Dec. 14, 1943. J. H. MURCH ET AL 2,336,499

SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 1

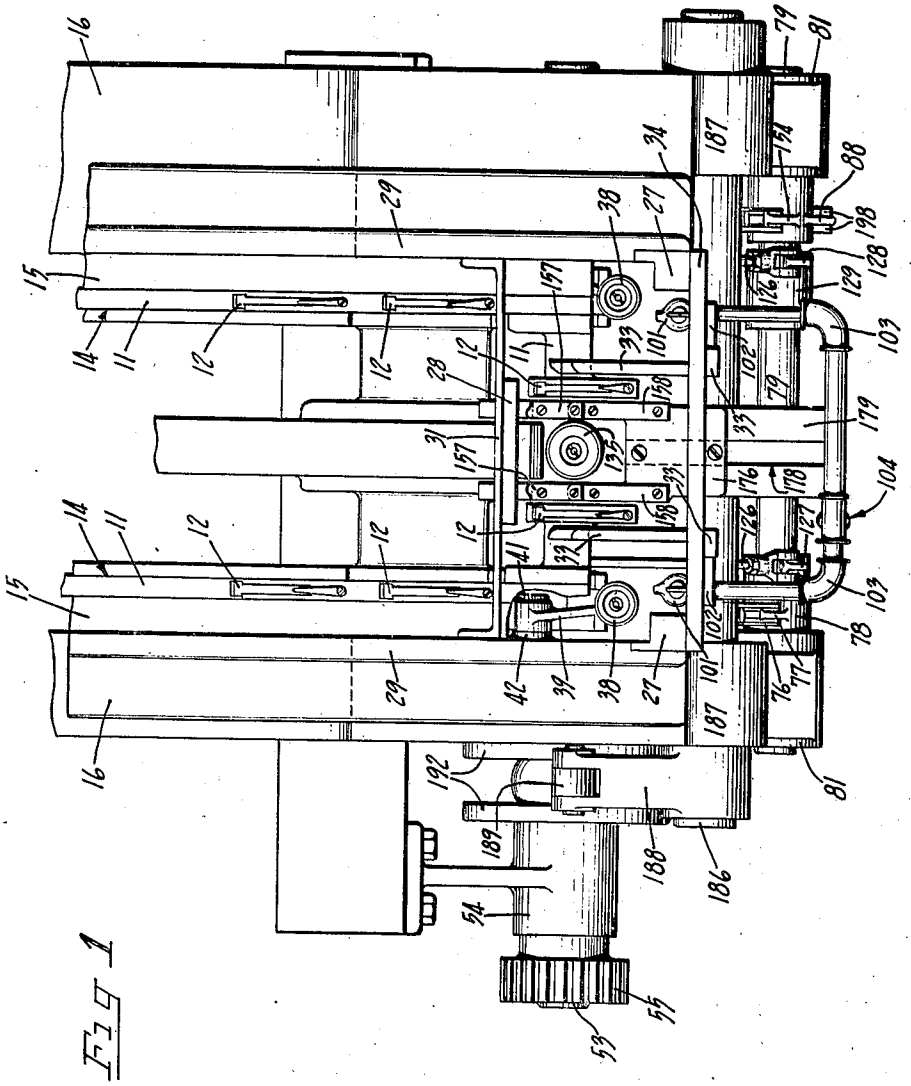

Fig 1

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SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 2

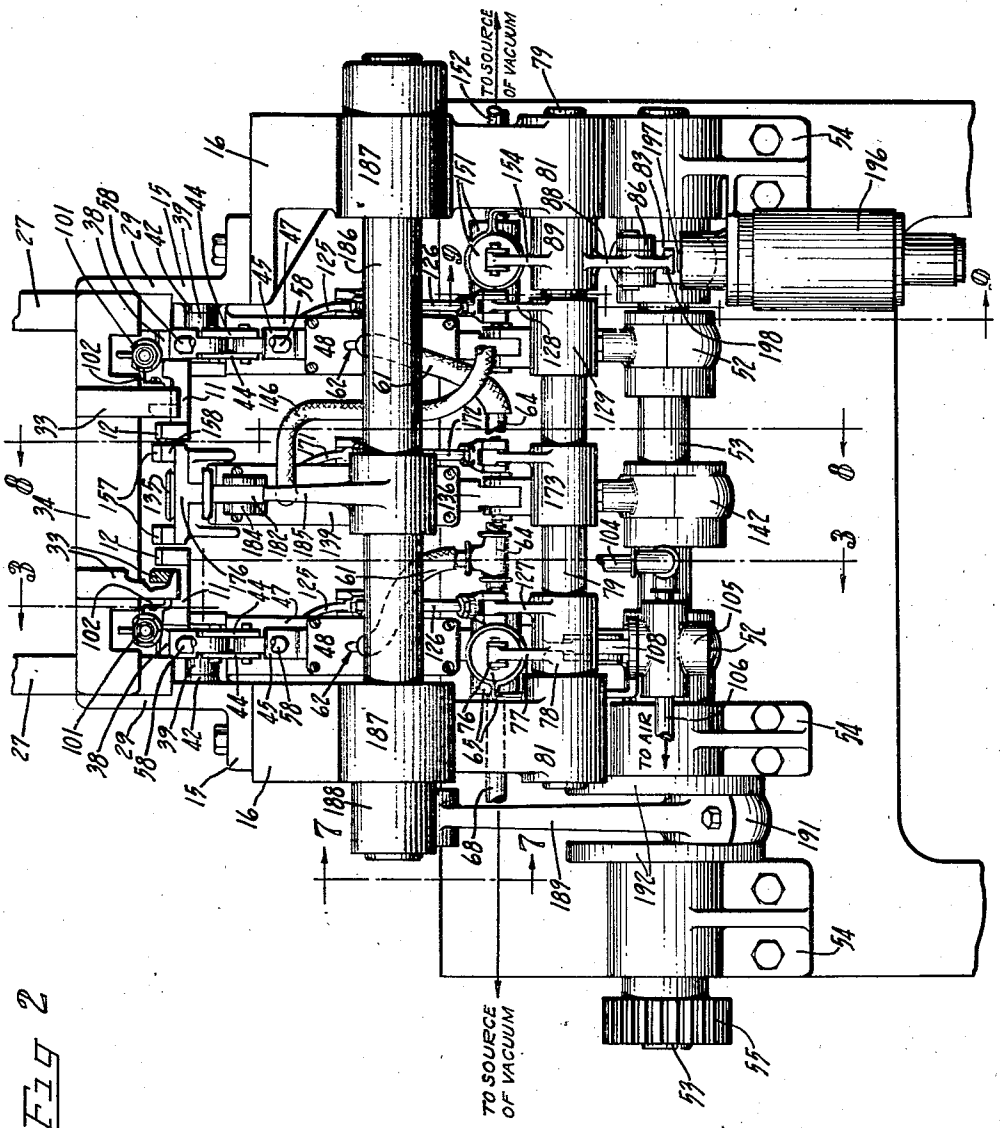

FIG 2

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SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 3

Fig 3

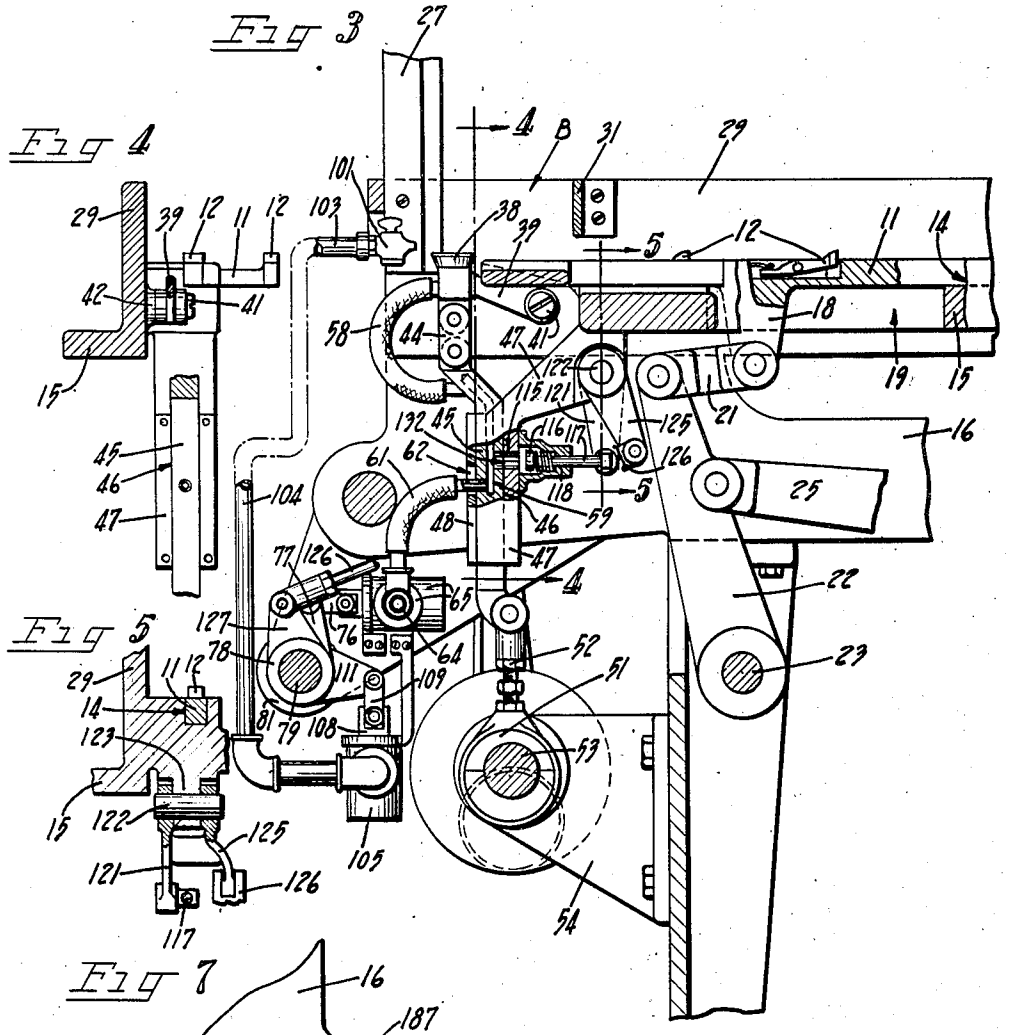


Fig 4

Fig 5

Fig 7

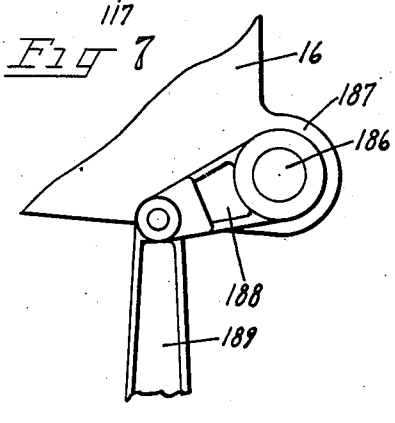
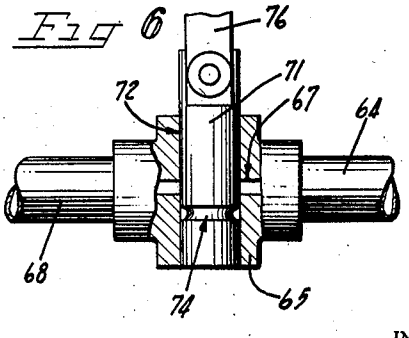


Fig 6



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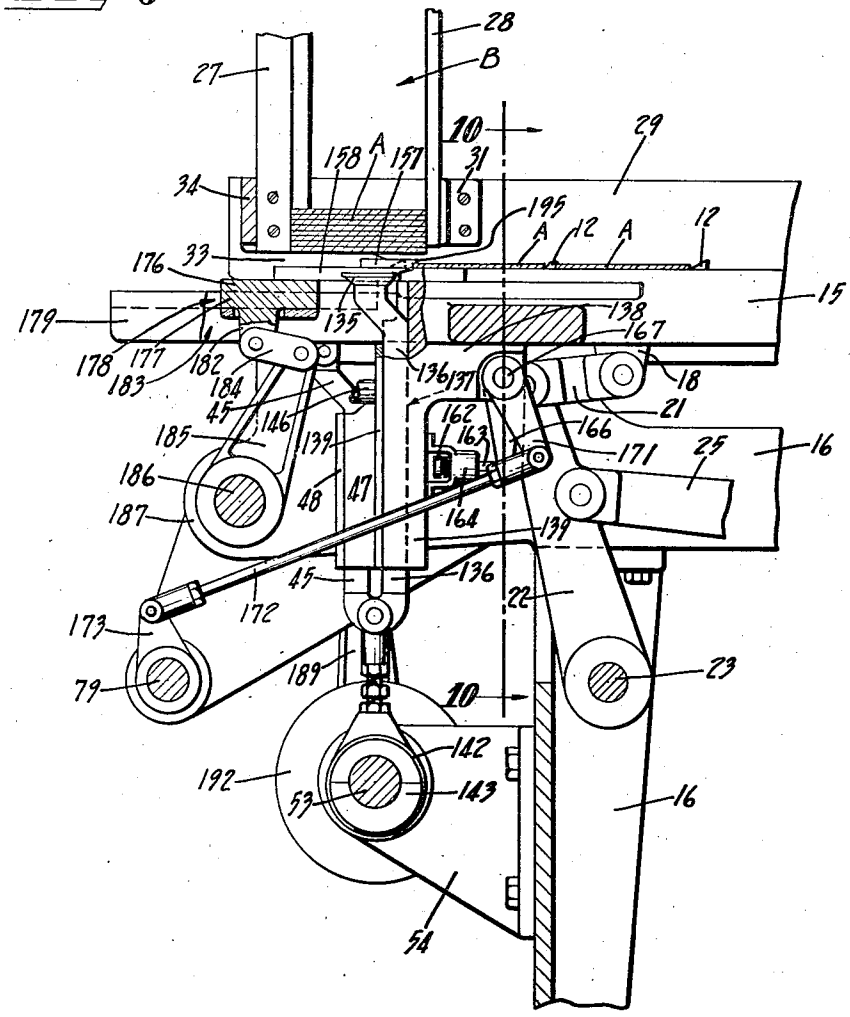
SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 4

Fig 8



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SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 5

Fig 9

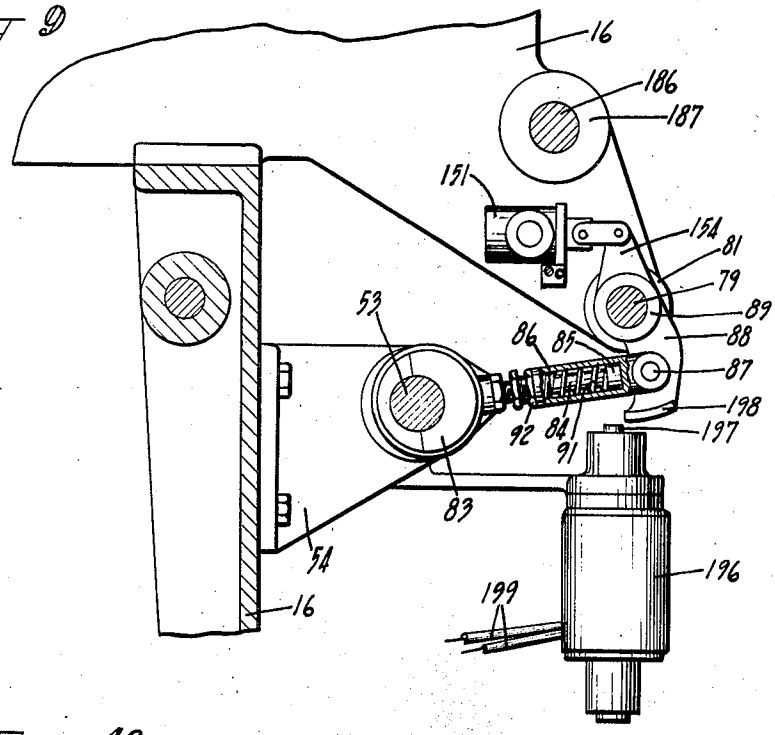
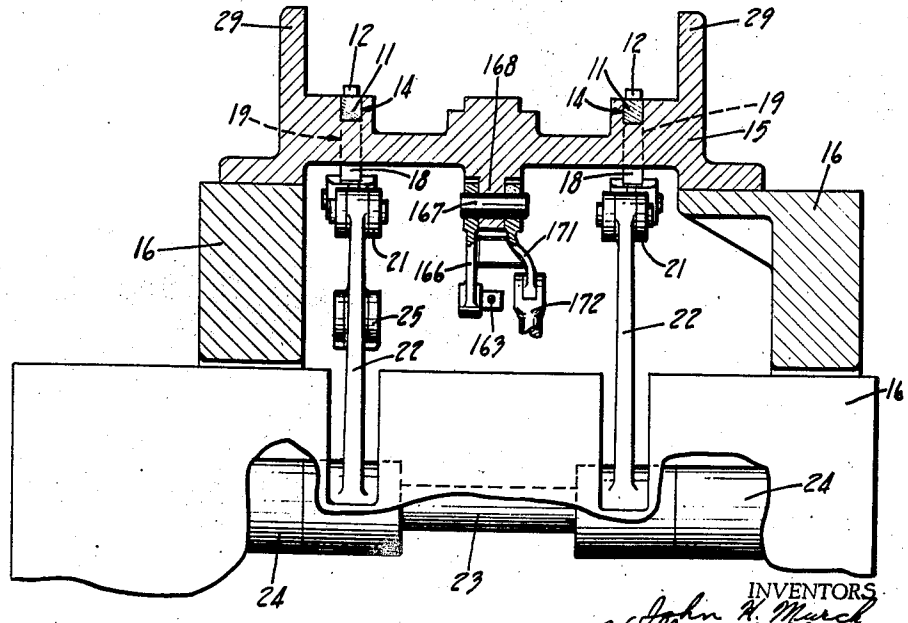


Fig 10



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Dec. 14, 1943. J. H. MURCH ET AL 2,336,499

SHEET FEEDING DEVICE

Filed Jan. 20, 1942 6 Sheets-Sheet 6

Fig 11

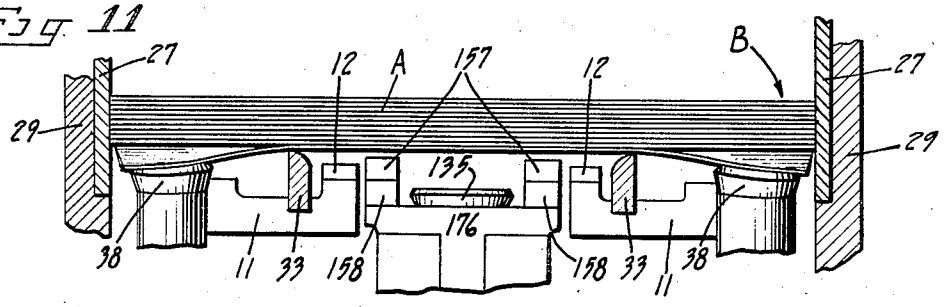


Fig 12

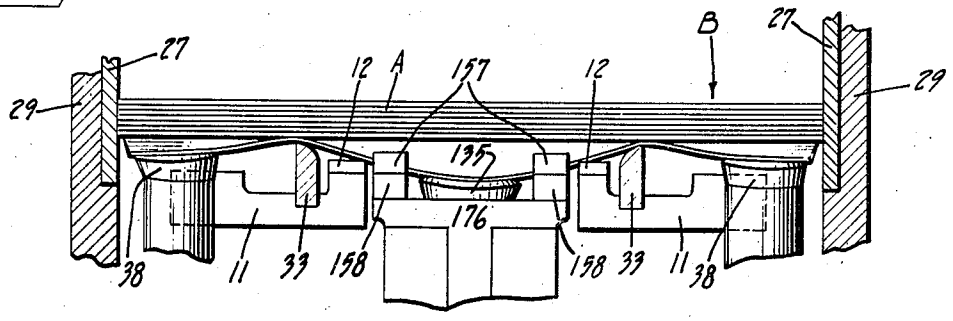
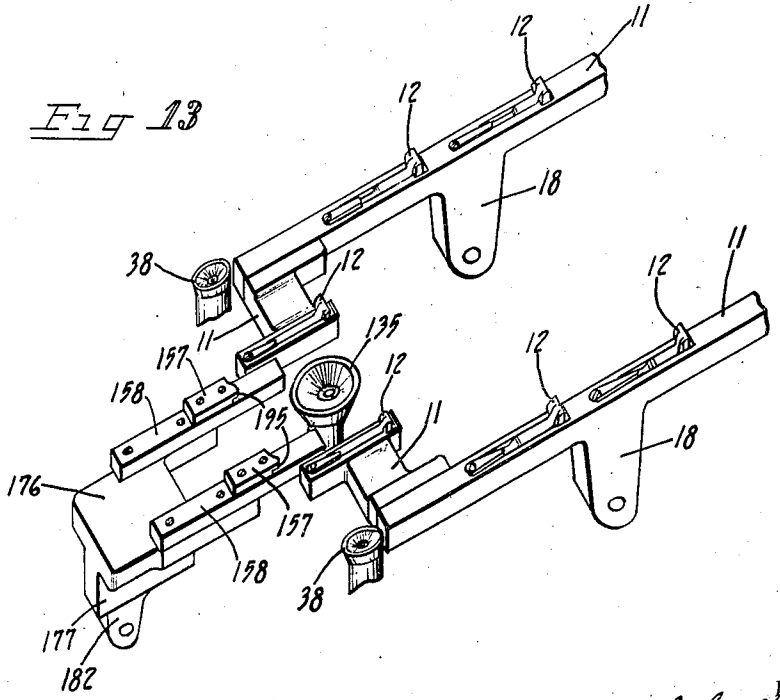


Fig 13



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Patented Dec. 14, 1943

2,336,499

UNITED STATES PATENT OFFICE

2,336,499

SHEET FEEDING DEVICE

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Application January 20, 1942, Serial No. 427,502

11 Claims. (Cl. 271—32)

The present invention relates to a sheet feeding device for container or can making machines and has particular reference to feeding sheets at high speeds without nicking them.

In the manufacture of cans the blanks from which the bodies are made are usually fed by a reciprocating stroke bar from a stack of such blanks contained in a magazine. At high speeds of production the feed dogs on the rapidly moving stroke bar engaging against a stationary blank to feed it from the magazine usually dent or nick the edge of the blank and this nick causes trouble during subsequent operations on the blank.

The instant invention contemplates overcoming this difficulty by providing a magazine or auxiliary feed stroke bar moving relatively slowly and through a short stroke and which operates in cooperation with the regular high speed feed bars on the machine and which keeps the blank moving after being fed from the magazine until the regular feed bars pick up the blank and carry it forward.

An object therefore of the invention is the provision in a can making machine of a high speed blank feeding device wherein blanks contained in a magazine are removed individually by a relatively slow moving auxiliary feed bar which advances and keeps the blank in motion while the regular high speed feed bars on the machine engage and further advance the blank so that denting or nicking of the blank edge is prevented.

Another object is the provision of such a blank feeding device wherein auxiliary suction cups are used in cooperation with the usual separator suction cup for pulling down the outer edge portions of a blank contained in a magazine so that the lowermost blank will be positively separated from the blank next above to prevent the feeding of double blanks.

Another object is the provision of a blank feeding device wherein auxiliary suction cups are used in cooperation with the usual separator suction cup for pulling down the outer edge portions of a blank contained in a magazine so that the lowermost blank will be positively separated from the blank next above to prevent the feeding of double blanks.

Another object is the provision of a blank feeding device of this character wherein the auxiliary suction cups for separating a blank from the others in a magazine are supplemented by air blast nozzles which direct blasts of air against the edges of the blank being separated to vibrate the blank and thus insure its positive separation.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a top plan view of a blank feeding device embodying the instant invention, with parts broken away;

Fig. 2 is a front elevation of the device shown in Fig. 1, with parts broken away;

Fig. 3 is a sectional view taken substantially along the broken line 3—3 in Fig. 2, with parts broken away;

Figs. 4 and 5 are sectional details taken substantially along the lines 4—4 and 5—5 in Fig. 3, with parts broken away;

Fig. 6 is an enlarged sectional detail of a valve used in the device, with parts broken away;

Fig. 7 is a side view of a detail of the device, the view being taken substantially along a plane indicated by the line 7—7 in Fig. 2, with parts broken away;

Fig. 8 is a sectional view taken substantially along the broken line 8—8 in Fig. 2, with parts broken away;

Fig. 9 is a sectional view taken substantially along the line 9—9 in Fig. 2, with parts broken away;

Fig. 10 is a transverse sectional view taken substantially along the line 10—10 in Fig. 8, with parts broken away;

Figs. 11 and 12 are enlarged schematic transverse sectional views taken substantially through the blank magazine of the device and showing different positions of the suction cups incident to separating and removing the lowermost blank from the magazine; and

Fig. 13 is a schematic perspective view of the feed bars and suction cups used in the device, with parts broken away.

As a preferred embodiment of the instant invention the drawings illustrate a blank feed for a sheet metal can body making machine of the character disclosed in United States Patent 1,770,041, issued July 8, 1930, to John F. Peters on Roll bodymaker. In such a machine flat sheet metal blanks A (Figs. 8, 11 and 12) are fed from the bottom of a magazine B and are propelled through the machine by a pair of spaced and parallel reciprocating high speed feed bars 11 (see also Figs. 3 and 13) having spring held feed dogs 12 spaced at intervals along their length. These feed bars slide in longitudinal groove 14 (see Fig. 10) formed in a horizontal table 15 bolted to a frame 16 which constitutes the main frame of the machine.

The feed bars 11 are reciprocated through a forward or feeding stroke and thence through a return stroke by depending lugs 18 which are formed on the feed bars. These lugs extend down through slots 19 formed in the table frame

15 and are connected with short links 21. The links are connected to the upper ends of a pair of substantially vertical actuating arms 22 which are mounted on a cross shaft 23 carried in bearings 24 formed in the main frame 16.

One of the arms 22 is connected to a connecting rod 25 which is reciprocated in any suitable manner in time with the other moving parts of the machine, such as that disclosed in the above mentioned Peters patent. This connecting rod reciprocates the feed bars 11 and thus advances the blanks A in an intermittent or step-by-step manner through the machine for subsequent operations.

In the instant invention the blanks A are retained in the magazine B by a pair of upright corner guide bars 27 (Figs. 1, 3 and 8) and a guide plate 28 located opposite the rods. The corner bars 27 are secured to a pair of spaced and parallel longitudinal wall sections 29 (see also Fig. 10) of the main frame 16. The guide plate 28 is located centrally between the wall sections 29 and is secured to a cross beam 31, the ends of which are bolted to the wall sections.

The blanks A in the magazine B are supported on a pair of spaced and parallel support arms 33 which are located one on each side of the middle of the blanks and are bolted to a cross beam 34 secured to the corner guide bars 27. These support arms 33 hold the lowermost blank A in the stack just above the blank feed line so that the rear feed dogs 12 of the feed bars 11 will clear the blanks when they pass under the magazine on a return stroke.

The lowermost blank A in the magazine B is pulled down by suction cups to separate it from the other blanks in the stack and to bring it into the region of the feed line just prior to its withdrawal from the magazine. Separation of the lowermost blank is brought about by a pair of separator suction cups 38 (Figs. 1, 2, 3, 11, 12 and 13). These two suction cups are located just under the magazine and are disposed one adjacent each rear corner of the lowermost blank in the magazine.

The separator suction cups 38 are carried on swing arms 39 (Figs. 1, 2 and 3) which are mounted on pivot studs 41 threaded in bosses 42 formed on the table frame 15. The outer ends of the swing arms are connected by links 44 to vertical slides 45 (see also Fig. 4). There are two of these slides 45, one for each separator suction cup 38. These slides operate in slideways 46 formed in brackets 47 secured to the table frame 15. A cover plate 48 on each bracket retains the slides within their slideways.

The slides 45 are moved through an upward stroke to engage the lowermost blank in the magazine and thence through a downward stroke. This movement within their slide-ways 46 is effected by a pair of eccentrics 51 having connecting rods 52 which connect with the lower ends of the slides. These eccentrics are mounted on an eccentric shaft 53 which extends across the front of the machine and is journaled in three spaced bearing brackets 54 bolted to the main frame 16. The eccentric shaft is rotated in any suitable manner, such as by a gear 55, in time with the feed bars 11 and the other moving parts of the machine.

The slides 45 and the suction cups 38 are also in communication with a source of vacuum. For this purpose the suction cups 38 are connected by flexible tubes 58 to the slides 45. These tubes communicate with vertical passageways 59 (Fig. 3) one being formed in each slide. The lower end of each passageway 59 communicates with a flexible tube 61 which extends through a slot 62 in the cover plate 48 and which is secured in the slide. The opposite ends of the two tubes 61 connect with a pipe 64 (see also Fig. 6) which is threaded into a valve 65. The pipe communicates with a passageway 67 in the valve which opens into a pipe 68 leading from a suitable source of vacuum.

The valve 65 is provided with a valve plunger 71 which slides in a bore 72 formed in the valve and which extends across the passageway 67. The plunger normally cuts off communication between the vacuum pipe 68 and the pipe 64. However, the plunger is formed with an annular groove 74 which when brought into register with the valve passageway 67 by movement of the plunger, opens communication between the pipes 64, 68 to draw a vacuum on the suction cups 38.

This movement of the valve plunger 71 is brought about by a link 76 (see also Fig. 1) which is connected to an arm 77 of a rocker lever 78 mounted on a rocker shaft 79 carried in bearings 81 formed in the main frame 16. This lever shaft is parallel with the eccentric shaft 53 and extends across the front of the machine. The shaft 79 is rocked in its bearings 81 in time with the other moving parts of the feeding device by an eccentric 83 (Figs. 1 and 9) which is mounted on the eccentric shaft 53.

This eccentric 83 is formed with a long stem 84 having at its outer end a head 85 which is located in a sleeve 86, connected by way of a pivot pin 87, to an arm 88 of a rocker lever 89 mounted on the rocker shaft 79. A compression spring 91 surrounds the eccentric stem 84 and is located in the sleeve 86 between the stem head 85 and a locknut 92 on the end of the sleeve. This provides a flexible connection between the eccentric 83 and the rocker arm 88.

Hence as the slide eccentrics 51 on the rotating eccentric shaft 53 move the slides 45 through an upward stroke to bring the separator suction cups 38 into engagement with the two outer corners of the lowermost blank A in the magazine B, the eccentric 83 moves the rocker shaft 79 and the rocker lever arm 77. This shifts the valve plunger 71 to bring its groove 74 into register with the vacuum passageway 67 of the valve 65. This opens communication between the vacuum pipe 68 and the pipe 64 and thus draws a vacuum on the suction cups 38 by way of the tubes 61, slide passageway 59, and the tubes 58. The vacuum thus created in the cups makes them adhere to the corners of the lowermost blank A.

While the separator cups 38 thus are holding the two outer corners of the blank A, the separator eccentrics 51 draw the slides 45 and the cups 38 thereon, downwardly through the return or separating stroke. This pulls the two outer corners of the blank A downwardly, as best shown in Fig. 11. While the corners are thus being drawn downwardly a blast of air is directed against each of the two front corner edges of the lowermost blank and those immediately above. This separates the lowermost blank from the others.

The blasts of air issue from two nozzles 101 (Figs. 1, 2 and 3) which are located adjacent the separator cups 38 and which are carried in brackets 102 secured to the blank supports 33. These nozzles are connected by pipes 103, 104 to a normally closed air valve 105 which is iden-

tical with the vacuum valve 65 and which is connected by way of a pipe 106 to a suitable source of compressed air. The air valve 105 is fitted with a sliding plunger 108 which is connected by a link 109 to an arm 111 of the rocker lever 78 mounted on the rocker shaft 79.

Hence when the shaft 79 is rocked to open the vacuum valve 65 it also opens the air valve 105. It is this operation of the air valve that permits air from the pipe 106 to pass through the pipes 103, 104 and issue from the nozzles 101 at the proper time to separate the blanks as hereinbefore mentioned.

While the two outer corners of the lowermost blank A are being drawn downwardly and separated from the blanks next above in the magazine B, the middle portion of the blank, is pulled downwardly in readiness for removal of the blank from the magazine. However, just prior to this removal of the blank, the vacuum on the separator cups 38 is broken to release the cups from the separated blank. This release of the cups will now be explained.

Breaking of the vacuum on the separator cups 36 is brought about by the opening of normally closed valves in the slide brackets 47. There are two of these valves, one for each slide bracket. Each valve includes a port 115 (Fig. 3) formed in the rear of the bracket and normally closed by a valve head 116 of a spring pressed plunger 117 which is carried in an open bracket 118 secured to the rear of the slide bracket.

The plunger 117 is connected to the lower end of a depending arm 121 (see also Fig. 5) which is mounted on a short pivot shaft 122 carried in a bearing 123 formed on the bottom of the table frame 15. There are two of these arms 121, located one on each side of the feeding device. This provides for operation of the two valves independently. The pivot shafts 122 carry actuating arms 125 which are connected to long links 126 (see also Fig. 2). The link 126 on one side connects with an arm 127 of the rocker lever 78. The link on the other side is connected to an arm 128 of a rocker lever 129. Both levers 78 and 129 are mounted on the rocker shaft 79.

When the slides 45 on which the separator cups 38 are mounted, move downwardly to pull down the corners of the blank A by the vacuum created in the cups, the valve head 116 of the plunger 117 is in sealing position within the port 115 in the slide bracket. As the slides continue to move downwardly to the bottom of their stroke, the vacuum is held on the cups to keep the blank corners down until the blank is ready for removal from the magazine.

During this descent of the slide, a port 132 (Fig. 3) formed therein is brought into register with the port 115. The port 132 communicates with the slide passageway 59. With the port 132 in register, which takes place just as the blank begins to move out of the magazine, the valve head 116 of the plunger 117 is drawn back from the port 115 by the rocking of its actuating arm 125. This admits air into the slide passageway 59 by way of the aligned ports 115, 132. It is this admission of air that breaks the vacuum in the separator cups 38 and thus releases the blank from the cups. When the vacuum thus is broken in the separator cups the valve 65 is closed to cut off the cups from the source of vacuum.

The drawing downwardly of the lowermost blank A at its middle section is brought about by a main vacuum cup 135 (Figs. 1, 2, 8, 11, 12 and 13). This vacuum cup is located just under the magazine B at the middle of and near the forward edge of the lowermost blank A as it rests in the magazine. In this position of the vacuum cup it is centrally located between the two outer feed dogs 12 on the feed bars 11.

The vacuum cup 135 is secured to the upper end of a vertical slide 136 (Fig. 8) which is identical with the two slides 45 connected with the separator suction cups 38. The slide is located in a slideway 137 formed in a bracket 138 secured to the bottom of the table frame 15. The slide is held in place by a cover plate 139 secured to the outer face of the bracket.

The slide 136 is raised and lowered in time with the other moving parts of the feeding device by an eccentric ring 142 (see also Fig. 2) which is connected to the lower end of the slide. The eccentric ring rotates on an eccentric 143 mounted on the eccentric shaft 53. The slide 136 is formed with a cup vacuumizing passageway which is identical with the passageway 59 in the slide 45. This passageway leads from the cup 135 to one end of a flexible tube 146. The opposite end of the tube is connected into a vacuum valve 151 (Fig. 2) secured to a pipe 152 which leads to a suitable source of vacuum.

The vacuum valve 151 (see also Fig. 9) is identical with the other vacuum valve 65 hereinbefore mentioned and is fitted with a sliding valve plunger connected to an arm 154 of the rocker lever 89. It will be recalled that lever 89 is mounted on the rocker shaft 79. Hence when the slide 136 under the oscillation of rocker shaft 79, moves through an upward stroke and brings the vacuum cup 135 into engagement with the lowermost blank A in the magazine, the shaft 79 also rocks the lever arm 154 and shifts the valve plunger in the valve 151 to open position. This connects the vacuum cup 135 to the source of vacuum and thus makes the blank adhere to the cup.

On the following downward stroke of the slide 136, with the vacuum still maintained on the cup, the blank is drawn downwardly toward the feed line into the position shown in Fig. 12. By the time the bent middle portion of the blank reaches the feed line, a pair of spaced auxiliary feed dogs 157 (Figs. 11 and 13) engage the rear edge of the lowermost blank and push the blank horizontally out of the magazine B. The auxiliary feed dogs 157 are carried in short relatively slow moving feed bars 158 which are located one on each side of the vacuum cup. It is at this time that the vacuum on the separator suction cups 38 is broken and the corners of the blank thereupon are released. At the same time the vacuum on the main vacuum cup 135 is broken and the blank is released from this cup.

The breaking of the vacuum in the main vacuum cup 135 is brought about by registering a valve port in the slide 136 with another port in the slide bracket 138. These ports are identical in construction and operation to the ports 115, 132 in the bracket 47 and slide 45 hereinbefore explained. The valve port in the slide bracket 138 normally is closed by a valve head 162 formed on a spring held plunger 163 which is carried in an open valve bracket 164.

The outer end of the valve plunger 163 is secured to an arm 166 (see also Fig. 10) which is mounted on a short pivot shaft 167 carried in a depending bearing 168 formed on the bottom of the table frame 15. The pivot shaft also carries

a lever 171 which is connected to the inner end of a long link 172 (see also Fig. 8). The outer end of the link is connected to a rocker lever 173 (see also Fig. 2) mounted on the rocker shaft 79.

Rocking of shaft 79 and the corresponding movement of the link 172 and lever arms 166, 171 connecting therewith and with the valve plunger 163, opens the valve at the proper time and thereby admits air into the slide passageway leading to the vacuum cup 135. This breaks the vacuum therein and releases the blank from the cup. When the vacuum is broken in the vacuum cup 135, the valve 151 is closed to cut off the cup from the source of vacuum.

The auxiliary feed bars 158 (Fig. 13) which carry the feed dogs 157 are mounted on a horizontal slide block 176 formed with a depending tongue 177 which slides in a slideway 178 (see also Figs. 1 and 8). This slideway is formed in an extension 179 of the table frame 15. The slide block is reciprocated through a short slow forward or feeding stroke and thence through a slow return stroke below the magazine B and in time with the other moving parts of the feeding device. For this purpose a depending lug 182 extends downwardly through an opening 183 in the table frame extension 179.

The lug 182 is connected by a link 184 with the upper end of a lever 185 mounted on a cross shaft 186 which extends across the front of the feeding device in parallelism with the rocker shaft 79 and with the eccentric shaft 53. The cross shaft is carried in bearings 187 (Figs. 1 and 2) formed on the main frame 16. One end of the cross shaft 186 carries an arm 188 (see also Fig. 7) which has its outer end connected to an eccentric ring arm 189 of an eccentric 191. The arm 189 operates on an eccentric shaft section between two spaced and parallel discs 192 formed in the eccentric shaft 53.

Thus as the eccentric shaft 53 rotates it rocks the cross shaft 186 and lever 185 carried thereon and thus reciprocates the auxiliary feed bars 158. On the forward stroke of the feed bars, the feed dogs 157 carried thereon engage against the rear edge of the bowed blank A and push the blank out of the magazine B and carry it forward. The dogs are formed with overhanging hook noses 195 (Fig. 13) to hold the blank against springing upwardly after its release from the suction and vacuum cups.

While the removed blank is still in motion the regular feed dogs 12 on the main feed bars 11 gently engage the rear edge of the blank and carry it forwardly through the machine in the regular manner. Due to the short stroke of the auxiliary feed bars 158 they are actuated at a slower rate of speed than the regular high speed feed bars 11 with their long stroke. It is this slower speed and this manner of feeding the blanks from the magazine with the short stroke auxiliary feed dogs that prevents nicking of the blanks. After delivering the blank onto the regular feed bars 11, the auxiliary feed bars 158 move rearwardly under a return stroke and come into their original position in readiness for the next blank in the magazine.

A vacuum control is provided for preventing the feeding of the blanks from the magazine when it is desired. This feed stop is brought about by an electric solenoid 196 (Figs. 2 and 9) having a vertically disposed movable core 197. The core of the solenoid is located directly below a foot member 198 formed on the lower end of the rocker shaft actuating arm 88. The solenoid may be connected by wires 199 to a suitable source of electric energy and to a push button switch and to the usual automatic stop switches in the bodymaker so that it may be energized by any or all of these switches when desired or when a jam or wreck occurs in the machine.

Energizing of the control solenoid 196 shifts its core 197 up into the path of travel of the foot 198 of the actuating arm 88 as its rocker shaft 79 moves and thus stops further movement of the arm. This holds the rocker shaft 79 against movement but the eccentric shaft 53 continues to rotate and the throw of the eccentric 83 is taken up by the compression spring 91 in the sleeve 86.

With the rocker shaft thus held against movement, the rocker levers mounted thereon are stopped from operating. The vacuum valves 65, 151 and the air valve 195 thus remain closed. Vacuum is not drawn on the suction cups 38 or on the vacuum cup 135 and hence the blanks in the magazine are not removed therefrom.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a relatively slow moving auxiliary feed bar having a feed dog thereon for engaging and setting in motion the lowermost sheet in the magazine, and a high speed feed bar having a feed dog for gently engaging behind the started sheet while it is still in motion and for advancing it along a predetermined path of travel without the feed dogs nicking the sheet.

2. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, means for separating the lowermost sheet in the magazine from the others, a relatively slow moving auxiliary feed bar having a feed dog thereon for engaging and setting in motion the separated sheet in the magazine, and a high speed feed bar having a plurality of feed dogs thereon for gently engaging behind the started sheet while it is still in motion for advancing it along a predetermined path of travel thus preventing nicking of the sheet by the feed dogs.

3. In a high sped sheet feeding device, the combination of a magazine containing a stack of sheets, a pair of suction cups located below said magazine and adjacent opposite corners of the sheets in the magazine for pulling down the corners of the lowermost sheet to separate this sheet from the others in the stack, a vacuum cup for pulling the separated sheet down toward a feed line, and feeding means for removing the separated sheet from the magazine and for advancing it along a predetermined path of travel on the feed line.

4. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a pair of suction cups located below said magazine and adjacent opposite corners of the sheets in the magazine for pulling down the corners of the lowermost sheet to separate this sheet from the others in the stack, a vacuum cup for pulling down on the midle part of the separated sheet, an auxiliary feed bar having a feed

dog thereon for engaging and setting in motion the separated sheet in the magazine, and a main feed bar having a plurality of feed dogs for gently engaging behind the sheet already moving with said auxiliary feed bar and for advancing the sheet at an increased rate of travel, thus preventing nicking of the sheet by the feed dogs.

5. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a pair of suction cups located below said magazine and adjacent opposite corners of the sheets in the magazine for pulling down the corners of the lowermost sheet to separate this sheet from the others in the stack, a vacuum cup for pulling the center of the separated sheet down toward a feed line, feeding means for removing the separated sheet from the magazine for advancing it along the feed line in a predetermined path of travel, and means for rendering said suction cups and said vacuum cup inoperative to prevent feeding of the sheets from said magazine.

6. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a plurality of vertical slides located below said magazine, means for actuating said slides, a pair of suction cups carried on two of said slides, said cups being disposed adjacent opposite corners of the lowermost sheet in the stack for drawing these corners down to separate the sheet from the others, a vacuum cup carried on another of said slides for drawing the separated sheet down to a feed line, means for drawing a vacuum on said cups, valve devices for controlling said vacuum, a relatively slow moving auxiliary feed bar located adjacent said vacuum cup for setting in motion and for removing the separated sheet from the magazine, and a high speed feed bar for picking up the removed sheet while it is in motion without nicking the sheet and for advancing it along a predetermined path of travel in said feed line.

7. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a plurality of vertical slides located below said magazine, means for actuating said slides, said cups being disposed adjacent opposite corners of the lowermost sheet in the stack for drawing these corners down to separate the sheet from the others, a vacuum cup carried on another of said slides for drawing down the separated sheet adjacent its center to a feed line, means for drawing a vacuum on said cups, valve devices for controlling said vacuum, a short stroke relatively slow moving auxiliary feed bar located adjacent said vacuum cup for setting in motion and for removing the separated sheet from the magazine, a long stroke high speed feed bar for picking up the removed sheet while it is in motion to prevent nicking of the sheet and for advancing it along a predetermined path of travel in said feed line, and electric solenoid operated devices for holding said valve devices in closed condition to prevent drawing a vacuum on said cups and to prevent feeding of sheets from the magazine while the device is operating.

8. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a pair of suction cups located below said magazine and adjacent opposite corners of the sheets in the magazine, a pair of laterally spaced members under said stack and between said pair of cups for supporting said sheets, a third suction cup below said stack and between said spaced members for pulling downwardly a central portion of the lowermost sheet between said support members while each of said pair of cups is adapted to pull downwardly a corner of said lowermost sheet thereby to separate this sheet from those above it in the stack, and feeding means for removing this sheet from the magazine and for advancing it along a predetermined path of travel.

9. In a high speed sheet feeding device, the combination of a magazine containing a stack of sheets, a pair of suction cups located below said magazine and adjacent opposite corners of the sheets in the magazine, a pair of laterally spaced members under said stack and between said pair of cups for supporting said sheets, a third suction cup below said stack and between said spaced members for pulling downwardly a central portion of the lowermost sheet between said support members while each of said pair of cups is adapted to pull downwardly a corner of said lowermost sheet thereby to separate this sheet from those above it in the stack, an air blast device for ejecting a blast of air against a corner of the sheets in the magazine to insure separation of said lowermost sheet, and feeding means for removing this sheet from the magazine and for advancing it along a predetermined path of travel.

10. In a sheet feeding device, the combination of a magazine containing a stack of sheets to be fed for a subsequent operation thereon, a vacuum cup disposed beneath said magazine and connected with a source of vacuum for pulling down the lowermost sheet to separate it from other sheets in the stack, an auxiliary feed bar having a feed dog thereon for engaging and setting in motion the lowermost sheet in the magazine, a main feed bar having a feed dog for gently engaging behind the started sheet while it is still in motion for advancing said sheet along a predetermined path of travel without the feed dogs nicking the sheet, a valve for controlling said vacuum, and an electric solenoid actuating device for holding said valve in closed position to prevent drawing a vacuum on said cup and to prevent feeding a sheet from said magazine while said main feeding means is operating.

11. In a sheet feeding device, the combination of a magazine containing a stack of sheets to be fed for a subsequent operation thereon, a vacuum cup disposed beneath said magazine and connected with a source of vacuum for pulling down the lowermost sheet to separate the same from other sheets in the stack, an air blast device for ejecting a blast of air against an edge of the sheets in the magazine to insure separation of the lowermost sheet from the remaining sheets in the stack, an auxiliary feed bar having a feed dog thereon for removing the separated sheet from the magazine and for advancing the same, and a high speed feed bar having a feed dog for gently engaging behind the started sheet while it is still in motion and for advancing it along a predetermined path of travel without the feed dogs nicking the sheet, a valve for controlling said vacuum, and an electric solenoid actuating device for holding said valve in closed position to prevent drawing a vacuum on said cup and to prevent feeding a sheet from said magazine while said high speed feed bar is operating.

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