United States Patent

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[54] **BRUSH FEEDER FOR WARPED SHEETS**
21 Claims, 5 Drawing Figs.

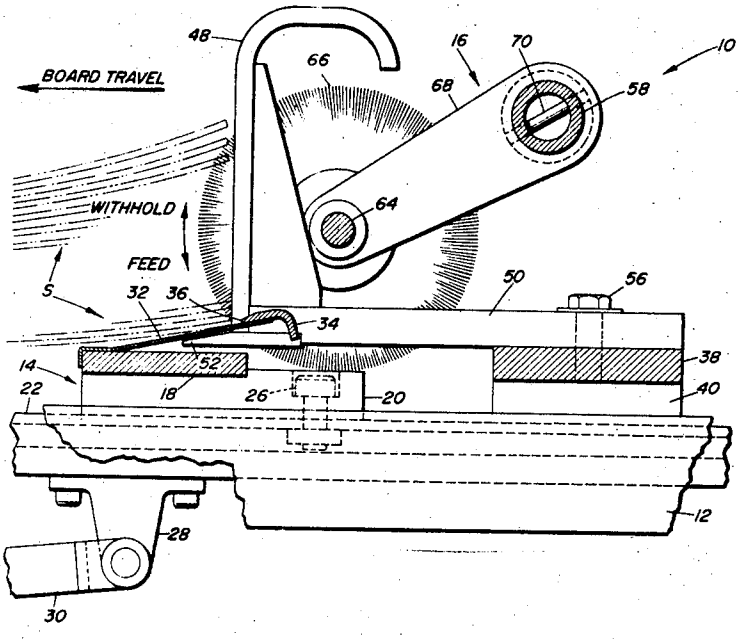
[52] **U.S. Cl.** **271/44,** 271/61
[51] **Int. Cl.** **B65h 1/06,** B65h 5/16
[50] **Field of Search** ..... 271/44, 43 (A), 41, 23, 61

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ABSTRACT: This invention pertains generally to sheet feeding apparatus wherein a bottom feeder is provided for bottom feeding of sheets from a stack in a hopper. The hopper is provided with sheet retaining and aligning vertical means. A reciprocating feeder bar with spring clips works beneath the hopper. A revolving friction brush positioned to wipe against the trailing edges of the stack of sheets continuously brushes them down against force of the spring clips and presents the lowermost sheet for engagement by an extractor ledge as it rests upon an extended ledge of lips.



3 Sheets-Sheet 1

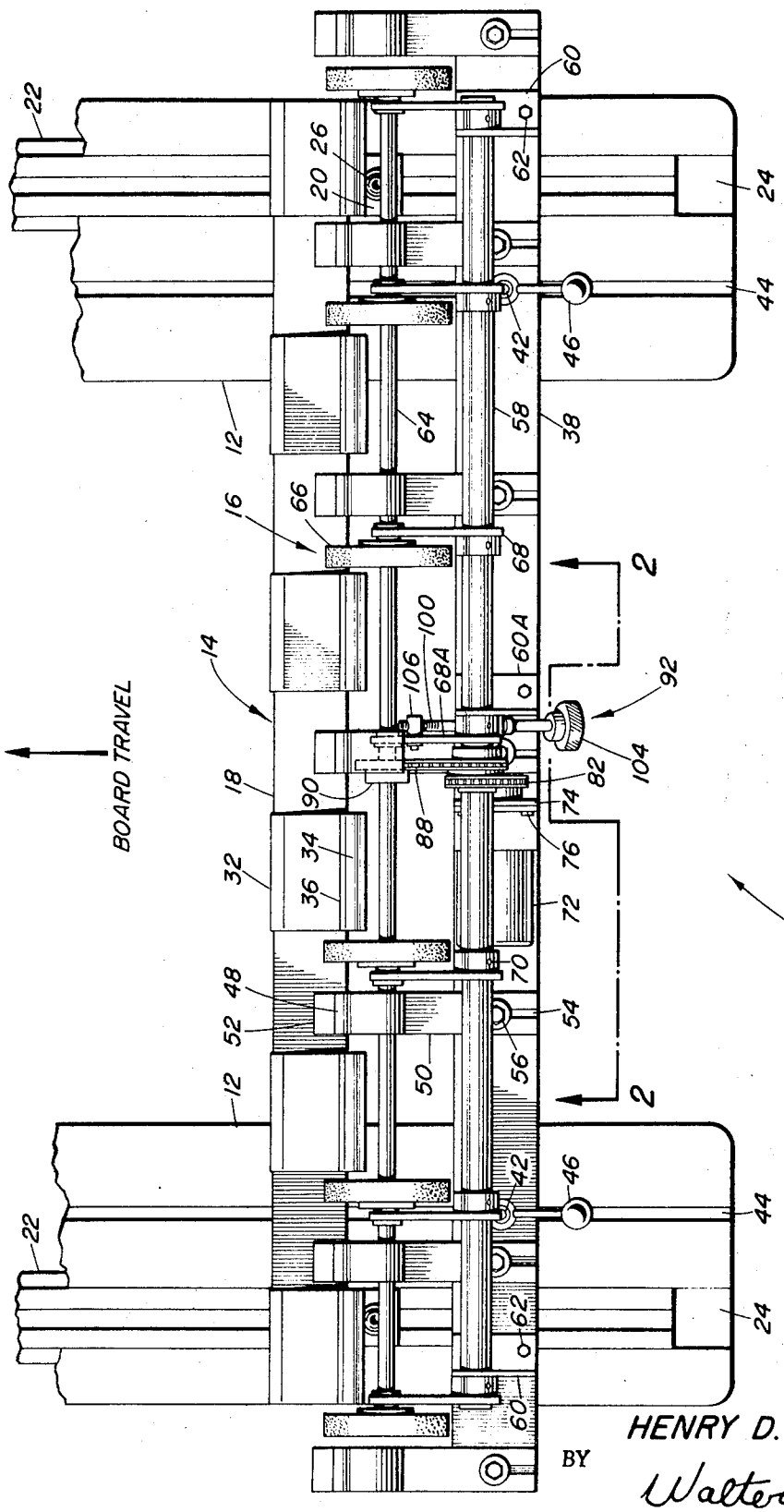


FIG. 1.

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3 Sheets-Sheet 2

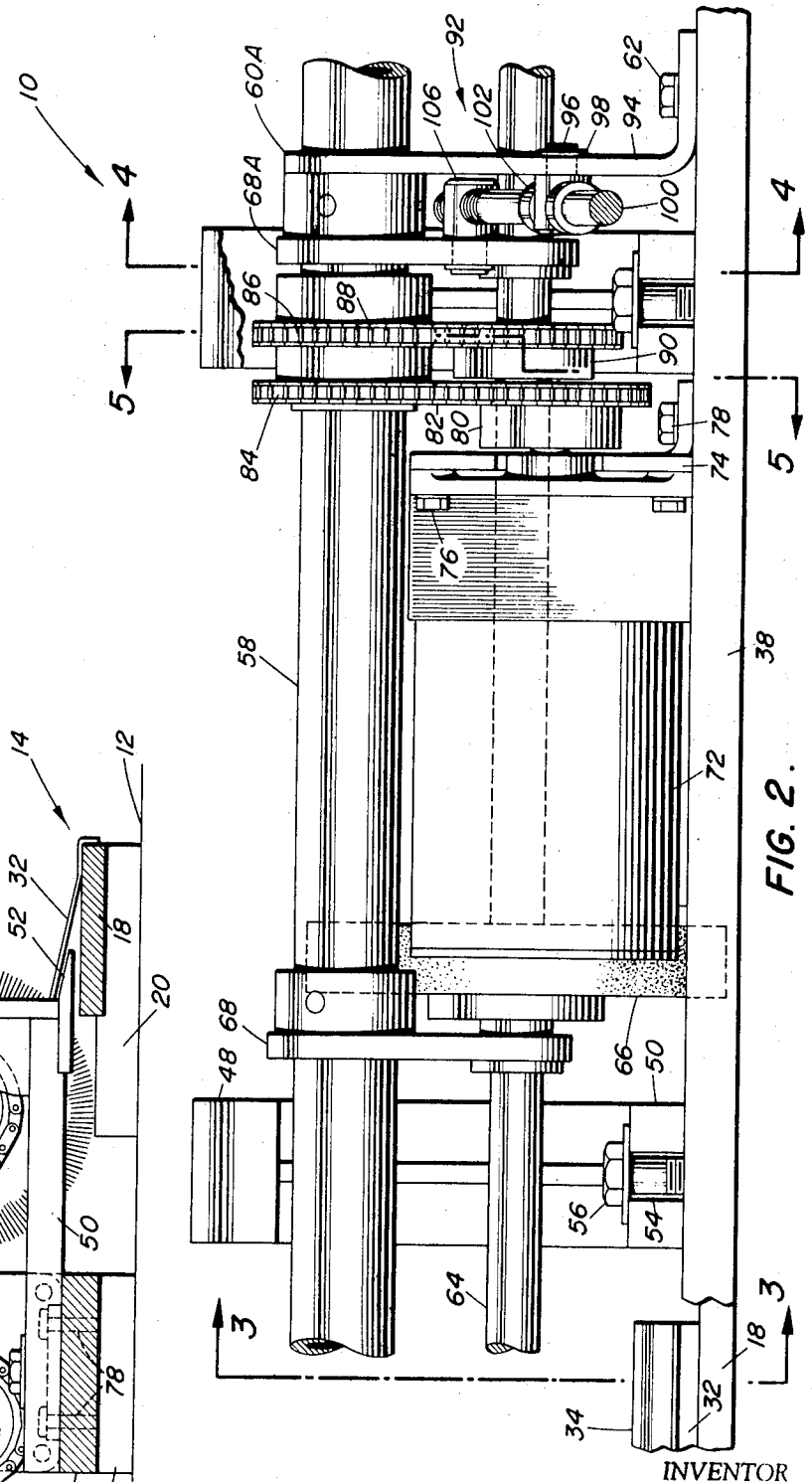


FIG. 2.

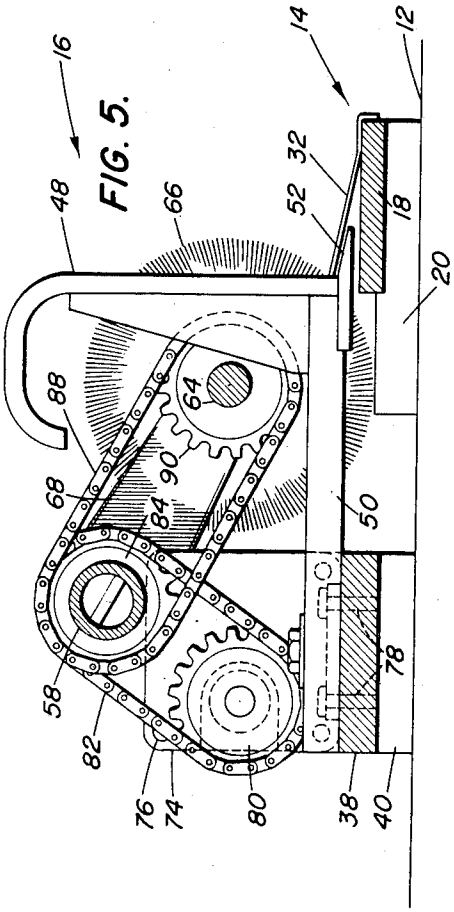


FIG. 5.

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3 Sheets-Sheet 3

FIG. 3.

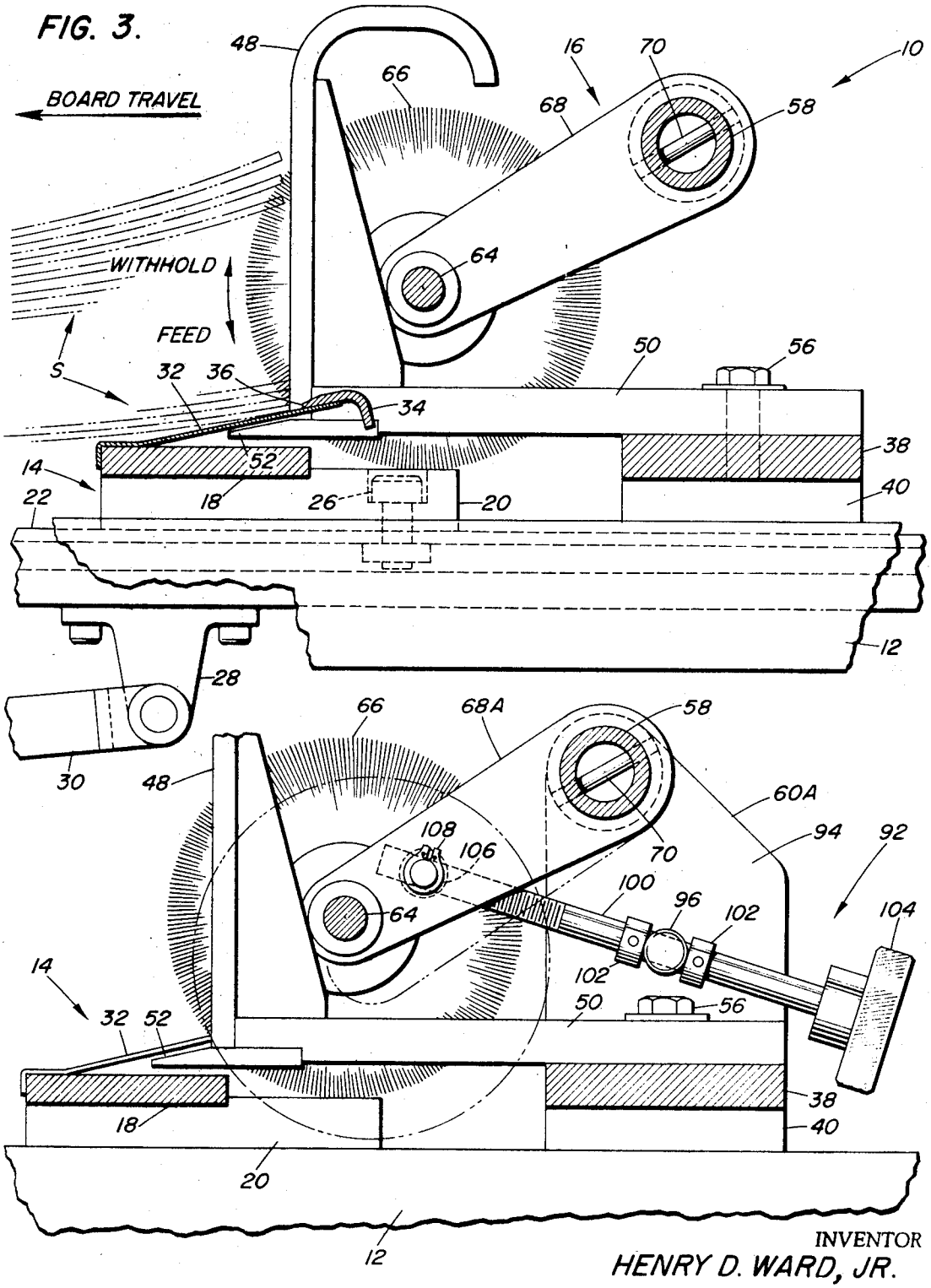


FIG. 4.

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BRUSH FEEDER FOR WARPED SHEETS

This invention relates generally to sheet feeding apparatus, and more particularly it pertains to a rotary brush feeder system for processing or warped sheets from a bottom-delivery sheet hopper.

In rotary die cutter or printer slotter machines for processing of corrugated paperboard for use in shipping containers, these machines are automatically fed from a hopper into which the sheets of corrugated board are loaded in stacks of 6 to 12 inches high. Generally, the bottom of the hopper is formed by a table on which the sheets are laid. The forward edge of the hopper is formed by two vertical plates which are spaced above the table a small distance just equal to the thickness of one sheet, but close enough to the table to prevent two sheets from being fed into the machine at one time.

The rear or outer edge of the hopper is formed by a series of vertical plates which help to align the back edge of the pile of sheets. On the table and underneath of the pile of sheets, there is provided a reciprocating feeder bar on which feeding clips are mounted and sprung upward against the bottom of the pile. The edges of these spring clips catch the trailing edge of the bottom sheet in the pile as the feeder bar moves to its outer or rearmost position then engage the trailing edge of the bottom sheet and pulls it into the machine—or pushes it into the machine—as the feeder bar moves forward under the pile.

The problem which is often encountered with this type of mechanism is that corrugated paperboard is made of a lamination of a flat sheet glued to a corrugated sheet, with another flat sheet being glued to the top of that. If a moisture unbalance occurs in the two outer or flat sheets of paper as they are laminated to the corrugated sheet, the sheets of corrugated board will then wrap as the sheets are stored in the box plant. This warpage is caused by the fact that the moisture unbalance will eventually equalize through the sheets, causing the previously wet liner to dry out and shrink and the previously dryer liner will become moist and will expand.

Because of the nature of the corrugator machine which laminates the sheets, the liner sheet which will form the outer or the good side of the box normally is on the concave side of the warped sheet. All the machines, such as a rotary die cutter, which prints on the bottom of the sheet, the concave side of the sheet is usually on the bottom edge of the stack as it is loaded into the machine. As the board is positioned on the table, the warp in the board causes the leading edge to be off of the table level and the trailing edge is usually also above the table level, and, in cases of severe warp, can be above the level of the feeding clip.

In the past, a suction table has been used along the leading edge of the sheets under the gates to pull the leading edge down flat on the table so that the sheets can enter the machine under the gates without becoming jammed against the gates. However, this tends to aggravate the situation on the other edge of the sheet which is backed by the feeding clip, making it even more difficult for the feed clips to pick up the sheets at the high rates of speed under which these machines usually operate, that is, up to about 170 sheets per minute. It is desirable then to use some means to pull the trailing edge of the sheets down to the level on which the feed clips operate.

Thus, in the corrugated container industry, there is the common problem of feeding warped individual sheets from the bottom of a stack of sheets for further processing, with a moisture difference in the outer faces of the sheets causing the sheets of corrugated board to warp. When this warpage of the sheet is such that the leading and trailing edges thereof are elevated, the problem becomes even more severe because the usual vacuum pulldown of the sheet at the forward end causes the trailing end to rock up beyond the reach of feed arm fingers. At high operating rates, the use of pawls on the sheet may cause damage and, being cyclic with the machine operation, may skip a sheet unless carefully adjusted in stroke for thickness of material variations.

It is an object of this invention, therefore, to provide a brush type feeder for warped sheets which is capable of feeding therewith sheets having a wider range of warpage than prior feeders.

Another object of the invention is to provide a stack edge pulldown arrangement for sheets which may be used for any weight of corrugated board or sheets without damages to their edges.

Still another object of this invention is to provide a sheet feeder of low inertia in which feeding can be stopped almost instantaneously.

To provide a pulldown arrangement for the edge of sheets in a pile which brings down a sheet edge in readiness for feed in continuous fashion, rather than cyclic with operation of the feed stroke, is still another object of this invention.

Other objects and attendant advantages of this invention will become more readily apparent and understood from the following detailed description and accompanying drawings in which:

FIG. **1** is a plan view of a sheet feeder system incorporating features of this invention;

FIG. **2** is an enlarged detail view of the brush drive arrangement along line **2–2** of FIG. **1**;

FIG. **3** is a view taken along line **3–3** of FIG. **2** showing details of the feed;

FIG. **4** is a view taken along line **4–4** of FIG. **2** showing details of the brush adjustment; and

FIG. **5** is a view taken along line **5–5** of FIG. **2** depicting details of the brush drive.

Referring now to the details of the invention as shown in FIG. **1**, the novel sheet feeder system is designated generally by reference numeral **10** and it is shown mounted on the side arms **12** of a printer-slotter-die cutter feed table. This sheet feeder system **10** comprises two major assemblies, a feed bar assembly indicated generally by reference numeral **14** and a brush mechanism indicated generally by numeral **16**. In the usual manner, a feed bar **18** spans the side arms **12** and it is provided with shoes **20** near its ends. These shoes **20** as best shown in FIG. **3** are secured by fasteners **26** to reciprocating slides **22** which operate in slots **24** in the side arms **12**. A fitting **28** extends from the bottom of the slide **22** to oscillate it through the medium of a connecting rod **30** that extends to a drive crank which is not shown.

The feed bar **18** is provided with a plurality of spaced leaf springs **32** secured to its forward edge. The near portions of these springs **32** are bent upwardly and have pawls **34** extending over the rear edge. The leading edge **36** of each pawl **34** is squared off abruptly and aligned with that of its neighbor pawl **34** all across the machine. The thickness of these pawls **34** must be no greater than that of the sheets to be fed.

The brush mechanism **16** is built upon a cross beam **38** which, like the feed bar **18**, spans the side arms **12**. However, this cross beam **38** lies on shim blocks **40** as shown best in FIGS. **3** and **4**, and it is fastened adjustably in place by means of inverted bolt fasteners **42** which reside in inverted T grooves provided in the sidearms **12** as best shown in FIG. **1**. The nuts for the bolt fasteners **42** are conveniently provided with lockery levers **46**.

A plurality of backstop posts **48** are mounted on the cross beam **38**. They are so named because they form the back of a hopper area, a portion of which is defined by the stack of sheets S shown in FIG. **3**. Sheets S are generally of the corrugated type, but the invention will apply to any type of warped sheet.

The backstop posts **48** have rearwardly extending support arms **50**, the front undersides of which carry forwardly extending lips **52**. These lips **52** provide a ledge for the sheets S to rest upon after they are pulled down as will be related. The support arms **50** are slotted at **54** and bolts **56** passed therethrough are tapped into the crossbeam **38**.

A carrier tube **58** is rotatably mounted at the ends in end supports **60**. These supports **60** are shown in FIG. **1** secured to the crossbeam **38** with bolts **62**. A middle support **60A** for carrier **58** is similarly provided intermediate the ends.

A brush shaft 64 having a plurality of spaced circular brushes 66 is swingably mounted parallel to the carrier tube 58 on arms 68 and journaled thereon for rotation as best shown in FIG. 3. The arms 68 are pinned to the carrier tube 58 with dowels 70 so as to all swing together. The spacing of the brushes 66 on shaft 64 is chosen to locate them in the inter spaces between the backstop posts 48.

A reversible gear motor 72 is mounted on a mounting bracket 74 with bolts 76. The mounting bracket 74 is secured by bolts 78 to the crossbeam 38 as best shown in FIG. 2. The motor 72 has a drive sprocket 80. The carrier tube 58 has a free running idler on it comprising a driven sprocket 84 and formed integral therewith is a second sprocket 86. The brush shaft 64 has a sprocket 90 secured thereon. A chain belt 82 links the drive sprocket 80 with the driven sprocket 84 and the second sprocket 86 is linked by a chain belt 88 to the final sprocket 90, as shown in FIG. 5.

An adjustment mechanism indicated generally by numeral 92 is shown in FIG. 4 for oscillating the carrier tube arms 68, thus raising and lowering the brushes 66 as shown by the phantom lines. An apertured post 96 is rotatably mounted in the vertical web 94 of the middle support 60A and is secured there as shown in FIG. 2 with a snap ring 98.

A threaded rod 100 passes transversly through the post 96 and it is held in position by keepers 102 on each side thereof. An adjustment knob 104 is secured on one end of the rod 100, with a threaded post 106 receiving the other end, as seen best in FIGS. 2 and 4. The threaded post 106, then, is rotatably secured in the central arm 68A with a snap ring 108.

The brushes 66 are preferably made with nylon bristles of about 0.011 inches diameter, each about 1¾ inches in length. The circumferential speed of the brushes 66 may be low, with a speed of 40 or 50 r.p.m. having been found satisfactory for operation of the feeder system. Thusly, the brushes 66 may be run continuously against a stack of sheets S without harming the normal corrugated board with the wiping action thereof.

The sheets S may be from a few inches in length to several feet in length. To accommodate this wide variation in dimension of the sheets in fanout from warpage, the adjustment mechanism 92 of FIG. 4 was provided together with the positioning feature of the crossbeam 38 on the side arms 12. The brushes 66 may accordingly be advanced against the edges of the sheets S exposed between the backstop posts 48 and also be raised to any desired degree.

The sheets S by such friction are pulled down, one or several at a time, against their warpage to be held upon the ledge formed by the lips 52. In this position, the upwardly bias of the leaf spring 32 reciprocating with the feeder bar 18 beneath is overcome so that on rearward stroke the leading edge 36 of the pawls 34 will snap behind the trailing edge of the lowermost sheet S. The forward stroke of the feeder bar 18 then feeds this sheet to subsequent processing.

If the motor 72 is thrown into reverse, the sheets S already pulled down are instead simultaneously raised away from the ledge of lips 52 and out of reach of the reciprocating leaf springs 32. Thus, the feed may be almost instantly interrupted. This avoids serious jams which might otherwise occur during the much slower shutdown of a high inertia drive for the feeder bar 18.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

I claim:

1. In a sheet feeder system for successively feeding the lowermost sheet in a plane parallel to said sheet from a stack of said sheets for further processing of said sheet, structure defining a hopper for a stack of sheets to be fed by said feeder system, means for defining the trailing edges of said stack of sheets, a feeding bar assembly positioned beneath said stack of sheets and arranged to reciprocate in contact thereunder and having a feed bar, at least one sheet engaging means positioned upon said feed bar for engaging the trailing edge of said lowermost sheet, and means for continuously driving the adjacent trailing edges of at least some of said sheets in said stack of sheets against the lowermost sheet so that said engaging means on the rearward stroke of said feed bar positions itself for engagement with the trailing edge of said lowermost sheet and upon forward stroke of said feed bar extracts said lowermost sheet from said stack of sheets.

2. In a sheet feeder system as recited in claim 1, wherein a plurality of sheet engaging means are positioned in spaced relationship upon said feed bar to engage the trailing edge of the lowermost sheet of said stack of sheets at a plurality of spaced positions.

3. In a sheet feeder system as recited in claim 1, wherein said driving means includes a rotary brush.

4. In a sheet feeder system as recited in claim 3, and means for advancing said rotary brush against the trailing edges of said stack of sheets.

5. In a sheet feeder system as recited in claim 3, wherein means are provided for selectively advancing said rotary brush against the trailing edges of said stack of sheets to drive the margins of said stack of sheets.

6. In a sheet feeder system as recited in claim 3, and means are provided for reversing the direction of rotation of said rotary brush to drive said margins of said stack of sheets out of range of engagement by said engaging means.

7. A continuous bias arrangement for consolidating at least the margins of lowermost sheets of a stack of sheets, comprising, a rotary brush having flexible bristles with end portions that are extendable normally into a position ultimately occupied by a portion of said stack of sheets, and means for continuously advancing said bristles of said rotary brush against a side of said portion of said stack of sheets to consolidate the margins thereof.

8. A continuous bias arrangement as recited in claim 7, and reciprocating means biased to contact the underside of the lowermost sheet and to engage the edge thereof for removing the lowermost sheet from said stack of sheets.

9. A continuous bias arrangement as recited in claim 8, wherein said reciprocating means includes at least one pawl.

10. A sheet feeder system for successively feeding the lowermost sheet in a plane parallel to said sheet from a stack of said sheets for further processing of said sheet, comprising, structure defining a hopper for a stack of sheets to be fed by said feeder system, means for retaining and aligning said stack of sheets in said hopper, a feeding bar assembly positioned beneath said stack of sheets and arranged to reciprocate in contact thereunder and having a feed bar, sheet engaging means positioned upon said feed bar for engaging the trailing edge of said lowermost sheet, and means for continuously driving the adjacent trailing edges of at least some of said sheets in said stack of sheets against the lowermost sheet so that said engaging means on the rearward stroke of said feed bar positions itself for engagement with the trailing edge of said lowermost sheet and upon forward stroke of said feed bar extracts said lowermost sheet from said stack of sheets.

11. The sheet feeder system of claim 10, wherein a plurality of sheet engaging means are positioned in spaced relationship upon said feed bar to engage the trailing edge of the lowermost sheet of said stack of sheets at a plurality of spaced positions.

12. The sheet feeder system of claim 10, wherein said driving means includes a rotary brush.

13. The sheet feeder system as recited in claim 12, and means for advancing said rotary brush against the trailing edges of said stack of sheets.

14. The sheet feeder system as recited in claim 12, and means for selectively advancing said rotary brush against the trailing edges of said stack of sheets to drive the margins of said stack of sheets.

15. The sheet feeder system as recited in claim 14, and means for reversing the direction of rotation of said rotary brush to drive said margins of said stack of sheets out or range of engagement by said engaging means.

16. In a sheet feeder system as recited in claim 1, and means for operating continuously said driving means independently of the movement of said feeding bar assembly.

17. In a sheet feeder system as recited in claim 1, and means for supporting at least a trailing edge of a next lowermost sheet after said lowermost sheet has been extracted from the bottom of said stack of sheets by the forward stroke of said feed bar, and said supporting means positioned for permitting said next lowermost sheet to be engaged by said engaging means when said feed bat is moved on the rearward stroke thereof in preparation for the extraction of said next lowermost sheet from said stack.

18. In a sheet feeder system as recited in claim 17, wherein the supporting means includes a ledge which extends partially into a rear portion of said hopper adjacent to and below a rearwardmost position assumed by said engaging means.

19. In a sheet feeder system as recited in claim 10, and means for operating continuously said driving means independently of the movement of said feeding bar assembly.

20. In a sheet feeder system as recited in claim 10, and means for supporting at least a trailing edge of a next lowermost sheet after said lowermost sheet has been extracted from the bottom of said stack of sheets by the forward stroke of said feed bar, and said supporting means positioned for permitting said next lowermost sheet to be engaged by said engaging means when said feed bar is moved on the rearward stroke thereof in preparation for the extraction of said lowermost sheet from said stack.

21. In a sheet feeder system as recited in claim 20, wherein the supporting means includes a ledge which extends partially into a rear portion of said hopper adjacent to and below a rearwardmost position assumed by said engaging means.