March 1, 1927. 1,619,207

J. F. JONES

MACHINE FOR FORMING BLANKS FOR CORRUGATED PAPER BOXES

Filed Jan. 24, 1925 5 Sheets-Sheet 1

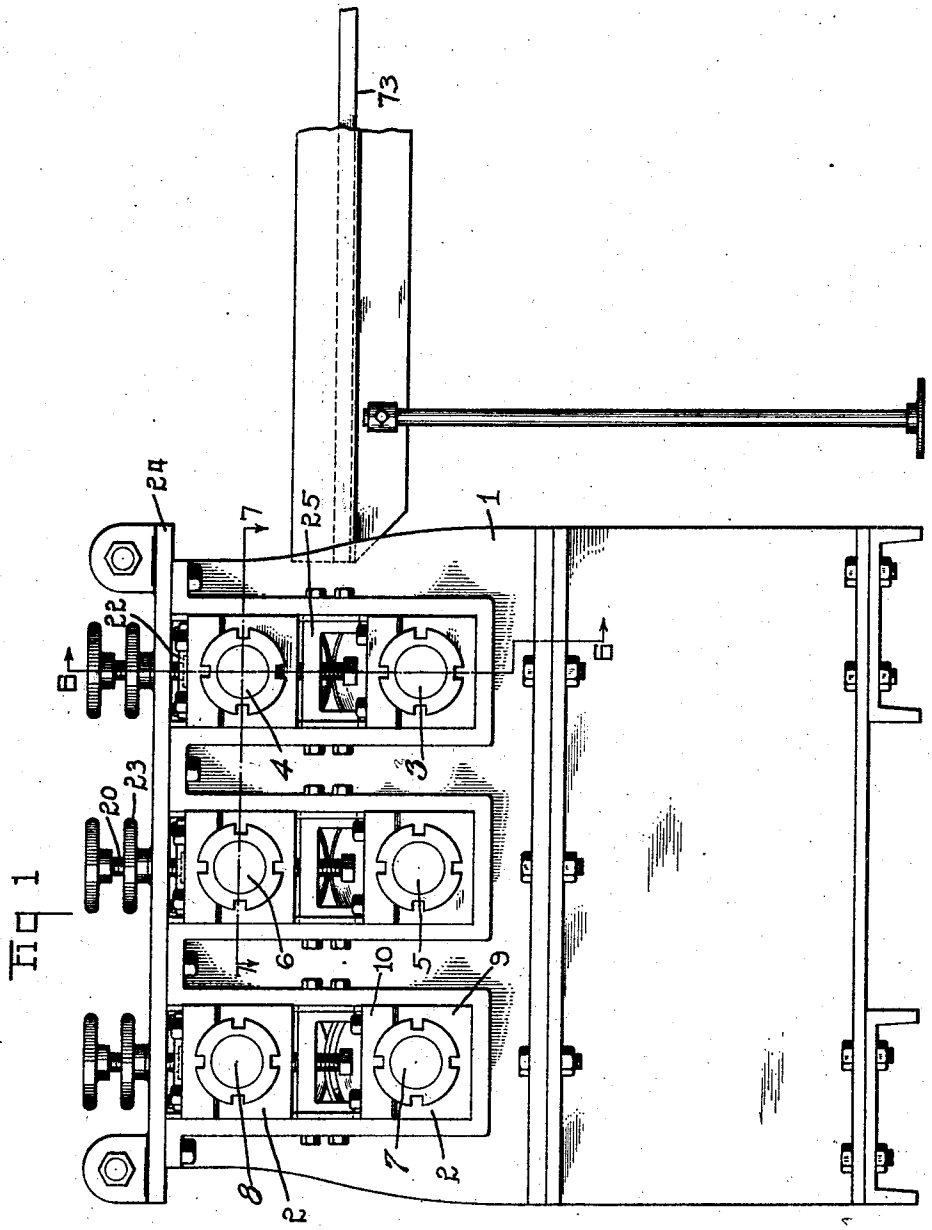


Fig 1

Inventor
James F. Jones

By Owen, Owen & Crampton
Attorney

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Filed Jan. 24, 1925 5 Sheets-Sheet 2

Fig 2

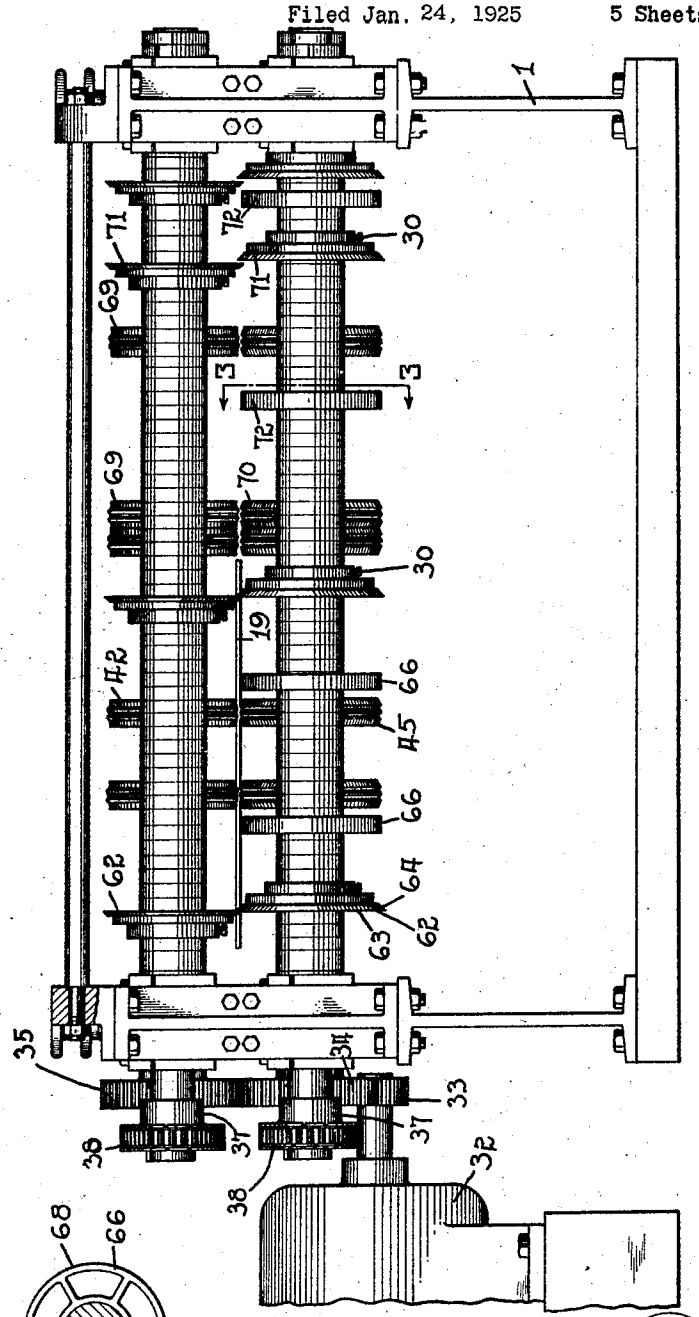
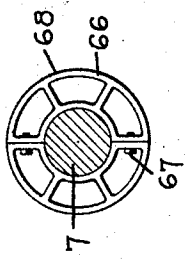


Fig 3



Inventor

James F. Jones

By Owen, Owen & Crampton

Attorney

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J. F. JONES

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Filed Jan. 24, 1925 5 Sheets-Sheet 3

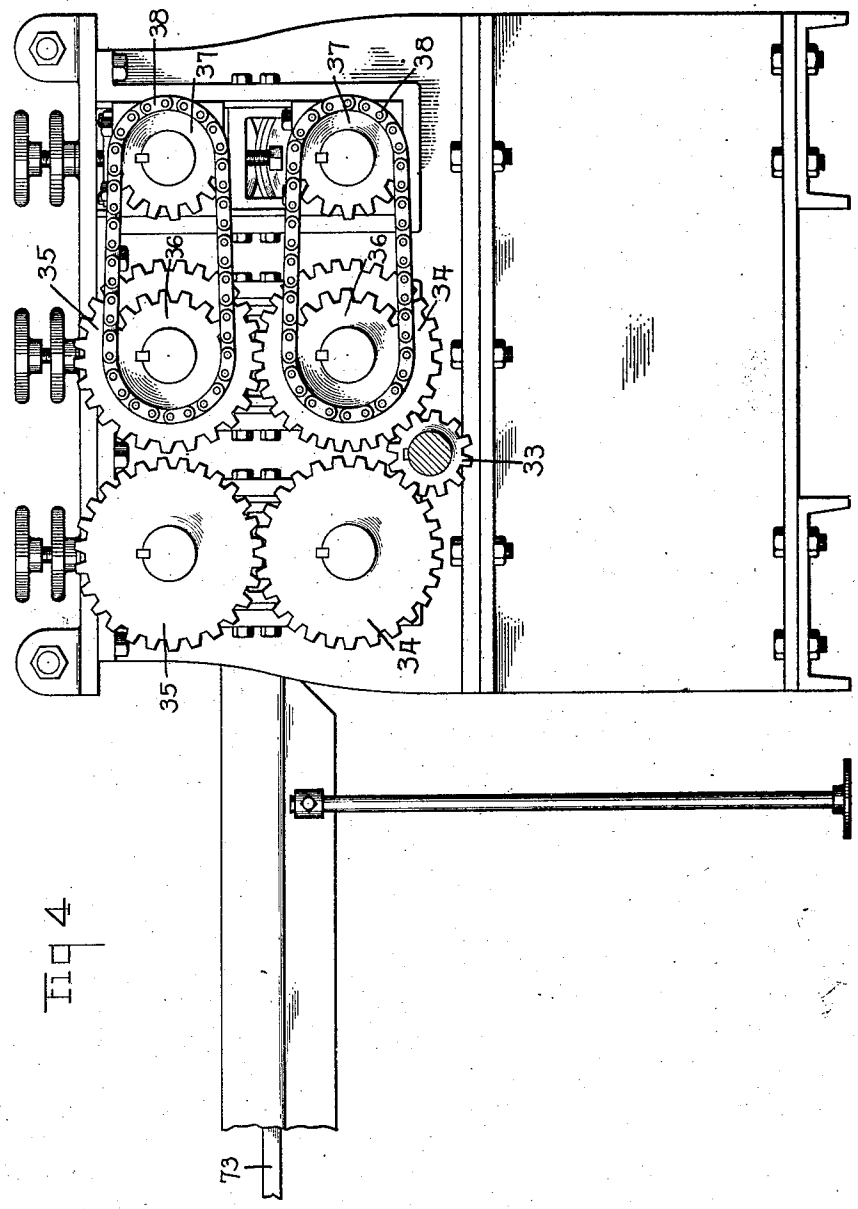


Fig 4

Inventor
James F. Jones

By Owen Owen Crampton.
Attorney

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J. F. JONES

MACHINE FOR FORMING BLANKS FOR CORRUGATED PAPER BOXES

Filed Jan. 24, 1925 5 Sheets-Sheet 4

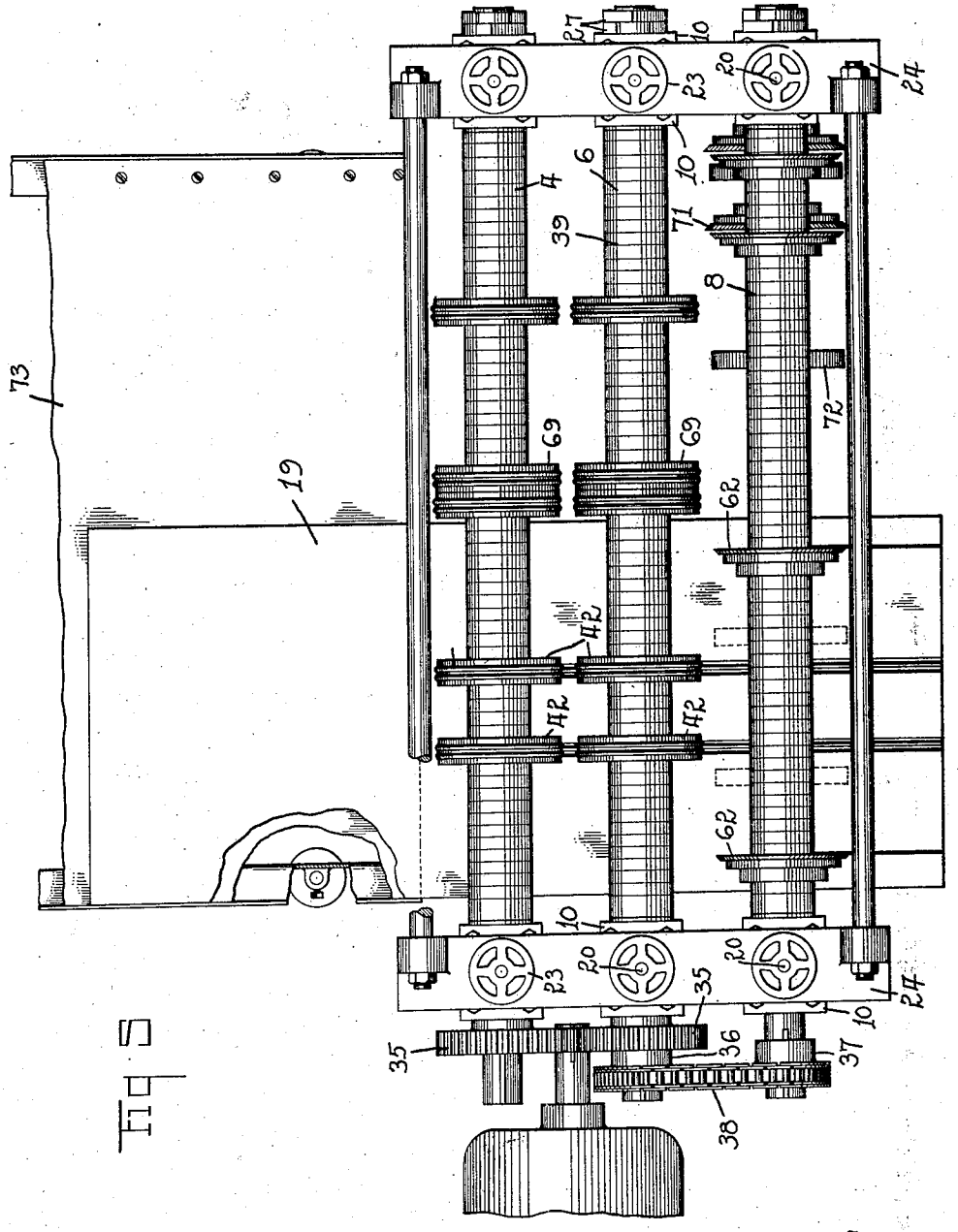


Fig 5

Inventor

James F. Jones

By Owen, Owen & Crampton

Attorney

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J. F. JONES

MACHINE FOR FORMING BLANKS FOR CORRUGATED PAPER BOXES

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Fig 6

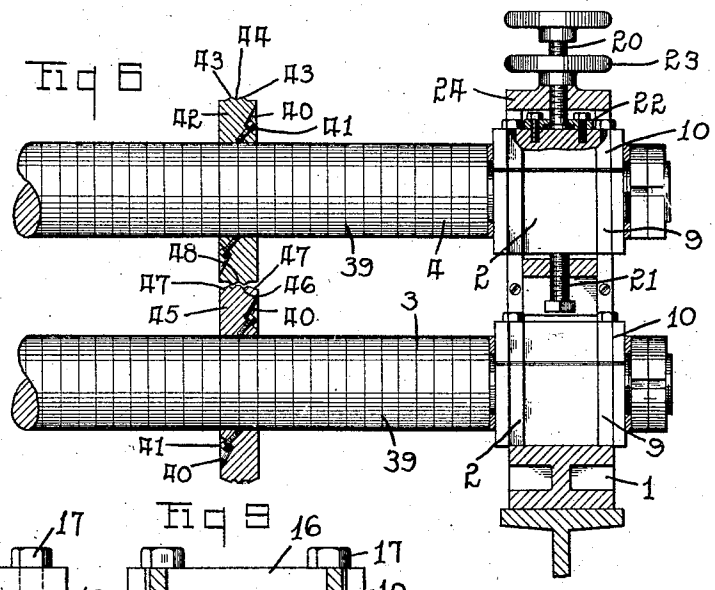


Fig 8

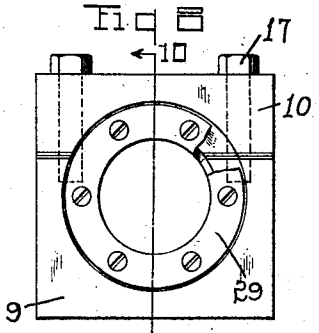


Fig 9

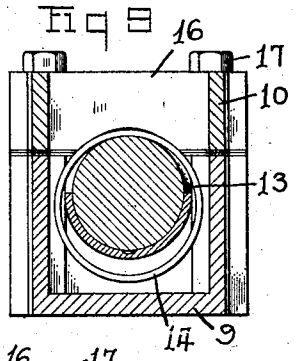


Fig 7

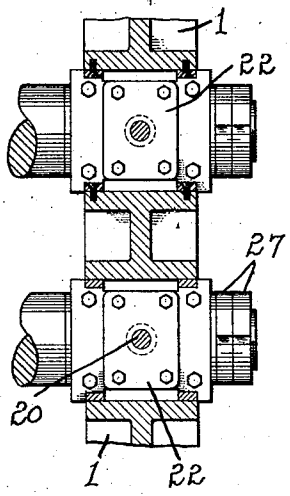


Fig 10

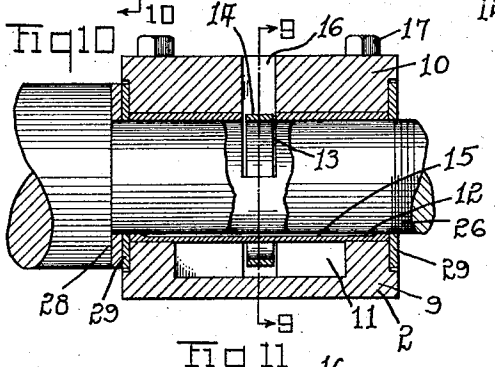
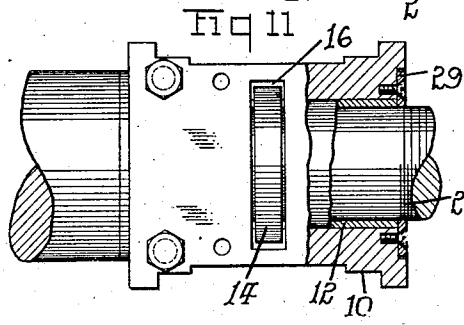


Fig 11



Inventor
James F. Jones

By Owen, Owen & Crampton
Attorney

Patented Mar. 1, 1927. 1,619,207

UNITED STATES PATENT OFFICE.

JAMES F. JONES, OF SEWICKLEY, PENNSYLVANIA, ASSIGNOR TO THE CONSOLIDATED PAPER COMPANY, OF MONROE, MICHIGAN, A CORPORATION OF MICHIGAN.

MACHINE FOR FORMING BLANKS FOR CORRUGATED-PAPER BOXES.

Application filed January 24, 1925. Serial No. 4,367.

My invention has for its object to provide corrugated paper boxes from a corrugated paper sheet that is so formed as to prevent breaking of the paper along the scored lines.

A very large proportion of packing boxes, commonly used in commerce for shipping purposes, as is well known, are formed of "corrugated paper", that is, paper formed of inner and outer smooth or plain sheets of paper and an inner corrugated sheet, which are suitably glued or otherwise secured together. Each box is usually formed of a single composite sheet having cross scorings that terminate in slits and its ends joined by a suitable flexible material such as cloth. The composite sheets are also longitudinally scored along the inner ends of the slits. The parts of the sheets defined by the scorings form the sides, while the parts defined by the longitudinal scorings and the slits form the flaps that are folded down to form the ends of the box.

In the production of such boxes machines heretofore used have been crude in that they permit angular creeping of the sheets which grinds or mars the scorings; in that the scoring disc supporting shafts flex which produces varying depressions according to the dryness and composition of the paper and prevents proper adjustment of the shafts and of the scoring discs relative to each other and in that the edges of the sheets are trimmed by pinching as distinct from shearing.

The boxes commonly used in commerce are scored so as to form a single depression extending linearly and a slightly raised portion on the opposite side of the sheets along each score line. The depressing operation on the sheets is practically absorbed by the inner corrugated sheet, the plain sheet, other than the one that is acted upon by the depressing disc in the scoring operation, being but slightly affected to produce a very slightly raised ridge. When the parts of the composite sheets are bent to form the boxes they bend along the score lines, the depressed side of the composite sheet being located within the box. Scoring of the composite sheets makes definite bending lines to form definite corner edges of the boxes formed therefrom but the indented side sheet of the composite sheet in each case and the inner corrugated sheet form a rib extending into and located within the composite sheet over which the very slightly raised outer plain sheet must be stretched when the parts of the composite sheet are bent to box form. The bending operation is, therefore, a levering operation that draws the outer sheet with great force over the rib that extends into and is located within the composite sheet. This greatly taxes the elasticity of the outer sheet of plain paper and invariably breaks open the sheet, particularly when the adjoining parts of the box are opened and closed angularly with respect to each other. This particularly occurs with respect to the flaps that form the ends of the box in the reuse of the box. Fracture also usually occurs along the corners when the corners of the box are struck by an object which will start the tearing of the paper by reason of the stretched condition of the outer sheet. When the paper is dry or the composition and the manufacture is varied from exact desired conditions, which unavoidably and continuously occurs, the weakness at the corners of the boxes is greatly increased.

By my invention I have provided a machine that overcomes in a practical way these objections. The machine is so constructed that the shafts that support the scoring discs will not flex; that the shafts are readily adjustable and yet may be thoroughly lubricated and that angular creeping of the composite sheets is prevented while they are being operated upon. Also the scoring discs used in the machine are so formed as to produce a pair of parallel linear depressions in the composite sheets that are so formed that when the parts of the composite sheets are bent to form the box they will bend along a line parallel to the lines of depression, the depressions being located on the outside of the box. Thus the depressions form areas of the exterior sheet in slack that are partially taken up when the adjoining parts are bent relative to each other to a 90° angle. Thus the exterior plain paper is not stretched in the slightest and remains smooth and intact and is not easily marred or broken in the use of the box. Moreover the end parts of the box will stay in the right angular positions in which they are placed without springing up. Also the portions of the composite sheet between the parallel linear depressions are not affected by the machine and are left free to be com-

pressed by the exterior plain sheet when the slacked areas have been taken up and the adjoining parts of the composite sheet are bent 180° so as to place the adjoining parts of the composite sheet in contact with each other. An attractive rounded edge is formed between two integral layers or parts without placing the exterior sheet of plain paper under tension to a material degree. Thus the end parts of the box may be folded into the box leaving the edge of the box smooth and untorn. Also the boxes are sometimes stored and shipped collapsed, that is, with the ends of the composite sheets joined by cloth or other flexible sheet material and the sides of the box folded flat against each other along a single corner line. When, therefore, the composite sheet is bent to bring the inside faces of the parts into contact, the exterior plain sheet remains smooth and intact along the fold.

The invention may be contained in paper box machines that vary in their details of construction, and in productions of such machines that likewise may vary in their details and to illustrate a practical application of the invention I have selected a machine and its product and shall describe them hereinafter. The machine is shown in the accompanying drawings.

Figure 1 illustrates a side view of a part of the machine showing the adjustable bearings for the scoring and shearing shafts. Fig. 2 is an end view of a part of the machine showing the driving gear and the shearing shafts. Fig. 3 is a sectional view taken on the line 3—3 and illustrates a side view of a paper supporting disc. Fig. 4 is a view of a side of the machine opposite to the side view shown in Fig. 1. Fig. 5 is a top view of the machine. Fig. 6 is a view of a section taken on the vertical plane of the line 6—6 indicated in Fig. 1. Fig. 7 is a view of a section taken on the horizontal plane of the line 7—7 indicated in Fig. 1. Fig. 8 is an inside view of the bearing of one of the scoring or cutting shafts. Fig. 9 is a view of a section through a vertical plane taken on the line 9—9 indicated in Fig. 10. Fig. 10 is a view of a section of a vertical plane taken on the line 10—10 indicated in Fig. 8. Fig. 11 is a top view of one of the bearings.

The machine, whereby the composite sheets are cut and scored so that they may be readily formed into boxes having corner edges that are smooth and without being stretched, has a suitable frame or bed 1 for supporting the actuating and operating parts thereof. The frame 1 is provided with a plurality of bearings 2 in which the ends of the shafts 3, 4, 5, 6, 7 and 8 are supported. The bearings 2 are each formed of two parts 9 and 10. The parts 9 as shown in Figs. 9 and 10 are each provided with a cavity 11 that is partially closed by a cylindrical shell 12 that surrounds the shaft located in the bearing. The shell 12 is provided with a slot 13 that extends semi-cylindrically through the upper half of the shell. A ring 14 surrounds the shaft located in the bearing and rides on the top of the shaft. The ring 14 may be slightly thinner than the thickness of the shell 12. The diameter of the ring 14, however, is considerably greater than the diameter of the shell 12 and so that the ring 14 extends to a point near the bottom of the recess or cavity 11. Since the ring 14 rides on the shaft in the bearing, it is rotated when the shaft is rotated and will carry up on to the upper surface of the shaft, lubricating oil that may be inserted in the cavity 11 whereby the shaft will be thoroughly lubricated. The ring 14 is located in the center of that portion of the shaft located in the bearing and in order that the lubricating oil may be spread over the entire surface of the shaft, a groove 15 is located at the bottom of the shell. The groove 15 is located on the inside of the shell and extends substantially from one end of the shell to the other. The upper part 10 of the bearing has an opening 16 for receiving oil whereby the cavity 11 may be filled and lubrication may be continued over a long period of time without further supply of oil. The parts 9 and 10 are secured together by suitable bolts such as the bolts 17.

The bearings of the shaft are so supported that they may be readily adjusted so as to properly locate the tools connected to the shafts that cooperate to perform the desired functions on the composite sheet. The lower bearings rest upon the parts of the frame 1 while the upper bearings are raised by the screws 20 or if desired they may be raised by the screws 21. The screws 20 are connected to plates 22, the screws 20 being provided with flanges that engage the edge portions of openings formed in the plate 22. The plates 22 are bolted to the upper bearings 2. The upper bearings 2 may thus be raised and lowered by the operations of the screws 20 and 21 and may be also clamped in any desired position by the said screws. The upper screws 20 are substantially locked by the clamp nut 23. The screws 20 extend through a bar 24, while the screws 21 are located in bridges 25 that may be bolted to the frame 1 of the machine. The shafts 3 to 8 inclusive are provided with threaded ends 26 located on the outside of the bearings 2 and spanner nuts 27 are threaded on to the ends of the shafts to secure them in the bearings as against endwise movements of the shafts, the shafts being suitably shouldered as at 28. The bearings may be provided with suitable bearing rings 29 that receive the endwise thrusts of the shafts.

The shafts are driven by any suitable means as indicated in Figs. 2 and 5, such as the electric motor 32. The motor is connected to the shafts 3, 4, 5, and 6 by means of the pinion 33 and the gear wheels 34 and 35. The lower shafts are driven by the gear wheels 34 while the upper shafts are driven by the gear wheels 35. The shafts 7 and 8 are driven at a higher speed than the other shafts of the machine and are connected to the gear wheels 34 and 35 by means of the chain gear wheels 36 and 37 and the chain gear wheel 38. The chain wheels 37 are smaller than the chain gear wheels 36 which drives the shafts 7 and 8 at a higher speed than the other shafts, the gear wheels 34 and 35 connected to the other shafts having the same size.

The shafts are provided with small grooves 39 located in parallel vertical planes and spaced equidistant apart along each of the shafts and constitute means for readily indicating the relative positions of the operating or functioning tools that are connected to the shafts. The operating tools may be shifted along the shafts to the desired positions as indicated by the location of the grooves 39. Thus the scoring discs may be readily placed in the proper alignment with each other. The scoring discs are provided with recesses 40 located in proximity to the central openings of the discs through which the shafts extend and key bolts 41 are located in the recesses 40 and extend diagonally towards the axis of the shafts. When the bolts are screwed into the discs, the discs are thus keyed to the shafts and thus the discs are secured in the desired positions on the shafts.

The discs are arranged in pairs and may be described as male and female scoring discs. The male discs are located on the upper shafts 4 and 6 while the other discs are located on the lower shafts 3 and 5. The upper discs 42 are provided with a pair of ridges 43 located in parallel vertical planes. The outer surfaces of the discs 42 have cylindrical surfaces that extend from the outer corners of the discs toward the central portion of the outer surface and these cylindrical surfaces are joined by a surface formed by the rotation of a continuous sinuous line producing a wave form extending around the outer portion of each of the discs. Thus there is formed a pair of smooth rounded ridges or beads joined by a trough 44 having a smooth rounded surface in continuity with the rounded surfaces of the ridges. Each of the lower discs 45 located on the lower shafts 3 and 5 have a pair of channels 46 that are likewise located in parallel planes that extend at right angles to the shaft. These planes are spaced the same distance apart that the planes in which the ridges 43 of the discs 42 are located, and so that the ridges 43 may be placed directly over the channels 46. The outer surface of each disc 45 has edge portions 47 that are conical and slope away from the outer edges of the channels 46, while the portion of the outer surface located between the inner edges of the channels 46 is the cylindrical surface 48. The discs are separated from each other the desired distances in order to produce the desired operations on the paper that is passed through the machines. This is accomplished by the adjustment of the shafts relative to each other. In the proper adjustment of the scoring discs of the machine the scoring discs of the shafts 5 and 6 are located closer together than the scoring discs of the shafts 3 and 4 in order that the paper may be stretched to the desired form and then released and again stretched to form in order that the configuration produced by the discs may be permanently retained notwithstanding the elasticity of the paper and without stretching the paper too severely and to allow the portions along the scoring lines to adjust themselves to the deformation produced by the scoring discs.

As the sheet is carried through the machine, it is snipped or sheared by the shearing discs or snippers 62 located on the shafts 7 and 8. The shearing discs 62 have shearing edges that co-act to shear the composite sheets as they are run through the machine. The shearing discs have practically vertical plane surfaces 63 located on one side and beveled edges 64 that produce sharp shearing edges for shearing the sheets to trim the edges thereof.

Between the shearing discs are located two or more supporting discs for supporting the sheet of paper as it is being carried between the shafts 7 and 8. The supporting discs 66 are split and the semi-cylindrical parts 68 are secured together by means of the bolts 67 that extend through radially extending webs formed integral with the semi-cylindrical parts 68.

If desired additional scoring discs such as the scoring discs 69 and 70 may be located on the shafts 3, 4, 5, and 6 so as to score sheets of the composite paper that are passed through the other side of the machine. Thus two sheets may be passed side by side through the machine. Preferably however, the scoring discs 69 and 70 are merely extra scoring discs that may be shifted into position to operate on the sheets as the discs are worn. Thus a number of the scoring discs may be placed on the shafts at one time and used when others have been worn out without removing the shafts from the bearings. The additional scoring discs form an extra supply for use as may be needed. The same is also true with reference to the shearing discs 71 and the supporting discs 72.

A suitable feed table 73 may be supported

at the feeding end of the machine for supporting the composite sheets as they are fed into the machine. Also a suitable delivering table may be provided for receiving the sheets or the sheets may be received on a conveyor for delivering them from the machine.

I have thus produced by my invention a machine wherein the shafts are made exceedingly large compared to the work to be done in order that there may be no flexing of the shafts and to prevent angular creeping of the sheets which causes the scoring discs to grind on the surfaces of the grooved or recessed portions, and a machine wherein the sheets are drawn forward by the shearing operation which is done by shearing discs that run at a speed higher than the scoring discs so as to shear as distinct from pinching that irregularly affect the continuous linear movement of the composite sheets. Thus the shearing discs draw on the composite paper instead of the composite paper being pushed in between the pinching trimming discs or snippers commonly used in the art in scoring machines.

I claim:—

1. A machine for forming blanks for corrugated paper boxes, a plurality of pairs of shafts, scoring discs located on the shafts, the pairs of following scoring discs being located closer together than the leading discs, the shafts having a diameter substantially one half of that of the scoring discs, adjustable bearings for supporting the shafts, oiling rings for lubricating the shafts.

2. In a machine for forming blanks for corrugated paper boxes, a pair of shafts, scoring discs located on the shafts, the shafts having a diameter substantially one half of that of the scoring discs, a second pair of shafts, overlapping shearing discs located on the second named pair of shafts, means for driving the second named pair of shafts at a higher rate of speed than the first named pair of shafts, means for adjusting the shafts.

3. In a machine for forming blanks for corrugated paper boxes, a plurality of pairs of shafts, scoring discs located on all but two of the shafts, the pairs of scoring discs of leading shafts being located farther apart than the following scoring discs, overlapping shearing discs located on the said two of the said shafts, means for driving the said two of said shafts at a higher rate of speed than the first named pair of shafts.

4. In a machine for forming blanks for corrugated paper boxes, a plurality of pairs of shafts, scoring discs located on all but two of the shafts, the pairs of scoring discs of leading shafts, being located farther apart than the following scoring discs, overlapping shearing discs located on the said two of the said shafts, means for driving the said two of said shafts at a higher rate of speed than the first named pair of shafts, said shafts having uniformly spaced grooves and means for keying the said discs to the shafts.

5. In a machine for forming blanks for corrugated paper boxes, a plurality of pairs of shafts, scoring discs located on all but two of the shafts, the pairs of scoring discs of leading shafts being located farther apart than the following scoring discs, overlapping shearing discs located on the said two of the said shafts, means for driving the said two of said shafts at a higher rate of speed than the first named pair of shafts, split supporting discs located between the shearing discs.

6. In a machine for forming blanks for corrugated paper boxes, a pair of scoring discs, one of the discs having a pair of beads separated by a trough, the beads and the trough having a continuous surface formed by a sinuous line located in a plane extending through the axis of the disc and rotated about the axis of the discs, and having cylindrical surfaces extending from the beads to the ends of the disc, the other of the discs having channels conforming to the said beads, the disc having conical surfaces extending from the outer corners of the channels to the ends of the disc and a cylindrical surface between the inner corners of the channels.

In testimony whereof I have hereunto signed my name to this specification.

JAMES F. JONES.