

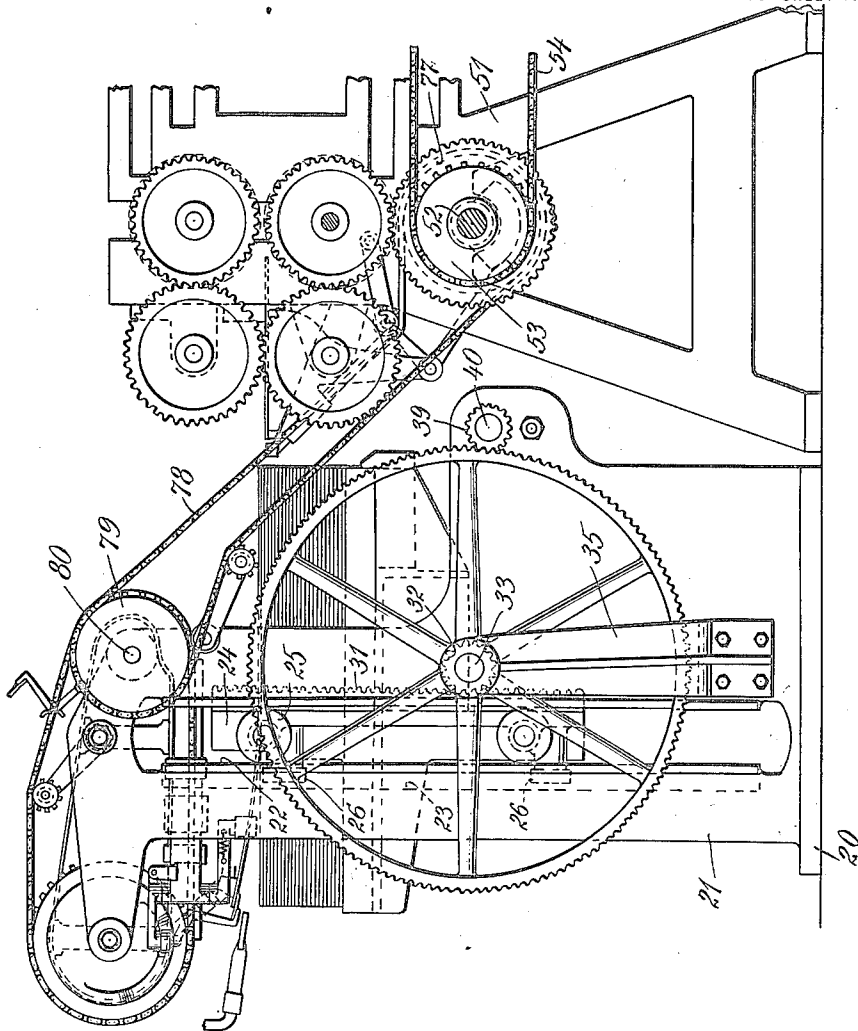
F. M. CONRAN.
AUTOMATIC SHEET FEEDING MECHANISM.
APPLICATION FILED OCT. 31, 1917.

1,301,799.

Patented Apr. 22, 1919

8 SHEETS—SHEET 1.

Fig. 1.



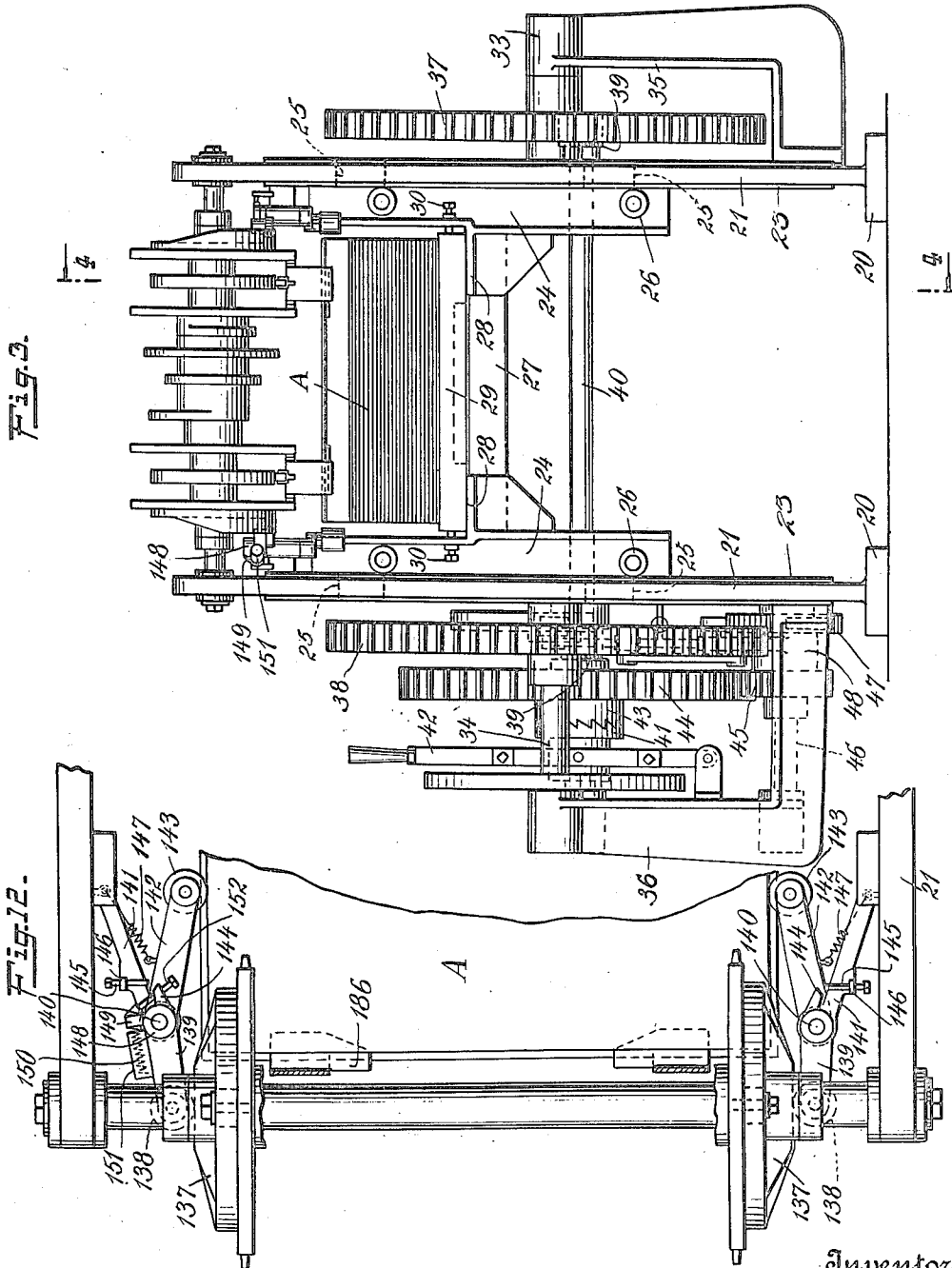
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Frederick M. Conran
By his Attorneys
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8 SHEETS—SHEET 4.

Fig. 9.

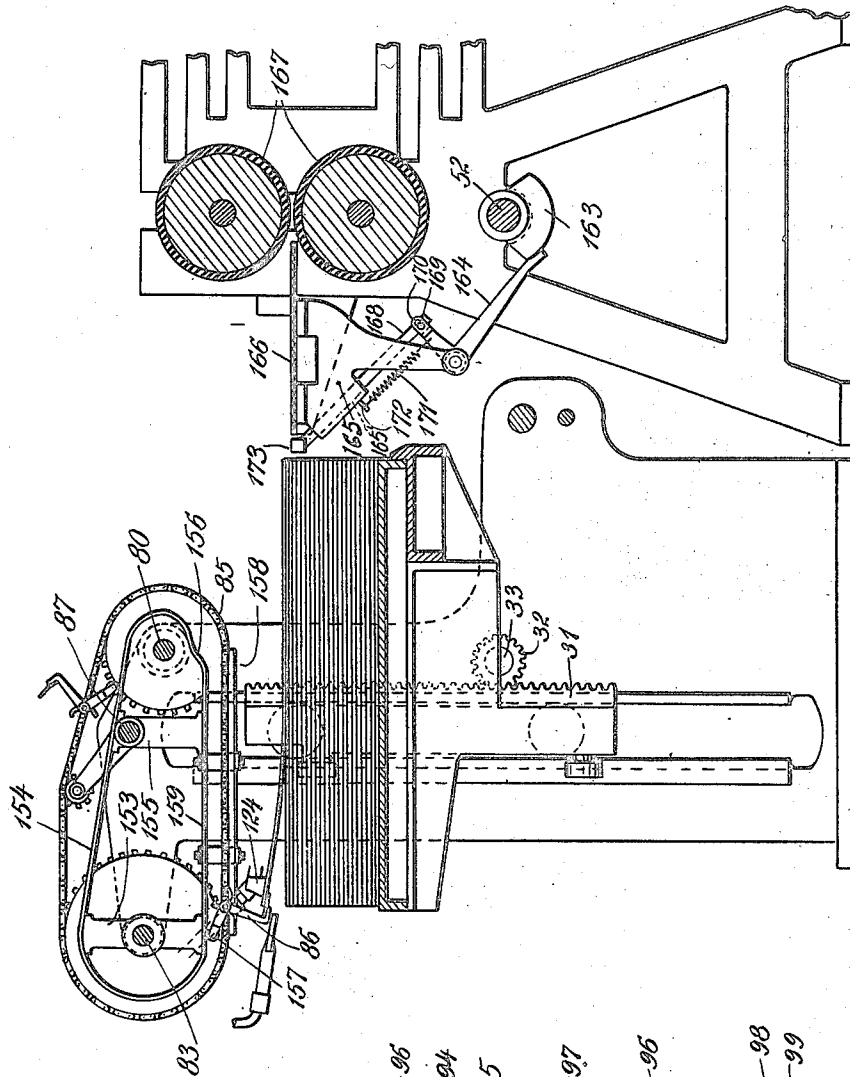


Fig. 10.

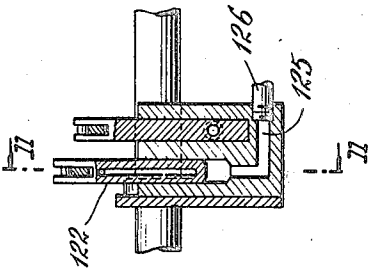
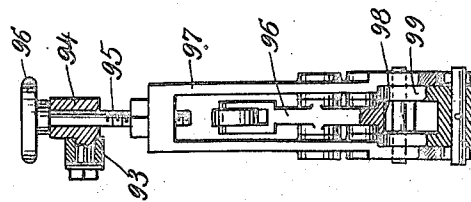


Fig. 11.



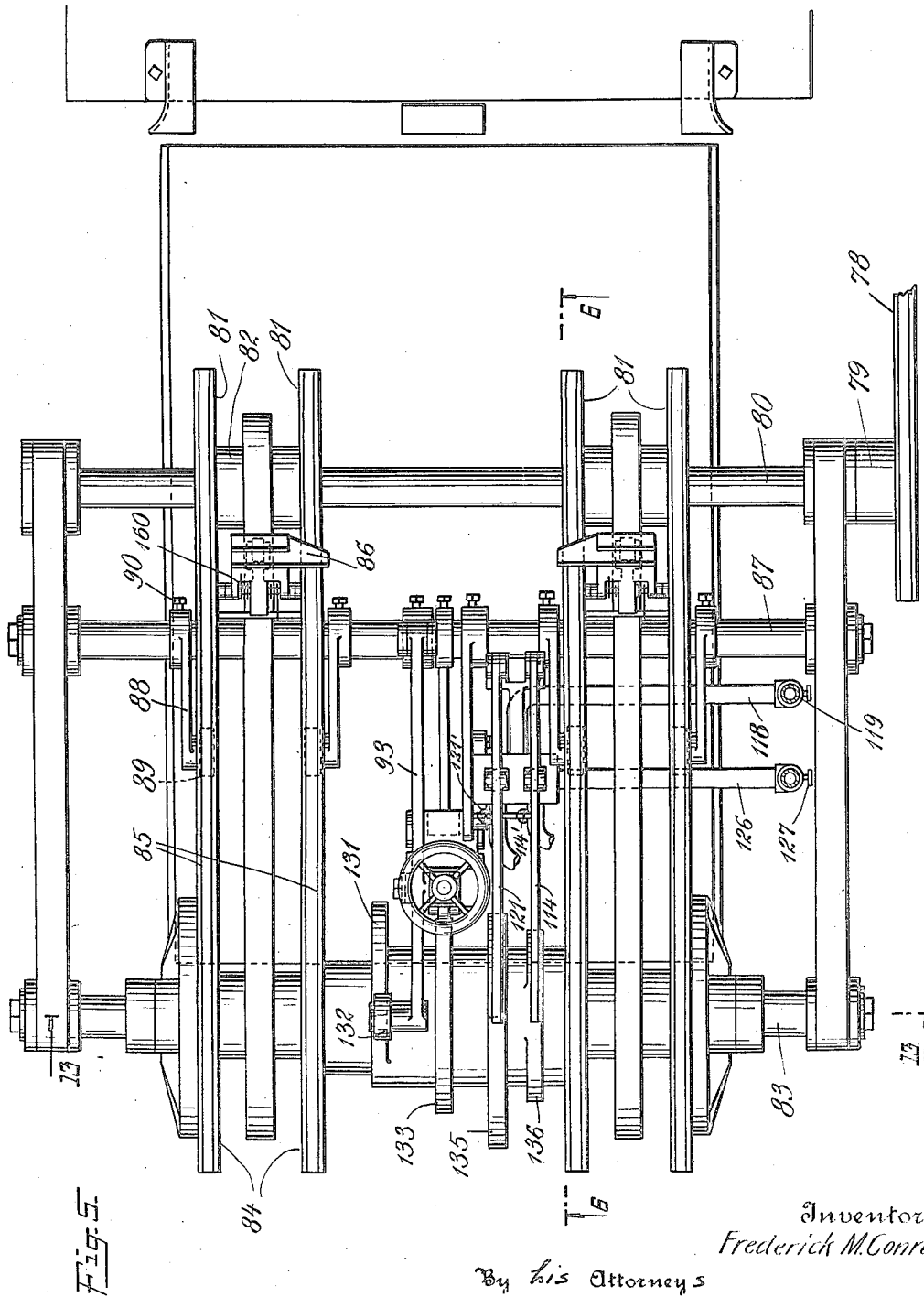
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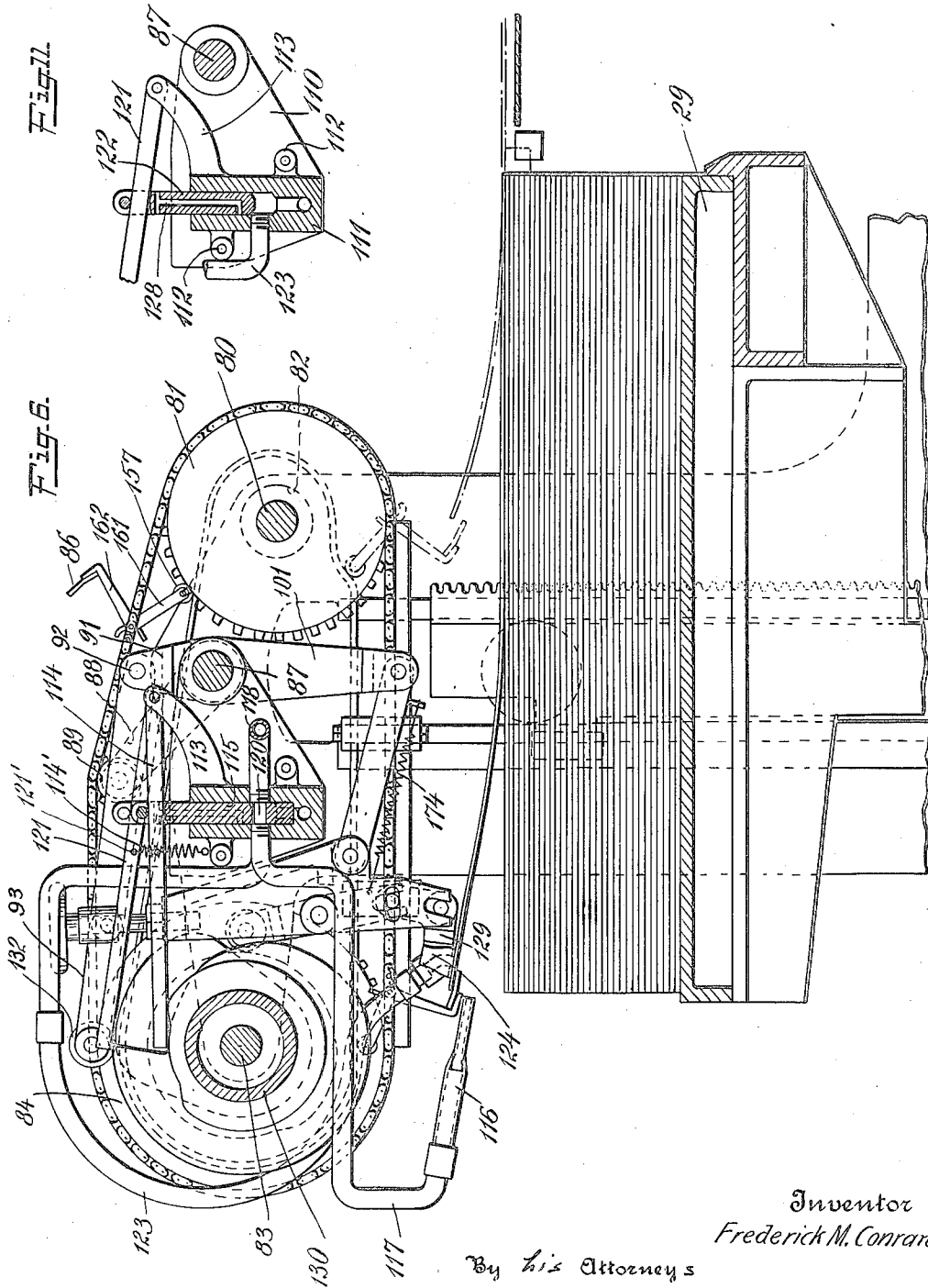
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8 SHEETS—SHEET 6.



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8 SHEETS—SHEET 7.

This diagram provides a detailed perspective view of the mechanical assembly shown in Fig. 5. It illustrates the internal components and their interconnections. Key features include:

- 96**: A hand crank or adjustment knob at the top.
- 94**: A vertical rod or shaft passing through the center of the crank.
- 93**: A horizontal arm extending from the central rod.
- 97**: A vertical support structure or frame member.
- 98**: A horizontal link or arm connected to the lower part of the assembly.
- 99**: A spring mechanism, likely providing tension or resistance.
- 100**: A component at the bottom right, possibly a foot or base plate.
- 101**: A large, curved structural element, possibly a handle or a protective guard.
- 102**, **103**, **104**, **105**, **106**, **107**, **108**: Various small components, joints, and fasteners that make up the lower mechanism.
- 109**: The base surface where the entire assembly rests.
- 130**, **131**, **132**, **133**: Components related to the circular disc or wheel assembly on the left side of the device.

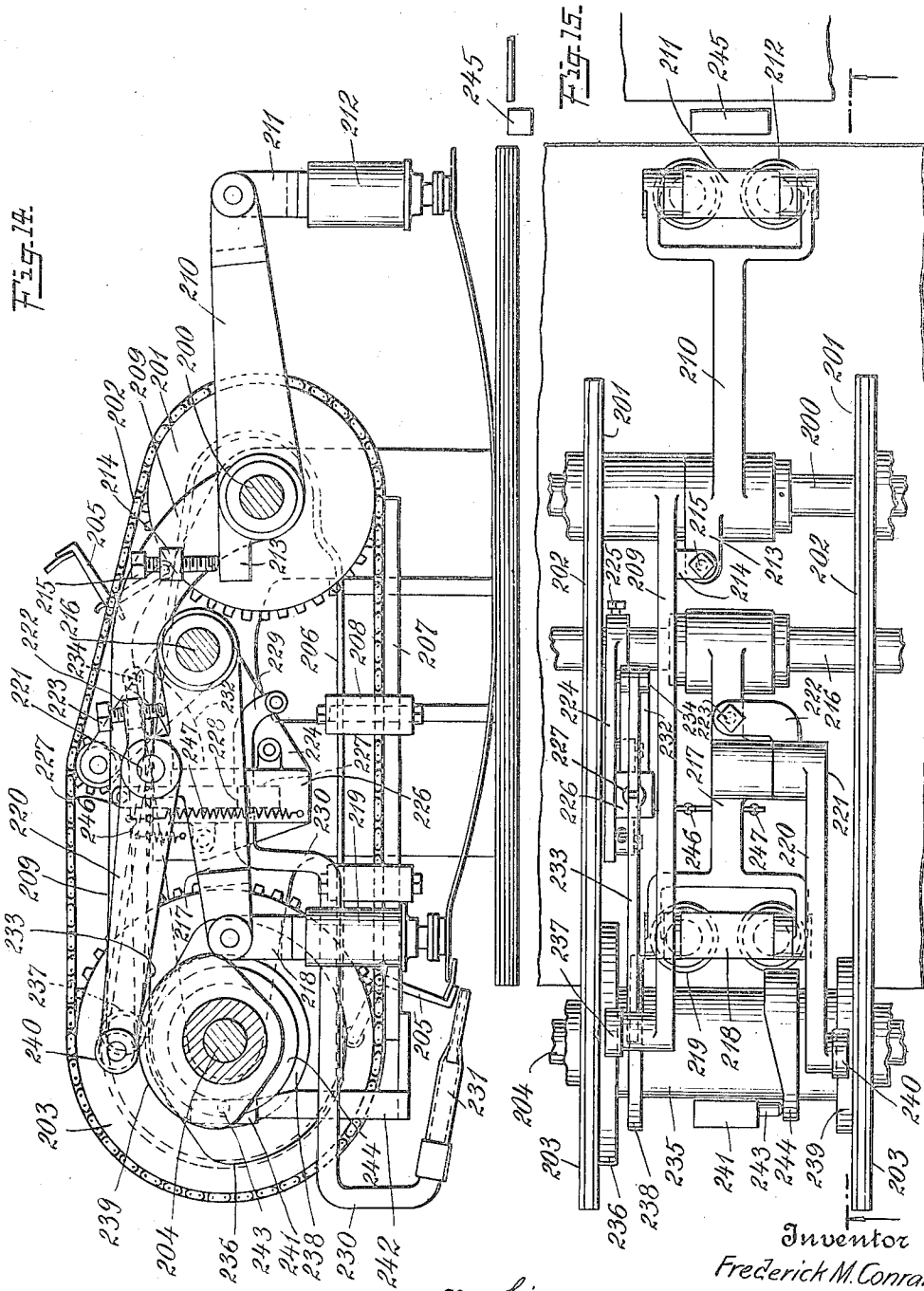
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8 SHEETS—SHEET 8.



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UNITED STATES PATENT OFFICE.

FREDERICK M. CONRAN, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE METALS PLATING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

AUTOMATIC SHEET-FEEDING MECHANISM.

1,301,799.

Specification of Letters Patent. Patented Apr. 22, 1919.

Application filed October 31, 1917. Serial No. 199,416.

To all whom it may concern:

Be it known that I, FREDERICK M. CONRAN, a citizen of the United States, residing at Elizabeth, in the county of Union, State of New Jersey, have invented certain new and useful Improvements in Automatic Sheet-Feeding Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to sheet feeding mechanism and has for an object the provision of a mechanism whereby sheets of material may be lifted one at a time from the top of a stack of sheets and fed successively therefrom. The invention further provides means for overcoming the cohesive effect between the top sheet and the one immediately beneath, thus insuring the complete separation of the top sheet from the next sheet in order to prevent the lower sheet from being carried along with the top sheet as it is being removed. This cohesive effect is due to several causes such, for instance, as static electricity, films upon the surfaces of the sheets, and suction effect between the sheets.

In order to bring the top sheet of the stack in proper position to be removed, the invention comprises feeding devices by means of which the stack of sheets is raised after each top sheet has been removed. The invention also comprises such a relationship of all of the moving parts of the device as to make the operations thereof occur in proper sequence, without interference with any of the other operations and the apparatus is entirely automatic in its actions. The mechanism may be used for a wide variety of purposes and in combination with many forms of mechanism in which the sheets are to be subsequently operated upon.

Other objects and advantages of the invention will appear more clearly from a detailed description of certain preferred embodiments thereof as illustrated in the accompanying drawings, in which Figure 1 is a side elevation of one embodiment of the machine as viewed from the right showing the same in combination with the mechanism to which the sheets of material are to be fed for subsequent treatment; Fig. 2 is a side elevation of the same machine as viewed from the left; Fig. 3 is an elevation of the

machine; Fig. 4 is a sectional elevation along the line 4—4 of Fig. 3; Fig. 5 is an enlarged plan view of the machine; Fig. 6 is an enlarged sectional elevation of the upper portion of the apparatus taken along the line 6—6 of Fig. 5; Figs. 7 and 8 are detail views showing the positions occupied by certain elements of the machine at certain times during the operation; Fig. 9 is a view in section along the line 9—9 of Fig. 7; Fig. 10 is a sectional view showing the valve of the machine; Fig. 11 is a section along the line 11—11 of Fig. 10; Fig. 12 is a view of the portion of the machine for placing the sheets of material in alinement; Fig. 13 is a section along the line 13—13 of Fig. 5 showing the mounting of the cams of the apparatus; Figs. 14 and 15 show a modification of the invention in which the apparatus is electro-magnetic in its operation.

Referring to the drawings, in which similar reference characters denote similar parts throughout the several views, 20 indicates the foundation or base plate of the machine above which project side frames 21. Each side frame is provided with a vertical slot. The edges of the slots are provided with guideways 22 which extend slightly beyond the faces of the side frames. Upon the inside face of each side frame and adjacent one edge of the slot is a guideway 23, the face of which is at right angles to the face of guideway 22. Mounted to slide upon each side frame 21 is a bracket 24 provided with rollers 25 fitting between and engaging the guideways 22 and other rollers 26 which engage the guideways 23. A cross bar 27 connects the brackets together and holds them in position with their rollers 26 against the guideways 23. Each bracket is provided with inwardly extending shelves 28 which in connection with the cross bar 27 support a table 29 which may be adjusted transversely of the machine by means of bolts 30. The sheets of material indicated by A are placed upon this table.

On the rear face of each bracket 24 is a rack bar 31 meshing with pinions 32 mounted on stub shafts 33 and 34 mounted in bearings on the ends of brackets 35 and 36 respectively, attached to and projecting from the side frames 21. Mounted on shaft 33 between bracket 35 and the corresponding side frame 21 is a gear 37. A similar gear 38 is mounted on shaft 34 between the

bracket 36 and corresponding side frame of the machine. The gear wheels 37 and 38 are driven by pinions 39 mounted on shaft 40 which extends across the machine and is mounted in suitable bearings in the side frames and on the left hand side of the machine is extended through a bearing on the upper end of bracket 36. Splined on the shaft 40 is a clutch member 41 having associated therewith an operating lever 42. This clutch member is adapted to engage a cooperating clutch member 43 fastened to gear 44 which is loosely mounted on the shaft 40. The gear 44 engages a pinion 45 fixed to a shaft 46 mounted in bearings in the bracket 36 and the corresponding side frame 21. Also mounted on the same shaft is a ratchet wheel 47. Loosely mounted upon the shaft 46 between a pinion 45 and ratchet wheel 47 is an arm 48 which carries pawl 49 which engages the teeth of ratchet wheel 47. A holding pawl 50 is mounted on the side frame 21 to prevent reverse rotation of the ratchet wheel.

The automatic feeding mechanism of the present invention is by way of illustration shown in combination with a machine for coating the sheets of material. Only the forward end of the coating machine is shown in the drawings. This portion comprises a frame 51 in which is mounted a shaft 52 adapted to be driven by a sprocket wheel 53 and chain 54 running to the other sprocket wheel, not shown, associated with the driving mechanism of the coating machine. Mounted upon one end of the shaft 52 is a cam 55 adapted to engage a roller 56 on the end of an arm 57 pivoted at 58 to the frame 51 on the coating machine. Pivoted to arm 57 and to arm 48 at 60 is a link 61. To limit the forward travel of arm 57 an adjusting screw 62 is mounted in a bracket 63 attached to the frame of the coating machine. Arm 57 is drawn against the end of adjusting screw 62 by a spring 64.

For the purpose of permitting the table 29 to be lowered in case it is desired to obtain access to the sheets of material, the hand wheel 65 is mounted on shaft 34 inside of frame 36. When the clutch members 41 and 43 are disengaged, gear wheels 37 and 38 and the pinions and rack bars which connect these gears to the sliding frame which supports the table, would be free to turn under the weight of the table and the sheets thereon. To prevent this action from taking place, a brake shoe 66 engaging the hand wheel 65 is provided. This brake shoe is pivoted to the bracket 36 at 67 and its free upper end is by means of a link 68 connected to a lever 69 pivoted at 70 to the extension of the bracket. An arm 71 is attached to the bracket 36 by bolts 72 and this arm is provided near its upper end with spring arm 73 which extends adjacent the lever 42 by

which the clutch member 41 is operated. This spring arm is provided with a lug 74 which engages a lug 75 near the upper end of arm 69 when the clutch lever 42 is in the position to throw the clutch members into engagement with each other. When the clutch lever is thrown so that the clutch members are disengaged, spring arm 73 will be pushed outwardly to disengage the lugs 74 and 75 and lever 69 will be drawn toward the arm 71 by a spring 76 connecting the upper end of the lever and the upper end of this arm. Movement of lever 69 will be communicated through link 68 to the brake shoe 66, thus causing the latter to bear firmly against the hand wheel 65 and prevent any rotation of the gears associated with this hand wheel, and hence will prevent any downward movement of the table upon which the sheets are supported. Whenever the clutch lever is thrown to connect the clutch members together, the brake is released by restoring the lever 69 to its position in engagement with the lugs 74 on the spring arm 73.

The apparatus thus far described is intended for elevating the table 29, upon which the sheets of material are carried, by a step by step mechanism to cause the top of the pile to be brought into position to be removed from the pile. The shaft 52 is continuously driven from the coating machine and the cam 55 engages the roller 56 on the end of arm 57 once during each revolution of shaft 52. The movement imparted to arm 57 will, through the link 61, cause a corresponding movement of the arm 48, and the pawl 49, mounted thereon, will engage the ratchet wheel 47 to rotate the same step by step. This movement of the ratchet wheel will be communicated through shaft 46 and pinion 45 to gear wheel 44, but unless the clutch members 41 and 43 are in engagement the rotation of gear wheel 44 will have no effect in moving the table on which the sheets are supported. If, however, the clutch members 41 and 43 are drawn into engagement by means of hand lever 42, the step by step movement of gear wheel 44 will be communicated to the shaft 40, and the latter will, through the pinions 39, cause the corresponding step by step movement of the gear wheels 37 and 38 which will be imparted to the pinions 32 mounted upon the same stub shafts 33 and 34 as are these gear wheels. The result will be that the rack bars 31 which engage the pinions 32 will be given a step by step movement upward to gradually lift the table 29 upon which the sheets of material are placed. The magnitude of each successive lifting movement of the table may be controlled by the adjusting screw 62 which determines the movement imparted to the ratchet wheel 47 upon each oscillation of the arm 57. The move-

ment imparted to the ratchet 47 is, through the proper proportioning of the gears and pinions of the apparatus, translated into the correct vertical movement of the sheet holding table to cause the latter to advance a distance just sufficient to bring successive sheets into position to be removed. This distance will correspond to the thickness of the sheets which are to be removed from the stack plus such additional movement as may be required to make up for the fact that the sheets may be slightly separated due to impurities or rust upon their surface. By proper calibration of the adjusting screw 62, the lifting action of the apparatus may be accurately adjusted to suit the particular sheets that are being removed.

The mechanism for removing the sheets one at a time from the top of the stack of sheets will now be described. Shaft 52 is provided with a sprocket wheel 77 over which passes a sprocket chain 78 for driving a sprocket wheel 79 connected to a shaft 80 mounted in bearings at the top of side frames 21. Mounted on shaft 80 are two sets of sprocket wheels 81, each pair of sprocket wheels being connected by a sleeve 82. A fixed shaft 83 is mounted at the top of the side frames 21 and this shaft carries sprocket wheels 84 which are driven by chains 85 passing over sprocket wheels 81 on shaft 80. Between each pair of sprocket chains are sheet-advancing members 86, there being two of these sheet-advancing members connected to each pair of sprocket chains.

A fixed shaft 87 is mounted between the side frames 21 and upon this shaft are arms 88 carrying on their outer ends idler sprocket wheels 89. Arms 88 may be retained in any position of adjustment by means of set screws 90. Mounted upon the shaft 87 is an arm 91 connected to the upper end of which at 92 is an arm 93. A lug 94 is pivotally attached to the arm 93 and through this lug passes a screw 95 adapted to be turned by a hand wheel 96. The lower end of the screw engages the upper end of a housing 97. A link 98 is pivoted to the housing 97 at 99 and at 100 is pivoted to an arm 101 connected to the shaft 87. A lever 102 is pivoted at 103 between the sides of the housing 97 and the lower end of this lever is bifurcated as at 104 to engage a pin 105 carried by the upper end of a member 106 and retained in place in slots 107 in the sides of the housing. The lower end of each side of housing 97 is provided with a slot 108 to receive a pin 109 extending through the member 106.

Attached to shaft 87 is a bracket 110 upon which is mounted a valve member 111 by bolts 112. At the upper end of the valve member is a bracket 113 to the upper end of which is pivoted an arm 114. Operated by

the arm 114 is a piston 115 which controls the air supply for nozzle 116 through a pipe 117. The air is supplied to the valve member by a pipe 118 having a controlling valve 119. The piston 115 which controls the air supply is provided with a port 120 which, when in the position shown in Fig. 6, provides a communication between pipes 117 and 118. Also pivoted on arm 113 is a second arm 121 which operates a piston 122 adapted to control through a pipe 123 a suction cup 124. The valve member 111 has a port 125 opening into a pipe 126 which leads to a vacuum pump and has a controlling valve 127. The other end of port 125 opens beneath the piston 122 and when the piston is elevated permits communication between pipes 123 and 126. Piston 122 is provided with a port 128 opening into the atmosphere near the top of the piston, and adapted when the piston is in its depressed position to communicate with the pipe 123 to permit air to enter this pipe and hence relieve the vacuum in the suction cup 124. The suction cup 124 is mounted on member 106 by means of an adjusting block 129 by which the position of the cup with relation to the member 106 may be determined.

The innermost sprocket wheels 84 of each pair are connected to a sleeve 130, as shown most clearly in Fig. 13. This sleeve carries four cams, of which cam 131 engages a roller 132 on the end of arm 93. Cam 133 engages roller 134 mounted on the end of lever 102, as shown most clearly in Figs. 7 and 8. Cam 135 engages the outer end of arm 121 which controls the piston 122 of the valve mechanism, spring 121' being provided to hold the arm 121 against the cam. Cam 136 engages the outer end of arm 114 which controls the piston 115 of the valve mechanism, and a spring 114' holds the end of the arm against the cam.

Cams 137 engage rollers 138 mounted on the ends of arms 139 on each side of the machine. As shown at the bottom of Fig. 12, the arm 139 on one side of the machine is connected to the upper end of a shaft 140 supported in a bearing 141 on a bracket extending inwardly from the corresponding side frame 21. Connected to the bottom of shaft 140 is an arm 142 having at its free end a roller 143 adapted to engage and align the sheets of material. The arm 139 is extended beyond the shaft 140 to form a projection 144 which is normally held against the end of an adjusting screw 145 mounted in a lug 146 on the bracket which supports bearing 141, the projection being held against this screw by a spring 147 connected between arm 142 and the side frame. On the other side of the machine the corresponding arm 139 is mounted loosely near the upper end of the shaft 140 but the arm 142 carrying a roller 143 is fixed upon the

lower end of the shaft precisely as at the other side of the machine. The shaft 140 is mounted in a bearing upon a bracket 141 extending inwardly from the side frame and this bracket is provided with a lug 146 within which is fitted a screw 145 adapted to be engaged by the lug 144 projecting from the arm 139. On this side of the machine, however, the upper end of the shaft 140 carries a collar 148 having a projection 149 which is engaged by the end of a spring 150, the other end of which is retained within a hollow lug 151 attached to the side of arm 139. On this side of the machine a lug 144 carries an adjusting screw 152 adapted to bear against a face on lug 149. There is thus provided between the arms 139 and 142 on one side of the machine a yielding connection for the purpose of permitting a slight movement between these arms in case there is any variation in the width of the sheet which is held between the roller 143 on this side of the machine and the roller 143 on the other side of the machine, the latter roller being rigidly connected through the arms 142 and 139 to the roller which engages the corresponding cam face.

Between each pair of sprocket wheels 84 there is fixed to the shaft 83 a spider 153, as shown most clearly in Fig. 4. These spiders serve as supports for guideways 154 which are also supported by spiders 155 attached to shaft 87. These guideways are carried about the shaft 80 and beneath this shaft are formed with a depression 156. These guideways are engaged by rollers 157 mounted on the ends of sheet-advancing members 86 which, as previously described, are carried between each pair of sprocket chains 85. To prevent these chains from sagging during their travel beneath the sprocket wheels, guides 158 are suspended from U-shaped brackets 159 depending from the lower portion of each guideway 154. The rollers 157 of the sheet-advancing members are held against the guideways 154 by means of springs 160 coiled about the shaft upon which the sheet-advancing members are supported between the two sprocket chains, one end of the spring being fastened to the arm 161 which carries the roller 157 and the other end being fastened to the arm 162 which carries the finger portion of the sheet-advancing member 86, thereby forming a yielding connection between the two parts of this member.

For the purpose of preventing more than one sheet being removed at a time, there is provided a stop mechanism which positively engages the other sheets. This mechanism appears most clearly in Fig. 4 where it is shown attached to the end of the coating machine to which the sheets are to be fed. A cam 163 is mounted upon shaft 52 and engages an L-shaped arm 164 supported in

a bracket 165 depending from the apron 166 which leads to the rollers 167 of the coating machine. Mounted in an inclined guide 165' in the bracket 165 is a rod 168 connected at its lower end by a pin 169 to a slot 170 at the end of the L-shaped arm 164. A spring 171 is attached at one end to the bracket as at 172, and its lower end is connected to the L-shaped arm 164 and thereby tends to hold the latter against the face of cam 163. The upper end of rod 168 carries a stop 173 of sufficient depth to engage a number of the sheets lying immediately below the one that is to be removed.

Assuming that a stack of sheets of material have been placed upon the table 29 and that the latter has been elevated so that the topmost sheet is in position to be removed, and that the shaft 52 is being driven from the driving mechanism of the coating machine, the sprocket chain 78 will, through the sprocket wheel 79, cause the shaft 80 to be continuously rotated. The latter shaft will, through the sprocket wheels 81 and chains 85, cause rotation of the sprocket wheels 84 upon the shaft 83. At the beginning of the lifting operation, the cam 132, which is mounted upon the sleeve 130, occupies a position substantially as shown in Fig. 7, so that the suction member 124 is depressed until it engages the upper face of the topmost sheet at a point near the center of the rear edge of the sheet. At this time the cam 135 on the sleeve 130 occupies such a position that arm 121 has lifted the piston 122 of the valve mechanism into the position shown in Fig. 11, thus permitting communication between the pipe 123 leading to the suction member 124 and the pipe 126 leading to the vacuum pump. Spring 121' holds arm 121 against the face of the cam and assists in drawing this arm down when it passes off of the raised portion of the cam. The point at which the suction member 124 engages the upper sheet is determined by using different widths of adjusting block 129. Also, as appears most clearly from Fig. 7, the cam 133 is in such a position with respect to the roller 134 on arm 102 that the latter permits the member 106 on which the suction member is supported to occupy such a position that the bottom face of the suction member is parallel to the face of the sheet. Further rotation of the cam 133 as the sleeve 130 upon which it is mounted is rotated will cause the depression in the cam to come into position to permit the roller 134 to be drawn into this depression by means of a spring 174 which is connected to the lower end of lever 102 at one end and at the other end to a stud projecting from link 98 near the pivot 100. The movement thus imparted to lever 102 will through the pin and slot connection at the lower end of this lever swing or tilt the mem-

ber 106 which carries the suction member into the position shown in Fig. 8, thus raising the suction member slightly and bending the sheet, as shown most clearly in this figure. After the suction member has gripped the edge of the sheet and the preliminary bending has been produced, the cam 131 will through the roller 132 on the end of arm 93 gradually lift this arm into the position shown in Fig. 6, carrying with it the suction member which throughout this stage of the operation is gripping the upper face of the sheet.

At this time in the operation of the apparatus, the cam 136, which controls the valve arm 114, has come into such a position as to permit this arm to drop under its own weight and the effect of spring 114', to carry the piston operated thereby into such a position that communication is established between the compressed air pipe 118 and the pipe 117 which leads to the nozzle 116 to direct a blast of air underneath the lifted top sheet. This air blast will tend to separate this sheet from the one immediately beneath, and after separating the two sheets, will tend to support the upper sheet upon the air cushion which is thus produced between the sheets. At about the same time that the air blast is directed under the sheet one of the sheet-advancing members 86 has come into position beneath the rear edge of the sheet, as shown in Fig. 6. An instant later the cam 135 upon which the arm 121 of the suction valve is supported has come into such a position that its cutaway portion permits this arm to suddenly drop, thus cutting off the suction to the suction member and putting the port 128 in the piston 122 into communication with the pipe 123 leading to the suction member. This is for the purpose of restoring the atmospheric pressure to the interior of the suction member to prevent it from retaining the sheet by any vacuum which might be left after the suction has been cut off. After the top sheet has been raised into the position shown in Fig. 6, the cams 137 connected to the outer sprocket wheels 84 will have come into such a position as to cause the arms 139 and the arms 142, actuated thereby, to be moved so that the rollers 143 engage the side edges of the sheet, thus preventing the latter from being displaced sidewise as it is being removed from the top of the pile, and further insuring that it is given the proper alinement to be carried into the coating machine. The continued travel of the sprocket chains 85 will carry the sheet-advancing members and hence the sheet which is engaged thereby off of the top of the stack of sheets, and after the sheet has traveled a short distance, the cam 135 which controls valve arm 114, will have come into such a position as to cause the valve piston 115 to cut off the supply of compressed air

to the nozzle 116. At about the same time the cam 163 on shaft 52 of the coating machine will have passed out of engagement with the end of the L-shaped arm 164, thus permitting the spring 171 to draw the rod 170 into such a position that the stop 173 will engage the front edge of a few of the sheets immediately below the top sheet and thus obviate any tendency of these other sheets to be carried along by the top sheet. Before the stop 173 has come into its position against the forward edge of the sheets, the upper sheet will have been carried forward a sufficient distance to prevent it from being engaged by this stop which, if it engages the upper sheet at all, will engage it upon the under face and not interfere with its forward travel. After the top sheet has been pushed forward by the sheet-advancing member until it occupies substantially the position indicated by the dotted lines in Fig. 6, the forward edge of the sheet will be engaged by the rollers 167 of the coating machine, thus completing the removal of the sheet from the top of the stack. At the same time roller 157 on the sheet-advancing member 86 will pass into depression 156 of guideway 154, thus causing this member to be thrown out of engagement with the sheet. Shortly thereafter, the cam 55 on shaft 52 will come into engagement with the roller 56 on the end of arm 57, thus gradually moving this arm and with it the link 61 which connects the arm to the pawl 49 which turns ratchet wheel 47. As previously described, the movement imparted to the ratchet wheel 47 will be just sufficient when transmitted through the train of gears 45, 44, 39, 38, 32 and rack bar 31, to elevate the table the right amount to bring the stack of sheets into such a position that the upper one will be engaged by the suction member, and the operation of removing the sheets will be then repeated.

Figs. 14 and 15 illustrate a modification of the invention in which the sheets are adapted to be gripped by electromagnetic means instead of the pneumatic means of the other figures. A shaft 200 is mounted between the side frames of the apparatus and is adapted to be driven by the sprocket chain running to the coating machine or other driving source precisely as shown in the former figures. Upon the shaft 200 is a pair of sprocket wheels 201 over which pass sprocket chains 202 traveling over sprocket wheels 203 on a fixed shaft 204 at the other side of the side frames. The sprocket chains 202 carry sheet-advancing members 205 similar to the corresponding members of the other modification. These sheet-advancing members engage on guideway 206 and the sprocket chain is supported on the guide 207 which is carried by brackets 208 depending from the guideway 206.

Loosely mounted upon shaft 200 is an arm 209 and a second arm 210 extending in the opposite direction and bifurcated at its outer ends to receive a U-shaped bracket 211 which carries a pair of electromagnets 212. The inner end of arm 210 is provided with a projection 213 and the arm 209 is provided with a lug 214 through which is threaded an adjusting screw 215. A fixed shaft 216 is mounted between the side frames and upon which shaft is loosely mounted an arm 217 having a bifurcated outer end to receive a U-shaped bracket 218 which carries a pair of electromagnets 219. An arm 220 is loosely mounted upon a pivot 221 attached to the arm 217 and the arm 220 is provided with an extension 222 at the outer end of which is an adjusting screw 223 which engages the upper face of arm 217. A bracket 224 is adjustably mounted upon the shaft 216 by means of a set screw 225. This bracket carries a valve mechanism 226 which comprises a piston 227 provided with a port 228 by which communication may be established between a pipe 229 leading to a source of compressed air and a pipe 230 leading to the nozzle 231, these features of the apparatus being substantially similar to the corresponding parts of the modification described above. A bracket 232 projects outwardly and upwardly from the valve mechanism and carries at its other end an arm 233 pivoted at 234, and this arm actuates the piston 227 of the valve mechanism.

Surrounding the shaft 204 and connected at its ends to the sprocket wheels 203 is a sleeve 235, and upon one end of this sleeve adjacent the corresponding sprocket wheel is a cam 236 which is engaged by a roller 237 on the end of arm 209. A second cam 238 is also mounted upon the sleeve 235 and this cam engages the arm 233 by which the valve mechanism is controlled. On the other end of the sleeve 235 and adjacent the corresponding sprocket wheel is a cam 239 which engages a roller 240 on the end of arm 220. An electric switch 241 is mounted upon a bracket 242 attached at its lower end to the guideway 207. The contacts of the switch control the circuit of the electromagnets 212 and 219 and for this purpose are provided with a plunger 243 adapted to be engaged by a cam 244 mounted upon the sleeve 235. As in the case of the modification first described, a stop 245 adapted to engage the forward edges of all of the sheets except the top one is provided, and this stop may be actuated by mechanism similar to that shown in the former figures.

It is intended that mechanism for progressively lifting the stack of sheets after each one has been removed shall be used in connection with the feeding mechanism shown in Figs. 14 and 15, and this lifting mechanism may be in all respects like that used with

the former modification of the feeding mechanism. Assuming that the stack of sheets is in position upon the table of the apparatus, the cams 236 and 239 driven by sprocket chains 202 from the shaft 200, which is driven from the coating machine, will come into position to lift the arm 209 and thus allow the arm 210 carrying the electromagnets 212 to be dropped until the pole pieces of these magnets engage the upper face of the top sheet. At the same time the cam 239 will have come into such a position that the arm 220 will be lowered, thus allowing the arm 217 and the electromagnet 219 carried thereby to drop into engagement with the face of the top sheet at the other end of the sheet. Also, at the same time, the cam 244 has actuated the plunger 243 of the switch 241 to cause the latter to establish the circuit of all of the electromagnets. The energized magnets now take hold of the top sheet and as the sleeve 235 continues its rotation the arm 209 will be lowered under the action of spring 246 and the lowering of this arm will through the screw 215 engaging the projection 213 cause the arm 210 to be lifted, carrying with it the magnets 212 and also the forward edge of the sheet. At the same time the cam 239 will lift the arm 220 against the effect of spring 247, and this arm acting through the projection 222 and screw 223 will cause the arm 217 to be lifted, thus raising the electromagnets 219 and the rear edge of the sheet which is attracted to the magnets. As the electromagnets 219 approach the position shown in Fig. 14, a pair of the sheet-advancing members 205 have come into position to engage the rear edge of the sheet. After this has occurred, the cam 244 has come into such a position as to permit the switch plunger 243 to move outwardly to open the switch contacts, it being understood that this plunger is provided with a spring (not shown) for causing a quick break of the contacts as soon as the upper face of the cam 244 has passed out of engagement with the switch plunger. If the magnets are not deenergized until after the sheet-advancing members have begun to give the sheet a forward movement, the magnets will swing about the pivots on which they are suspended from their supporting arms, but the mechanism should preferably be so arranged that these magnets will be deenergized at substantially the instant that the sheet-advancing members begin to produce a forward travel of the sheet. At about the time that these members engage the rear edge of the sheet, the cam 238 has come into such a position that it actuates the arm 233 to establish communication from the compressed air pipe 229 to the pipe 230 leading to the nozzle 231, thus permitting a blast of air to be directed against the

lower face of the top sheet which tends to separate this sheet from the one immediately beneath, and by the air cushion thus produced tending to assist the removal of the top sheet. As in the case of the modification shown in the other figures, the stop 245 should be arranged to come into engagement with the edges of the other sheets just after the top sheet has taken its forward travel.

I claim:

1. In sheet feeding mechanism, the combination of means for bending the entire rear edge portion of the topmost sheet of a stack of sheets above the plane of the sheet, means for lifting said first-named means to elevate the bent rear edge of the topmost sheet, together with the adjacent portions of the sheet, above the underlying sheet, means for supplying a separating fluid beneath the elevated part of the topmost sheet, means engaging the rear edge of the topmost sheet when in elevated position to carry the sheet off of the top of the stack of sheets, and means for operating the bending means, the lifting means, the fluid means, and the carrying means in timed relation to each other.

2. In sheet feeding mechanism, the combination of a suction member adapted to engage the rear edge of the topmost sheet of a stack of sheets, means for actuating said suction member to produce a preliminary bending of the rear edge of the topmost sheet and for thereafter lifting the rear part of said sheet, means for supplying a separating fluid beneath the lifted part of the topmost sheet, means engaging the rear edge of the topmost sheet when in lifted position to carry the sheet off of the top of the stack of sheets and means for operating all of said means in timed relation.

3. In sheet feeding mechanism, the combination of a supporting member, a member pivotally mounted on the supporting member and adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, means on said supporting member for tilting said sheet-engaging member, means independent of said supporting member for controlling said tilting means, means independent of said supporting member but operatively connected thereto for raising the rear part of the topmost sheet when said sheet-engaging member is in engagement with the sheet, a plurality of continuous traveling members, sheet-advancing members associated with said traveling members and adapted to be brought into engagement with the lifted rear edge of the topmost sheet to carry said sheet forwardly off of the top of the stack of sheets, and means for supplying fluid beneath the lifted rear edge of the topmost sheet to aid in separating and removing the sheet.

4. In sheet feeding mechanism, the combination of a supporting member, a member pivotally mounted on the supporting member and adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, means for controlling said sheet engaging means, means for lifting the supporting member to raise the rear edge of the topmost sheet when said sheet engaging means is in engagement with the sheet, a plurality of continuous traveling members, sheet-advancing members associated with said traveling members and adapted to be brought into engagement with the lifted rear edge of the topmost sheet to carry said sheet forwardly off of the top of the stack of sheets, means for supplying fluid beneath the lifted rear edge of the topmost sheet to aid in separating and removing the sheet, and means for swinging said sheet-advancing members out of engagement with the rear edge of the topmost sheet when said sheet has been partly removed.

5. In sheet feeding mechanism, the combination of a supporting member, a member pivotally mounted on the supporting member and adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, means on said supporting member for tilting said sheet-engaging member, means independent of said supporting member for controlling said tilting means, and means independent of said supporting member but operatively connected thereto for raising the rear part of the topmost sheet when said sheet-engaging member is in engagement with the sheet.

6. In sheet feeding mechanism, the combination of a shaft, a suction member adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, means for tilting the suction member about an axis lying immediately above the topmost sheet, slightly in advance of the rear edge thereof, to produce a preliminary bending of the rear edge portion of the sheet, means for lifting the suction member to elevate the bent rear edge of the topmost sheet, together with the adjacent portions of the sheet, above the underlying sheet, means for supplying a blast of air between the lifted part of the topmost sheet, means for controlling the air supply means, means for engaging the rear edge of the topmost sheet after it has been lifted, means for moving the sheet engaging means, and means associated with said shaft for operating the tilting means, the lifting means, the controlling means, and the moving means in timed relation to each other.

7. In sheet feeding mechanism, the combination of a suction member adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, a valve for controlling the operation of the

suction member, means for actuating said suction member to produce a preliminary bending of the rear edge of the topmost sheet and for thereafter lifting the rear part of said sheet, means for supplying fluid beneath the lifted part of the topmost sheet, a valve for controlling the fluid supplying means and means for operating both of said valves and said suction member operating means in timed relation.

8. In sheet feeding mechanism, the combination of a shaft, a suction member adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, a cam on the shaft for operating the suction member to produce a preliminary bending of the rear edge of the topmost sheet, a second cam on the shaft for raising the suction member to lift the rear part of the topmost sheet, a valve for controlling the suction member, a cam on the shaft for actuating the valve, means for supplying fluid beneath the lifted rear part of the topmost sheet, a valve for controlling said fluid-supplying means, a cam on the shaft for operating the last named valve, and means for driving said shaft to cause said cams to operate their respective mechanisms in timed relation to each other.

9. In sheet feeding mechanism, the combination of a shaft, means for initially separating the entire rear edge portion of the topmost sheet from the underlying sheet, means for thereafter lifting said first-named means to elevate the entire rear portion of the topmost sheet, means for supplying fluid beneath the lifted rear portion of the topmost sheet, means for controlling the fluid supplying means, means for engaging the rear edge of the topmost sheet to remove it from the stack of sheets, and means associated with the shaft for actuating the separating means, the lifting means, the controlling means, and the sheet engaging means in timed relation to each other.

10. In sheet feeding mechanism, the combination of means for engaging the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, means for tilting said engaging means to bend the entire rear edge portion of the topmost sheet above the plane of the sheet, means for thereafter lifting the engaging means to lift the entire rear portion of the topmost sheet, sheet advancing means for engaging the rear edge of the topmost sheet after it has been lifted, and means for operating the tilting means, the lifting means and the sheet advancing means in time relation to each other.

11. In sheet feeding mechanism, the combination of means for lifting the rear part of the topmost sheet of a stack of sheets, means for supplying fluid beneath the lifted rear part of the topmost sheet, means adapted to engage the lifted rear part of the top-

most sheet to remove the sheet after its rear part has been lifted, and means for operating the lifting means, the air supplying means and the removing means in timed relation.

12. In sheet feeding mechanism, the combination of a shaft, means for lifting the rear part of the topmost sheet of a stack of sheets, sheet-advancing means adapted to engage the rear edge of the topmost sheet when in lifted position to carry the same off of the stack of sheets, an inclined guide adjacent the forward end of the stack of sheets, stop mechanism slidably mounted in the guide, means operatively connected to said shaft for operating said lifting means, means operatively connected to said shaft for causing the sheet-advancing means to engage the rear edge of the topmost sheet after the same has been raised, and means operatively connected to said shaft for bringing the upper end of the stop mechanism into engagement with the front edges of sheets lying beneath the topmost sheet after the forward movement of said sheet has begun.

13. The method of removing sheets successively from the top of a stack of sheets which consists in applying a suction effect to the upper surface of the topmost sheet near its rear edge, producing by the suction effect a preliminary bending of the rear edge of the topmost sheet, raising the rear part of the topmost sheet by means of the suction effect, pushing the topmost sheet forwardly by a force applied against the rear edge of the sheet, cutting off the suction effect when the forward movement of said sheet begins, and supplying fluid beneath the lifted rear part of the topmost sheet to aid in separating the said sheet from the adjacent sheet.

14. In sheet feeding mechanism, the combination of means for lifting the rear edge of the topmost sheet of a stack of sheets, means for supplying fluid beneath the lifted rear edge of the topmost sheet, means adapted to engage the lifted rear edge of the topmost sheet to remove the sheet from off of the stack of sheets, movable stop mechanism adapted to be brought into engagement with the forward edges of sheets lying beneath the topmost sheet while said topmost sheet is being removed and means for actuating said lifting means, said fluid supply means, said sheet removing means and said stop mechanism in timed relation.

15. In sheet feeding mechanism, the combination of an arm, a supporting member pivotally attached to the arm, a suction member pivotally mounted at the lower end of the supporting member and adapted to engage the upper face of the topmost sheet of a stack of sheets near the rear edge thereof, a valve for controlling the suction member,

means mounted on the supporting member for tilting said suction member to bend the rear edge of the topmost sheet, means independent of said supporting member for controlling said tilting means, means independent of the supporting member for lifting the arm with the supporting member and suction member to raise the rear part of the topmost sheet, and means for operating said valve, said means for controlling the tilting means and said arm-lifting means in timed relation to each other.

16. In sheet feeding mechanism, the combination of a supporting member, a suction member pivotally mounted at the lower end of the supporting member and adapted to engage the upper face of the topmost sheet of a stack of sheets, a valve for controlling the suction member, means for lifting the supporting member to raise the rear edge of the topmost sheet when the suction member is in engagement therewith, a plurality of sprocket wheels, sprocket chains passing over said wheels, sheet-advancing members pivotally attached to the sprocket chains and adapted to be brought into engagement with the lifted rear edge of the topmost sheet to carry said sheet forwardly, guiding members cooperating with one end of each sheet-

advancing member and provided with depressed portions adapted to cause the sheet-advancing members to be swung out of engagement with the topmost sheet after the latter has been partly removed from the top of the stack of sheets, means for driving the sprocket wheels and means associated with said driving means for controlling in timed relation said valve and said means for lifting the supporting member.

17. In sheet feeding mechanism, the combination of a shaft, an arm, a depending member adjustably attached to the arm, a suction member pivotally mounted on the lower end of the depending member and adapted to engage the topmost sheet of a stack of sheets near its rear edge, a lever on the depending member operatively connected to the suction member, a cam on the shaft engaging the lever for tilting the suction member to produce a preliminary bending of the rear edge of the sheet, and a second cam on the shaft for lifting the arm and the depending and suction members to raise the rear portion of the sheet after the preliminary bending has been effected.

In testimony whereof I affix my signature.

FREDERICK M. CONRAN.