its side face, segmental slitting blades fitted to the sides of said wheels, and bolts arranged partly within said circular slots and serving as means for adjustably connecting said segmental slitting blades to said cutter wheels, each of said cutter wheels being provided

with an annular abutment at its hub and each of said segmental slitting blades being fitted to said annular abutment.

6. In a box blank making machine, means for scoring a box blank sheet longitudinally, a slitting device for slitting said sheet at the ends of the longitudinal scores to produce closure flaps, said slitting device comprising rotatable cutter wheels, segmental slitting blades having segmental cutting teeth, and rotatable wheels having annular peripheral grooves for the reception of said segmental teeth, the said segmental slitting blades being adjustable about the axis of said cutter wheels.

7. In a box blank making machine, rotatable shafts, a slitting device secured to one of said rotatable shafts, a scoring device secured to another of said shafts, and means for rotating said shafts, said means including a gear ring surrounding one of said shafts, a tapered bushing secured to the last mentioned shaft and fitted to the inner face of said gear ring and means for forcing said gear ring onto the tapered face of said bushing so as to prevent rotation of the gear ring on the tapered bushing, the last mentioned means being operable to release the gear ring from said tapered bushing so as to permit the shaft to be adjusted independently of said gear ring.

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