June 14, 1938. O. M. MASTERS ET AL 2,120,920

MACHINE FOR CUTTING PAPERBOARD

Filed July 8, 1936 2 Sheets-Sheet 1

FIG. 1

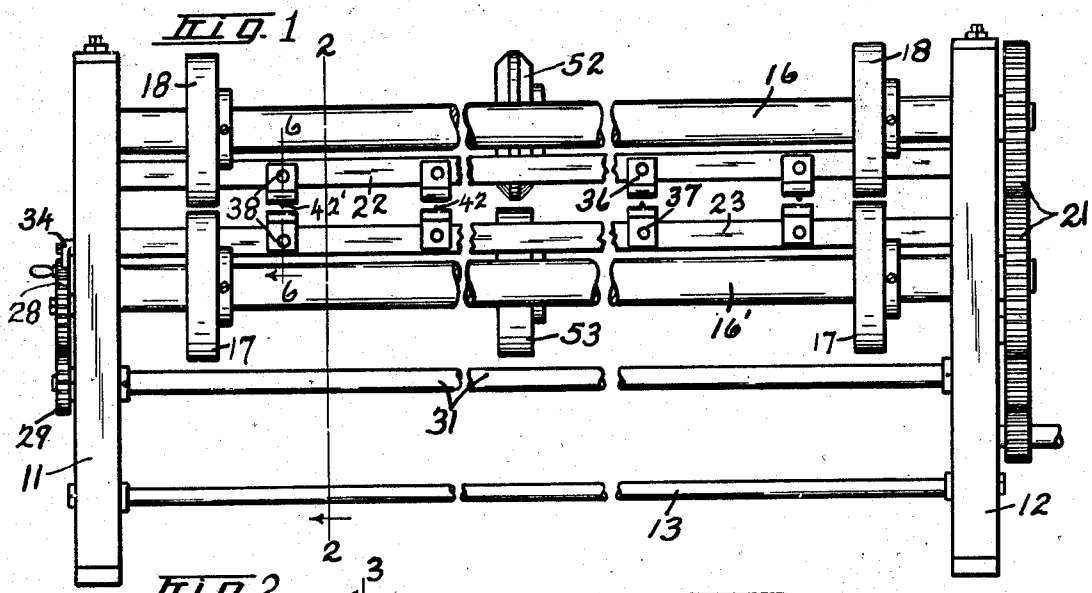


FIG. 2.

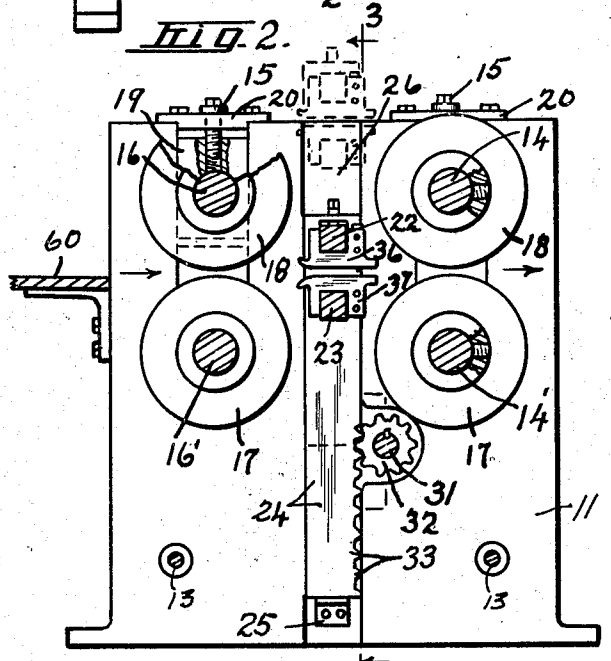


FIG. 3.

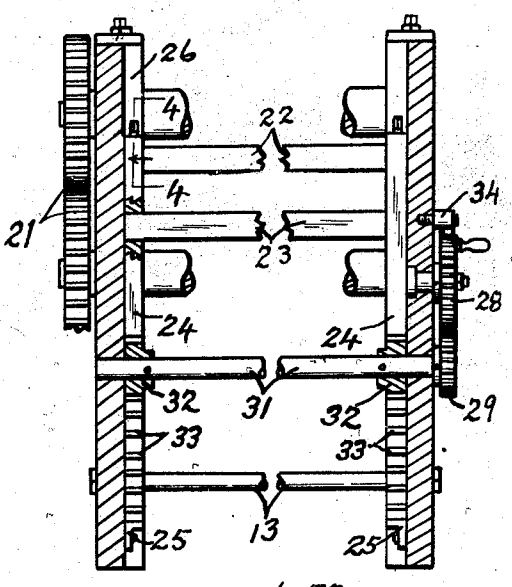


FIG. 4.

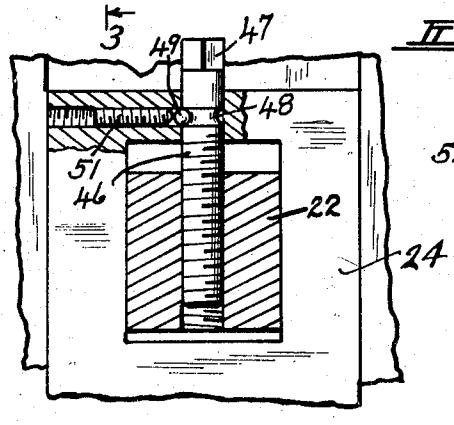
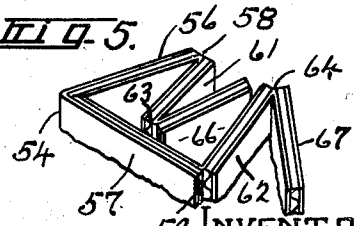


FIG. 5.



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FIG. 6.

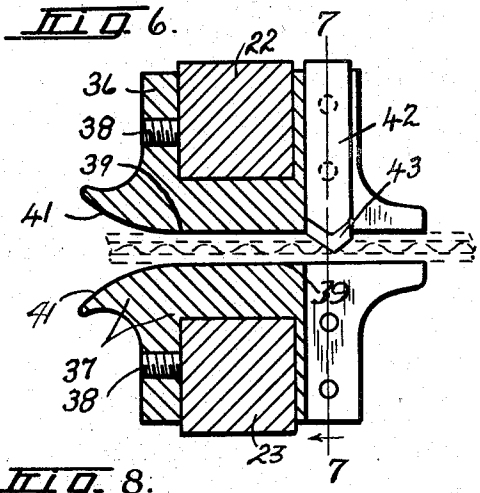


FIG. 7.

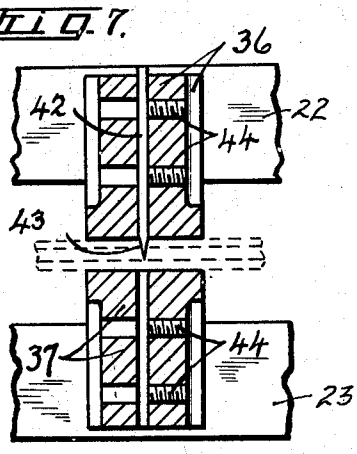


FIG. 8.

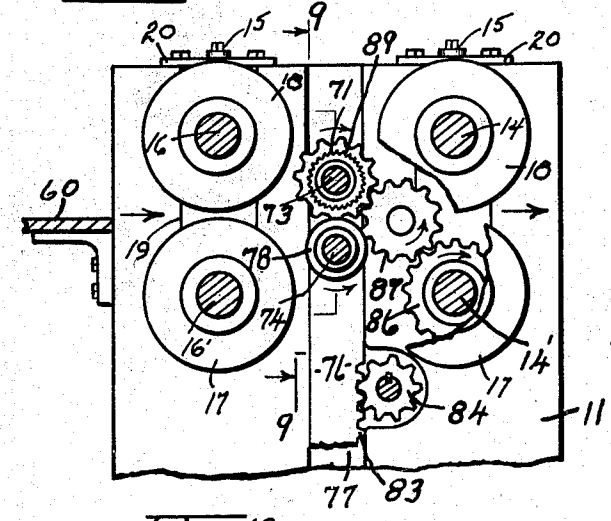


FIG. 9.

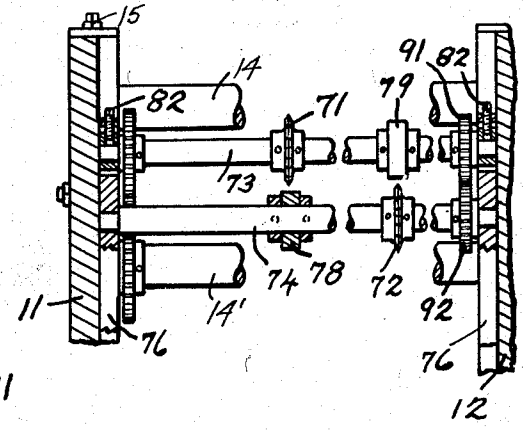


FIG. 10.

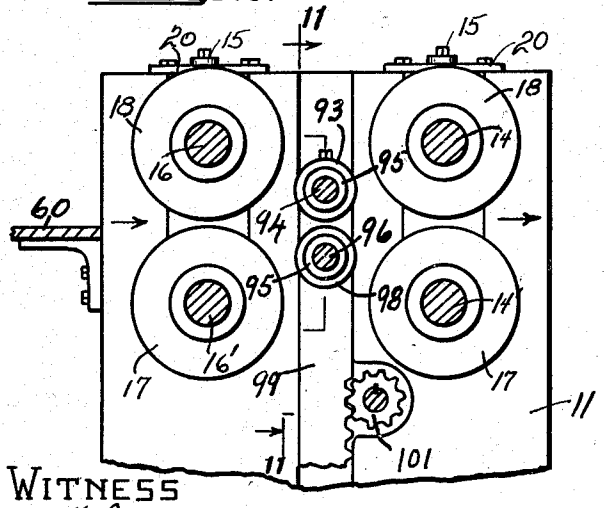
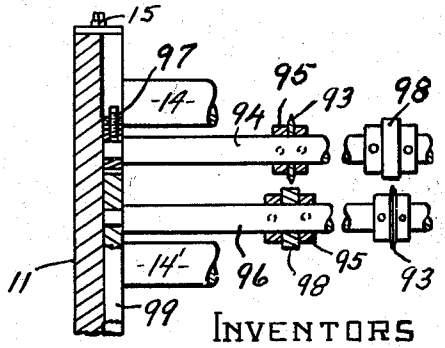


FIG. 11.



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UNITED STATES PATENT OFFICE

2,120,920

MACHINE FOR CUTTING PAPERBOARD

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Syracuse, N. Y.

Application July 8, 1936, Serial No. 89,612

11 Claims. (Cl. 164—38)

Our invention relates to a novel machine for cutting or slitting a unit of paperboard in such manner that the unit may be folded to form a corner of a protective skeleton padding adapted to fit into a shipping container to protect the article during shipment.

Reference is hereby made to our copending application Serial No. 31,079, filed July 12, 1935, for a description of the various corner pad structures adapted to be formed by the machine of this invention. In said application, we have disclosed a machine which, while it is capable of slitting and scoring the paperboard in a manner such that it may be folded to form the various protective corner pads disclosed therein, is objectionable for several reasons.

One disadvantage of the machine shown in that application is that the knives for cutting the paperboard are rotated at the same speed as the speed of passage of the paperboard through the machine. Because the speed of rotation of the cutting knives and the speed of passage of the paperboard through the machine are substantially the same, the knives tend to cut or slit the paperboard by a tearing or pressure rending action which at times causes the edges of the cut portions to be slightly ragged. Moreover, the knives become dull very rapidly in use and require rather frequent sharpening. A further disadvantage of the machine shown in said application is that the adjustment of the knives within the close limits desired is difficult to effect.

An object of our invention is to provide a machine for cutting paperboard wherein the knives or other instruments for cutting or slitting the paperboard rotate at a different rate of speed than the speed of passage of the paperboard through the machine or wherein the cutting instruments are held stationary while the paperboard is fed through the machine.

Another object of our invention is the provision of a machine for cutting paperboard in which a unit of the paperboard is fed through the machine and a plurality of incisions cut therein to form a plurality of unsevered sections of paperboard capable of being readily folded through 180 degrees on the incision lines to lie facing one upon the other.

A further object of our invention is the provision of a machine adapted to form a plurality of incisions in a unit of paperboard, the incisions being formed alternately on opposite sides of the paperboard enabling the unit to be folded into a protective corner pad structure having a plurality of ply of paperboard on each side of the corner.

Another object of our invention is the provision of a machine for slitting paperboard in which the knives or other means for performing the slitting operations are susceptible of fine and accurate adjustment.

Other objects and advantages of our invention will be more apparent from the following description when taken in connection with the accompanying drawings, in which:

Figure 1 is a view showing a front elevation of our novel paperboard scoring and slitting machine.

Figure 2 is a view taken on the line 2—2 of Figure 1, showing the means by which the cutting knives are raised from their operative position so that they may be readily adjusted or removed for resharpening.

Figure 3 is a view taken on the line 3—3 of Figure 2.

Figure 4 is a view taken on the line 4—4 of Figure 3, showing the means for varying the space between the guides to accommodate various thicknesses of paperboard.

Figure 5 is a perspective view showing a unit of paperboard scored and slit and partially folded into a corner pad.

Figure 6 is a view taken on the line 6—6 of Figure 1, showing the manner of mounting the cutting or slitting knives in the paperboard guides.

Figure 7 is a view taken on the line 7—7 of Figure 6.

Figure 8 is a view showing a modified form of our novel scoring and slitting machine.

Figure 9 is a view taken on the line 9—9 of Figure 8.

Figure 10 is a view showing another modified form of our novel scoring and slitting machine.

Figure 11 is a view taken on the line 11—11 of Figure 10.

The machine of our invention comprises a pair of side stands 11 and 12 extending between which are a plurality of tie rods 13 for connecting and supporting the side stands. Suitably journaled in the side stands are a pair of shafts 14 and 14' mounted directly one below the other on the rearward side of the machine and a second pair of shafts 16 and 16' mounted one below the other on the forward side of the machine. On the shafts 14 and 16, toward the ends thereof, are adjustably mounted feed rolls 17 and 18. The lower shafts 14' and 16' are retained at a constant heighth, being mounted in rectangular bearings which lie in the bottom of ways 19

formed in the side stands. The upper shafts 14 and 16 are adjustable toward and from the lower shafts 14' and 16' so that when adjusted, proper spacing of the feed rolls may be secured whereby units of corrugated paperboard of one, two, three or more ply may be fed through the machine. This adjustment may be accomplished, as indicated in the drawings, by providing rectangular bearings for the shafts which are slidably mounted in the ways 19 in the side stands. Raising and lowering of the shafts 14 and 16 may be accomplished by the adjustment of studs 15 which are threaded into the bearings. The studs are supported by suitable nuts in plates 20 which extend over the tops of the ways. The shafts 14, 14', 16 and 16' project through the end of the side stand 12 and may be driven from any suitable source of power through a train of gears, generally indicated by the numeral 21.

The paperboard cutting instruments are mounted on two square parallel shafts or cross bars 22 and 23 extending across the machine and lying between the forward and rearward feed rolls 17 and 18. The bars 22 and 23 are mounted in end members 24, as shown more clearly in Figures 2 and 3, which are movable vertically in ways 26 formed in the side stands. The end members normally rest upon stops 25 near the bottom of the ways. Any suitable means may be provided for raising the end members 24, such as a hand operated wheel 28, having suitable gear teeth which mesh with a gear 29 mounted upon a shaft 31 extending across the machine. On the shaft 31 are mounted a pair of pinions 32 which mesh with rack teeth 33 formed in the end members 24. When it is desired to change the mounting of the cutting instruments or remove them for sharpening, the end members, together with the bars 22 and 23, may be raised by rotating the hand wheel 28 to bring the bars, together with the cutting instruments, up to the position shown in dotted lines in Figure 2. A suitable pawl 34 may be provided for engaging the teeth of the hand wheel 28 and holding the bars 22 and 23 in their dotted line position.

Mounted on the bars 22 and 23 are a plurality of paperboard guides 36 and 37 which are mounted one above the other and spaced apart a distance sufficient to enable passage of the paperboard therebetween. The guides are U-shaped in cross section and fit over the bars and are held in position by means of set screws 38. Each of the guides has a horizontal flat surface 39 and a surface 41 rounded away from the flat surface 39 in a direction toward the forward side of the machine so as to form a throat which is substantially wider than the width of the paperboard, whereby the paperboard may be readily fed between the guides. The cutting instruments in the preferred form of our invention comprise a plurality of stationary knives 42 and 42', each of which has a cutting edge 43 adapted to cleanly cut the paperboard. The cutting knives are retained in the paperboard guides which also serve as holders for the knives by means of set screws 44.

As described in the above mentioned copending application, it is sometimes desirable to form corner protective pads by properly cutting a unit of paperboard of two, three or perhaps more ply. Accordingly, the spacing between the flat surfaces 39 of the guides must be adustable to accommodate various thicknesses of paperboard. This may be accomplished by retaining the lower guides 37 in a fixed cutting position and adjusting the upper guides to vary the spacing between the guides. As shown in Figure 4, this may be accomplished by threading into the upper bar 22 through the end members 24 studs 46 having squared heads 47. The studs may be provided with recesses 48 in each of which is seated a ball 49. A set screw 51 extending through each of the end members 24 engages the ball and holds it in contact with the stud. Adjustment of the studs will raise or lower the bar 22 and increase or decrease the distance between the flat surfaces 39 of the guides. On the rearward shaft 14 is mounted a creasing or scoring knife 52 below which, on the shaft 14', is mounted an anvil 53. The scoring knife 52 is adapted to crease or score the paperboard without cutting it so that it may be readily folded through approximately 90 degrees.

While the machine of our invention may be used to score and cut any kind of paperboard, it is primarily intended to be used to score and cut corrugated paperboard of the character illustrated in Figure 5. It will be understood that the corner pad structure shown in Figure 5 is merely illustrative of a structure which may be formed by the machine of our invention and that by properly cutting and folding the paperboard, various types of corner pad structures may be formed, some of which are illustrated in our copending application.

In the unit shown in Figure 5, the fold line 54 is formed by the scoring knife 52 which enables the sections 56 and 57 of the unit to be readily folded at an angle of 90 degrees with respect to each other. On opposite sides of the scoring knife 52' are placed, at the desired spacing from the scoring knife, cutting knives 42. The cutting knives 42 are both placed in the lower guides, as shown in Figure 1, so as to form incisions on the same side of the paperboard as indicated at 58 and 59. The pad unit, shown in Figure 5 is made of single ply, double faced, corrugated paperboard and the cutting knives 42 are spaced from the flat surface of the adjacent guides so that they will cut through one facing sheet and the corrugated sheet to the opposite face; that is, the distance, as shown in Figure 6, between the cutting edge 43 and the flat surface 39 of the lower guide plate 37 is the thickness of one facing sheet.

As shown in the drawings, the scoring knife 52 is mounted on the upper shaft 14 and the two adjacent cutting knives for forming the incisions 58 and 59 are both located on the lower bar 23 so that the incisions 58 and 59 are on the same side of the paperboard. This enables the sections 61 and 62 to be folded back through 180 degrees upon the sections 56 and 57. The next adjacent cutting knives which may be numbered 42' are secured in the upper guides on the bar 22, thereby forming incisions 63 and 64 which are on the opposite side of the paperboard from the incisions 58 and 59. Any number of cutting instruments may be placed on the bars 22 and 23 to form any desired number of incisions alternately on opposite sides of the paperboard so that the unit, when folded into a corner pad, will have the desired number of ply on each side of the corner, as more fully described in the above mentioned copending application.

The pad unit, partially shown in Figure 5, has been left in a partially folded condition to better illustrate the structure thereof, but it will be appreciated that the section 61 may be folded flat against the inner face of the section 56 and that

the section 66 may be folded flat against the face of the section 61. When these sections have been folded flat, the section 62 may be folded against the section 57 whereupon the edges formed by the incision 64 will lie flat against the face of the section 66, whereupon the section 67 may be folded upon the section 62. It will, of course, be appreciated that the section 62 must be cut smaller in width than the section 57 by the thickness of the sections 56, 61 and 66. For this reason the left-hand cutting element 42' must be spaced from the cutting element 42 the proper distance to cut the section 62 of the proper width. Similarly, the cutting knives 42 and 42' on the right side of the machine must be spaced so as to cut the sections 61 and 66 slightly narrower than the section 56.

When the machine has been properly set up with the correct spacing for forming the desired pad unit and the distance between the cutting edges of the knives and the guides has been adjusted as described above, the paperboard may be fed through the machine from left to right as shown in Figure 2, from a feed table 60 to a discharge table not shown. The scoring knife 52 and the cutting knives 42 and 42' will form scoring and incision lines similar to those shown in the corner unit illustrated in Figure 5. After the unit has been scored and cut, it may be folded as illustrated in Figure 5, thus forming a rigid protective corner pad.

It will, of course, be appreciated if corrugated paperboard of two or more ply is fed through the machine to be scored and cut, as described above, that after the upper bar 22 has been adjusted to provide the proper spacing between the flat surfaces 39 of the guide plates, the cutting knives 42 and 42' must be raised and lowered respectively. This is accomplished by loosening the set screws 44, adjusting the knives and resetting the screws to bring the knives into the proper adjustment so that they will cut through, in the case of 2-ply paperboard, two facing sheets and the corrugated sheets down to the outer facing sheet.

In Figures 8 and 9, we have shown a modification of the invention of Figures 1 to 7, inclusive, wherein instead of using stationary cutting knives, as described above, we use saw blades 71 and 72 which are rigidly mounted respectively on shafts 73 and 74. The shafts are rotatable in rectangular bearings supported in vertically movable end members 76 slidable in ways 77 formed in the side stands 11 and 12. Cooperating with the saw blades 71 and 72 are anvils 78 and 79. The spacing of the saw blades from the anvils may be adjusted by raising or lowering the shaft 73 by means of studs 82 threaded into the bearings of the shaft 73. Both of the shafts 73 and 74 may be raised to a position corresponding to that of the bars 22 and 23 of the first modification (shown in dotted lines in Figure 2) by means of rack teeth 83 formed on the vertically slidable members 76. The rack teeth are in engagement with pinions 84 which are rotated by a hand wheel and suitable gearing similar to that described in connection with the preferred form of the invention. It will, of course, be understood that any desired number of saw blades and anvils may be mounted on the shafts 73 and 74. The saw blades may be spaced from each other as desired to produce the proper spacing of the incisions for forming a corner pad structure similar to that shown in Figure 5. It will further be understood that the machine of this modification is equipped with a scoring knife similar to the scoring knife 52.

The shafts 73 and 74 may be driven from the shaft 14' by means of a gear 86 mounted on the shaft and rotatable therewith. Meshing with the gear 86 is an idler pinion 87 which is mounted on a stub shaft supported in the side stand 11. The idler pinion 87 meshes with a gear 89 mounted on the shaft 73. On the other end of the shaft 73 is mounted a gear 91 which meshes with a gear 92 mounted on the shaft 74. By this arrangement, the saw blades are driven in a direction opposite to the direction of movement of the paperboard through the machine, as indicated by the arrows in Figure 8. That is, the shaft 14' rotates in a clockwise direction while the lower saw blade rotates in a counterclockwise direction and the upper saw blade in a clockwise direction. By rotating the saw blades in a direction opposite to the direction of movement of the paperboard through the machine, the paperboard is cleanly and accurately cut. It will be understood that the saw blades may be rotated in the same direction as the direction of passage of the paperboard through the machine by changing the gearing. However, if this is done, the peripheral speed of the saw blades should be different and preferably slower than the lineal speed of the paperboard so that the incision lines will be cleanly cut.

In Figures 10 and 11, we have illustrated another modified form of our invention wherein instead of using stationary cutters, we provide circular cutters 93 which are free to turn respectively on shafts 94 and 96. The shafts 94 and 96 are non-rotatably supported in vertically movable members 99 slidable in ways in the side stands 11 and 12. The shaft 94 may be adjusted toward and from the shaft 96 by means of a stud 97 arranged in the support for the shaft in a similar manner to that described above. Cooperating with the freely rotatable circular cutting elements 93 are anvils 98 which are also free to rotate on the shafts 94 and 96. The circular cutters and their cooperating anvils may be prevented from sliding along the shafts by means of collars 95 held in position on the shafts by means of set screws. It will, of course, be understood that both the shafts 94 and 96 may be raised to a position corresponding to that of the bars 22 and 23, in Figure 2, by means of the vertically movable members 99 slidable in ways in the end stands. The members 99 may be operated in a manner similar to the slidable members 24 by means of a rack and pinion 101, a hand wheel and suitable gearing not shown. It will also be understood that any number of freely rotatable circular cutters may be mounted on the shafts 94 and 96 and spaced in a manner to produce the desired incisions on opposite sides of the paperboard to enable the pad unit to be folded in the manner illustrated in Figure 5. This machine may also be provided with a scoring knife.

While we have shown the preferred forms of our invention, it will be apparent that various changes and modifications may be made in the form and relation of parts thereof without departing from the spirit of the appended claims.

We claim:

1. In a machine for cutting paperboard, a frame, a set of rolls for feeding the paperboard through the machine supported in said frame on the forward side of the machine, a second set of feed rolls supported in said frame on the rearward side of the machine, means for rotating said

rolls, and a plurality of cutting elements located between said sets of rolls, said cutting elements being set so as to cut only part way through the paperboard at spaced intervals alternately on opposite sides thereof.

2. In a machine for cutting paperboard, a frame, a set of rolls for feeding the paperboard through the machine supported in said frame on the forward side of the machine, a second set of rolls supported in said frame on the rearward side of the machine, means for rotating the rolls to feed the paperboard through the machine, and a plurality of guide elements lying between said sets of rolls, each of said guide elements comprising an upper guide element and a lower guide element, means for adjusting the distance between said guide elements for accommodating various thicknesses of paperboard, and cutting elements carried by said guide elements for cutting the paperboard as it is fed through the machine.

3. In a machine for cutting paperboard, a frame, a set of rolls for feeding the paperboard through the machine supported in the frame on the forward side of the machine, a second set of rolls supported in the frame on the rearward side of the machine, cutting elements, means for mounting the cutting elements between said sets of rolls, and mechanism for raising said means above the level of the rolls to permit convenient adjustment or replacement of the cutting elements.

4. In a machine for cutting paperboard, means for feeding the paperboard through the machine, a pair of guides between which the paperboard is fed, a cutting knife carried by one of said guides, means for adjusting the distance between the guides for accommodating various thicknesses of paperboard, and means for adjusting the position of the cutting knife.

5. In a machine for scoring and cutting a unit of corrugated paperboard to adapt the unit to be folded into a corner pad structure having a plurality of ply of paperboard on each side of the corner, a frame, a set of feed rolls supported in the frame on the forward side of the machine, a second set of feed rolls supported in the frame on the rearward side of the machine, and cutting elements located between said sets of feed rolls, said cutting elements being arranged so as without severing to cut part way through the paperboard alternately on opposite sides of the paperboard whereby to enable the sections of paperboard thus cut to be folded through 180 degrees to face upon each other.

6. In a machine for scoring and cutting a unit of corrugated paperboard to adapt the unit to be folded into a corner pad structure having a plurality of ply of paperboard on each side of the corner, a frame, a set of feed rolls supported in the frame on the forward side of the machine, a second set of feed rolls supported in the frame on the rearward side of the machine, cutting elements located between said sets of feed rolls, said cutting elements being arranged so as without severing to cut part way through the paperboard alternately on opposite sides of the paperboard whereby to enable the sections of paperboard thus cut to be folded through 180 degrees to face upon each other, and a scoring knife mounted in said machine adapted to form a scoring line in said corrugated paperboard to enable the sections adjacent the scoring line to be folded through 90 degrees with respect to each other.

7. In a machine for cutting paperboard, a frame comprising a pair of side stands, a pair of shafts journaled in the frame on the forward side of the machine, a second pair of shafts journaled in the frame and parallel to said first shafts on the rearward side of the machine, means for driving said shafts, a set of feed rolls carried by each of said shafts, and a plurality of saws mounted in said frame between the forward and rearward feed rolls and between the side stands.

8. In a machine for cutting paperboard, a frame, a pair of shafts journaled in the frame on the forward side of the machine, a pair of shafts journaled in the frame and parallel to said first shafts on the rearward side of the machine, feed rolls mounted on said shafts, a set of upper saw blades mounted between the upper and lower feed rolls arranged so as to cut incisions in the paperboard on its upper face as it is fed through the machine, and a lower set of saw blades arranged so as to cut incisions in the paperboard on its lower face as it is fed through the machine, said saws being set so that the incisions are cut for the most part alternately on opposite sides of the paperboard, and means for rotating said saw blades.

9. In a machine for cutting paperboard, a frame comprising a pair of side stands, an upper forward shaft and a lower forward shaft journaled in said frame, an upper rearward shaft and a lower rearward shaft journaled in said frame, feed rolls mounted on each of said shafts, a set of upper saw blades mounted between the forward and rearward feed rolls, said saw blades being mounted so as to cut incisions in the upper face of the paperboard extending only part way through the paperboard, a second set of lower saw blades mounted between the forward and rearward rolls, said saw blades being mounted so as to cut incisions in the lower face of the paperboard extending only part way through the paperboard, said sets of saw blades being arranged so as to cut incisions in the paperboard for the most part alternately on opposite sides thereof, and means for driving said shafts and said saw blades.

10. In a machine for cutting paperboard, a frame comprising a pair of side stands, an upper forward and a lower forward shaft journaled in said frame, an upper rearward shaft and a lower rearward shaft journaled in said frame, feed rolls mounted on each of said shafts, a set of upper cutting elements mounted between the forward and rearward feed rolls and between the side stands, said cutting elements being mounted so as to cut incisions in the upper face of the paperboard extending only part way through the paperboard, a second set of lower cutting elements mounted between the forward and rearward rolls and between the side stands, said lower cutting elements being mounted so as to cut incisions in the lower face of the paperboard extending only part way through the paperboard, said sets of cutting elements being arranged to cut incisions in the paperboard for the most part at spaced intervals alternately on opposite sides thereof, and means for driving the rolls so as to cause the paperboard to be fed between said cutting elements.

11. In a machine for cutting paperboard, a frame comprising a pair of side stands, an upper forward shaft and a lower forward shaft journaled in said frame, feed rolls mounted on each of said shafts adjacent the side stands, the feed rolls on the upper shaft lying directly above the feed rolls on the lower shaft, means for adjusting the spacing between said upper and lower feed rolls to accommodate various thicknesses of pa-

perboard, an upper rearward shaft and a lower rearward shaft journaled in said frame, feed rolls mounted on each of said shafts adjacent the side stands, the feed roll on the upper shaft lying directly above the feed roll on the lower shaft, means for adjusting the spacing between said upper and lower feed rolls to accommodate various thicknesses of paperboard, a set of upper cutting elements lying between the forward and rearward feed rolls and between the side stands, said cutting elements being set so as to cut only part way through the upper face of the paperboard, a second set of cutting elements lying between the forward and rearward feed rolls and between the side stands, said cutting elements being set so as to cut only part way through the lower face of the paperboard, said cutting elements being arranged so as to cut incisions in the paperboard for the most part alternately on opposite sides of the paperboard, a set of upper and lower guides lying between the forward and rearward feed rolls, means for adjusting the spacing between said guides to accommodate various thicknesses of paperboard, and means for driving the rolls to feed the paperboard through the machine.

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