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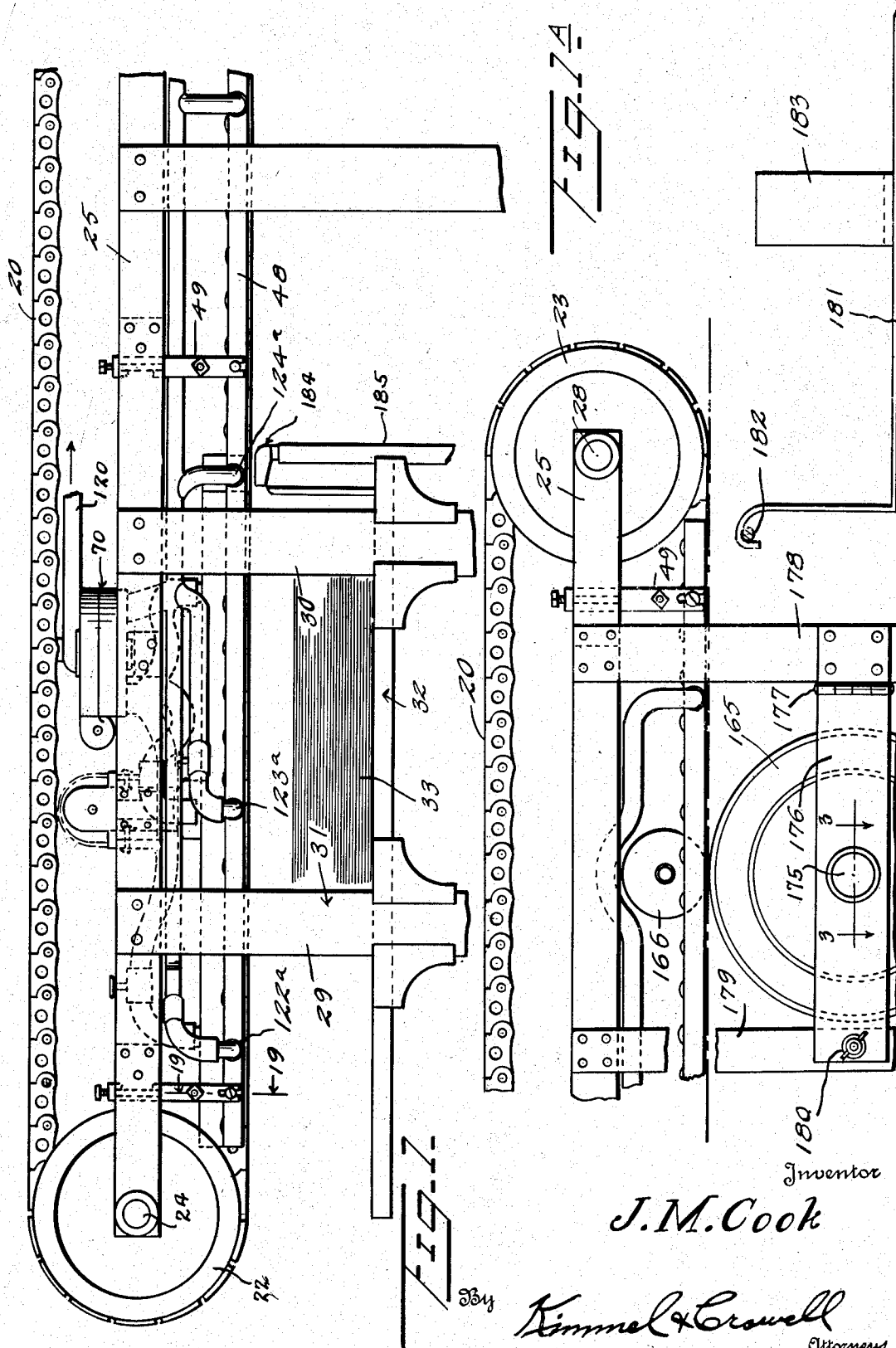
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2,274,590

SUCTION CONVEYING OR FEEDING APPARATUS

Filed Nov. 4, 1940

5 Sheets-Sheet 1



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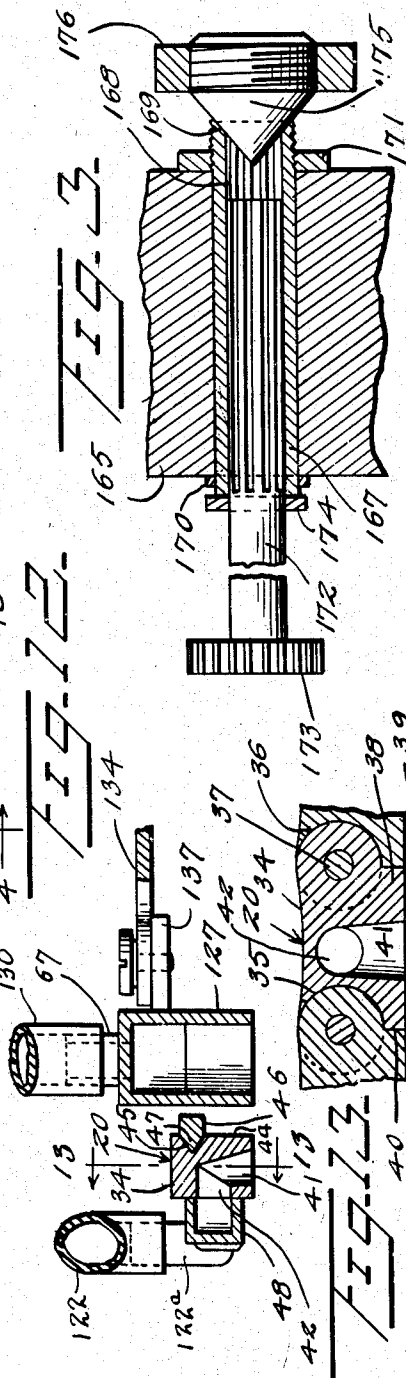
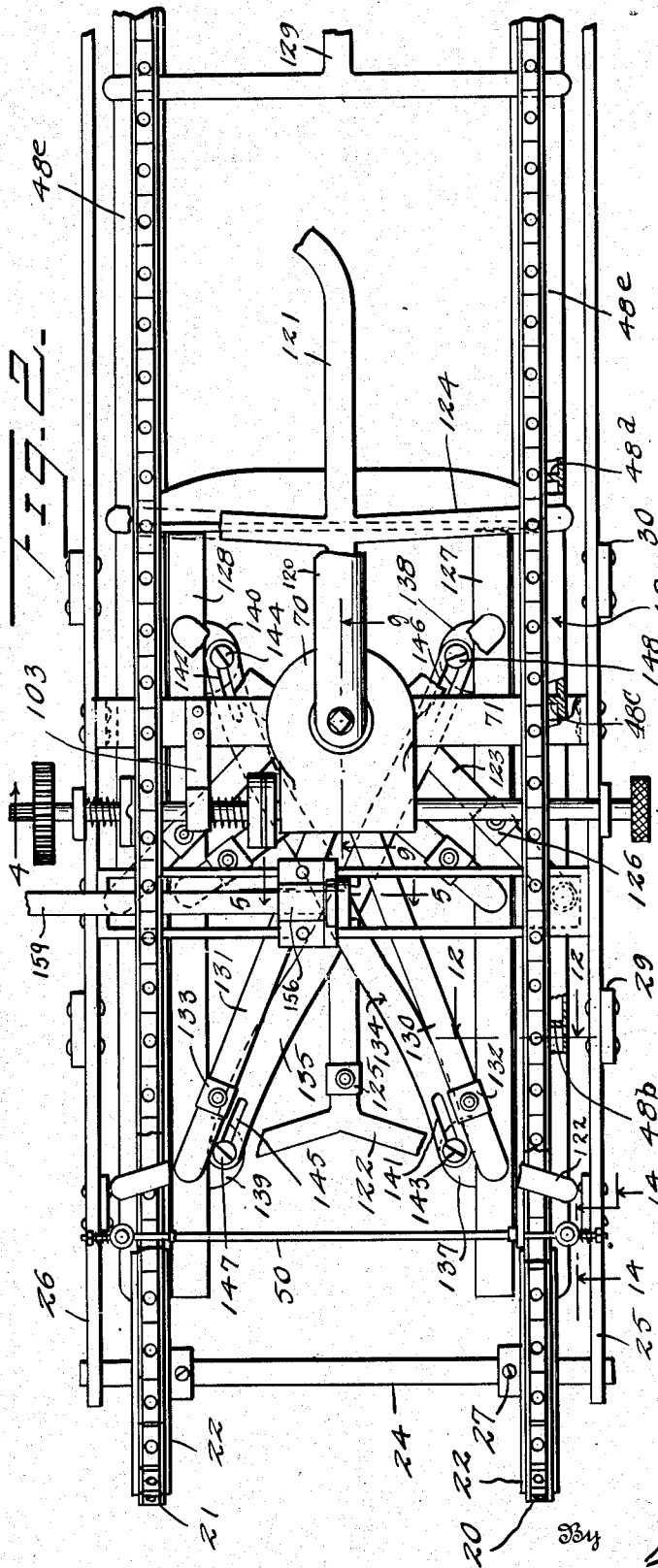
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SUCTION CONVEYING OR FEEDING APPARATUS

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5 Sheets-Sheet 2



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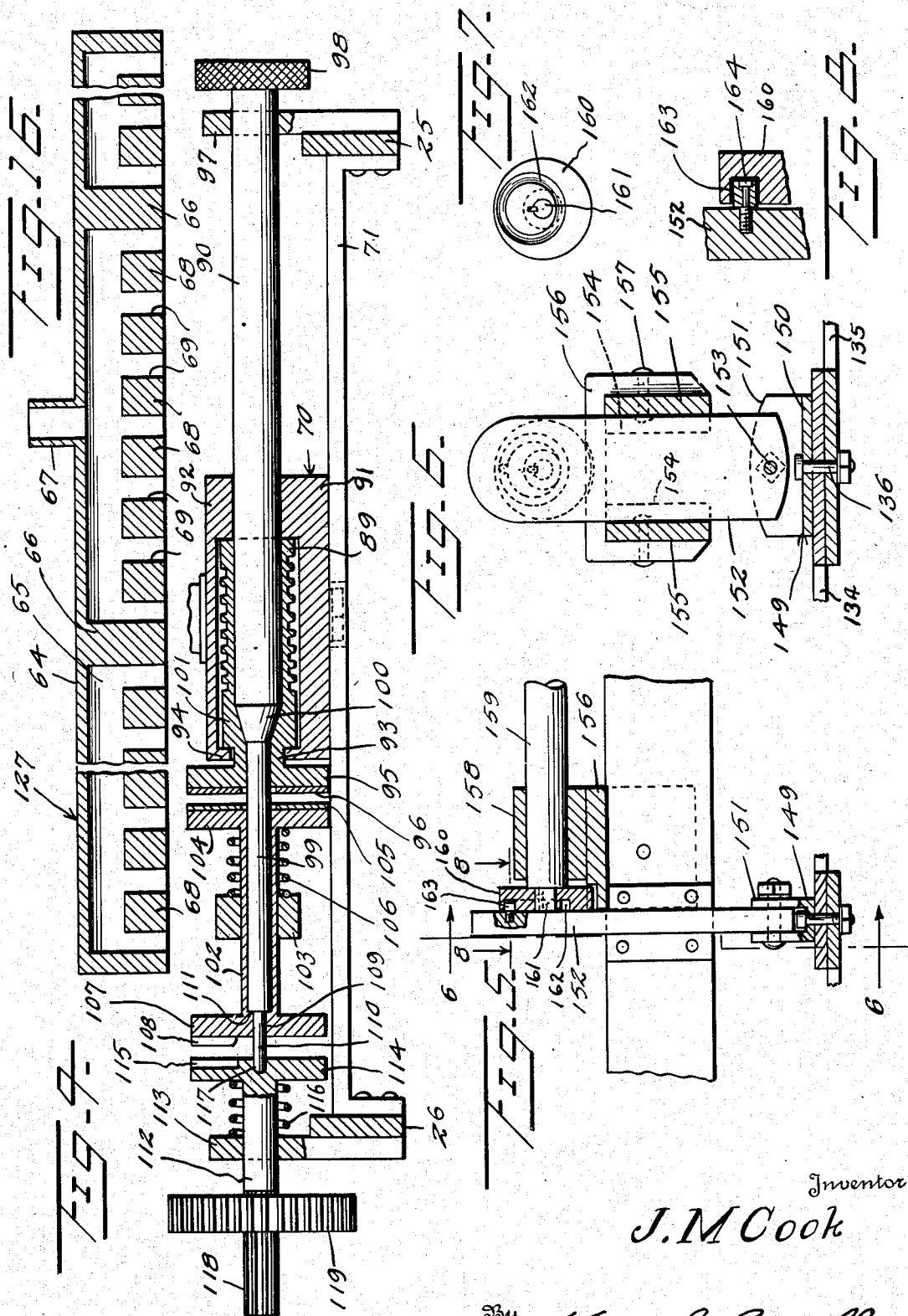
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SUCTION CONVEYING OR FEEDING APPARATUS

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5 Sheets-Sheet 3



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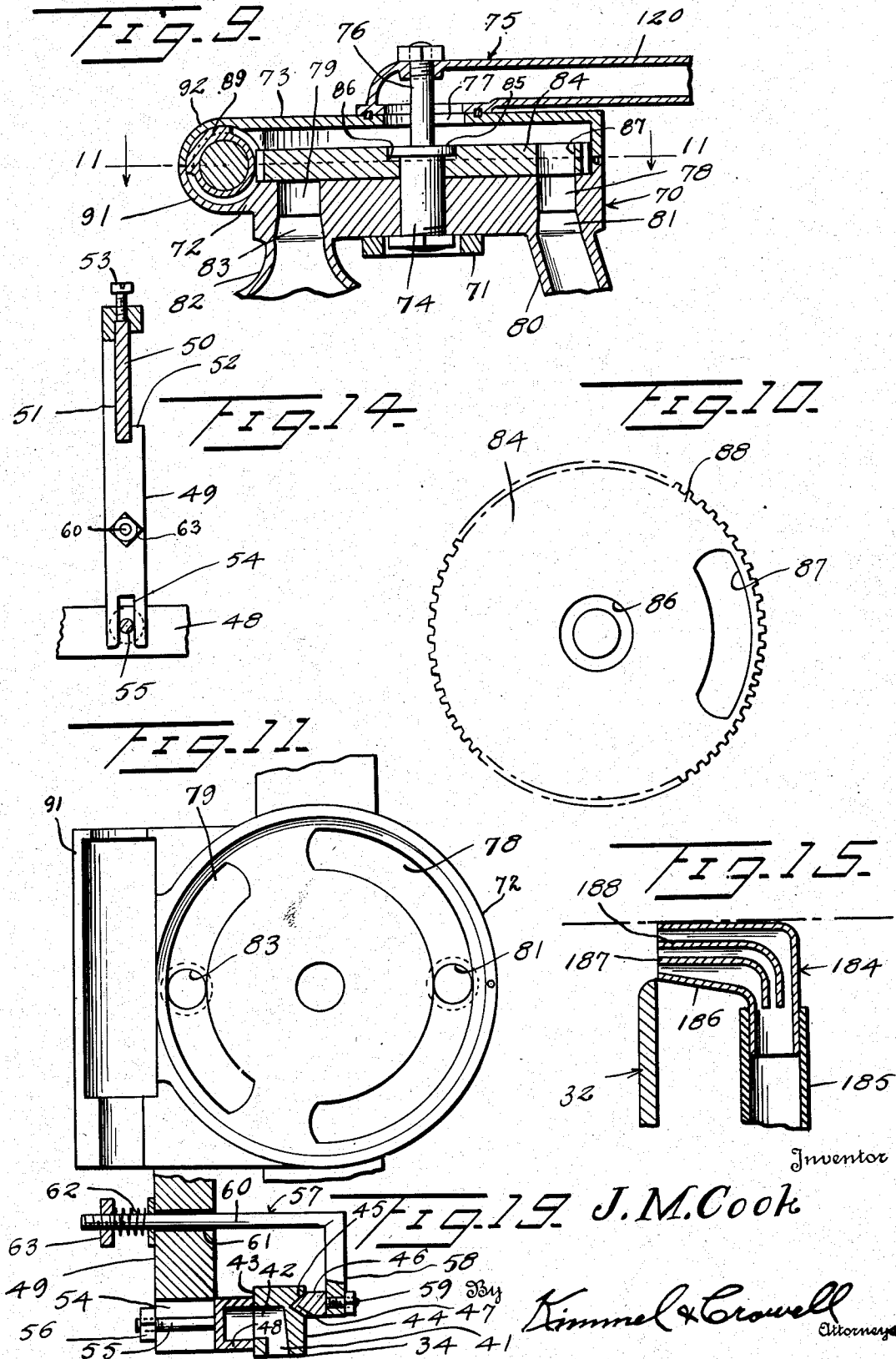
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SUCTION CONVEYING OR FEEDING APPARATUS

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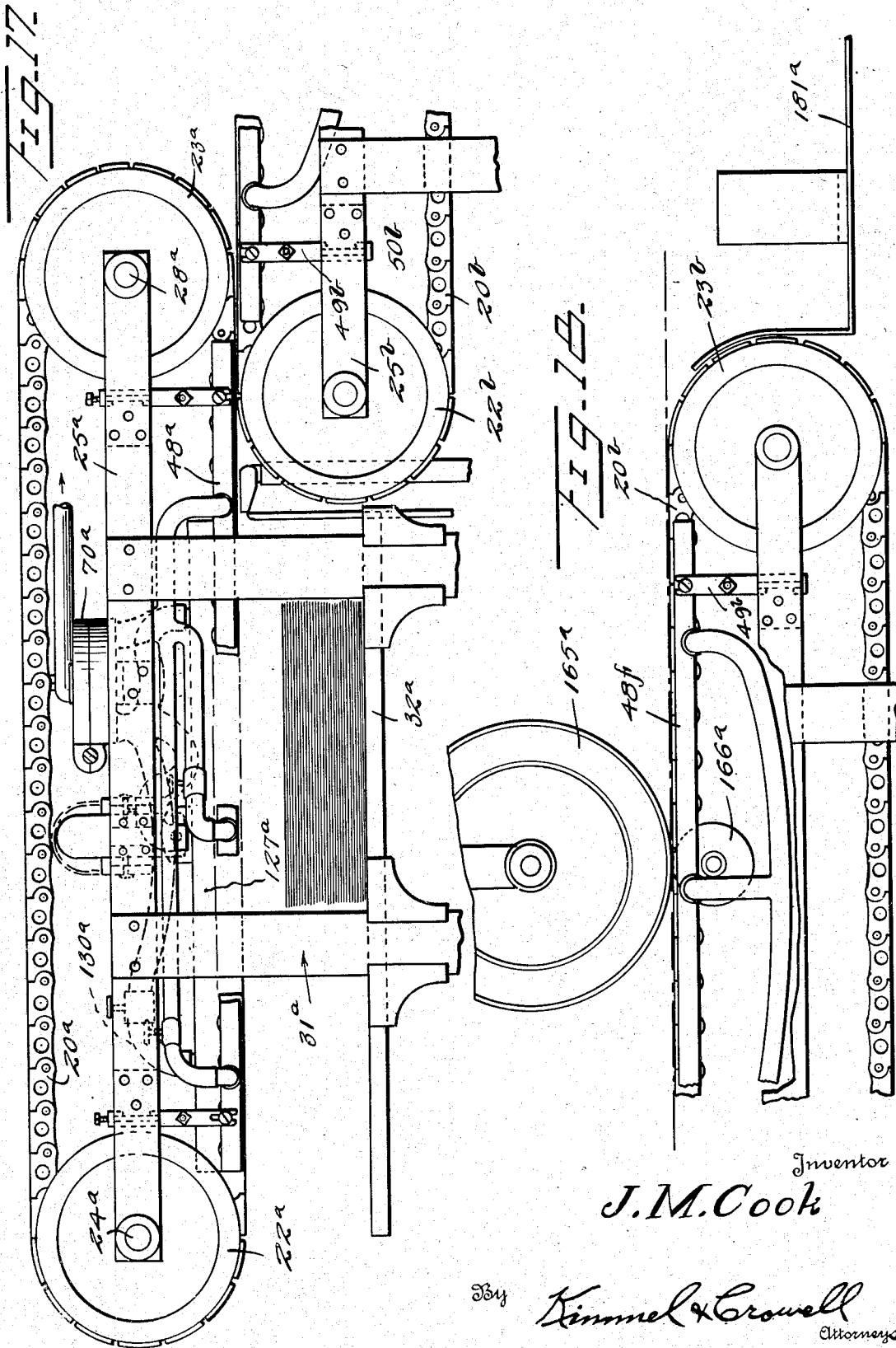
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SUCTION CONVEYING OR FEEDING APPARATUS

Filed Nov. 4, 1940

5 Sheets-Sheet 5



UNITED STATES PATENT OFFICE

2,274,590

SUCTION CONVEYING OR FEEDING
APPARATUS

John Mason Cook, Arlington, Va.

Application November 4, 1940, Serial No. 364,312

28 Claims. (Cl. 271-5)

This invention relates to improvements in feeding mechanisms for duplicating machines, presses and the like.

An object of this invention is to provide an improved feeding means for a duplicating machine, a press or other similar apparatus which operates through a vacuum for feeding the paper through the machine and releases the paper after the proper imprint has been made thereupon.

Another object of this invention is to provide a feeding mechanism of this kind in the form of an endless feeding mechanism which at one point is subjected to a suction force so as to initially lift a single sheet of paper from a feeding table, release the sheet to an endless carrier, the carrier being also subjected to a suction force to thereby hold the paper in a position for engagement with the impression means and finally cut off the suction force so that the paper will be automatically released from the endless carrier by atmospheric pressure acting on the sheet.

A further object of this invention is to provide in a feeding mechanism of this kind, a pair of chain devices which have their links so formed that the links may be subjected to a vacuum so as to hold a sheet of paper tightly against the links in order that the paper may be moved with the links through the machine.

A still further object of this invention is to provide in a device of this kind an improved means for preventing the lifting of more than one sheet of paper.

A further object of this invention is to provide a feeding mechanism of this kind which may be used as an attachment for a duplicating or mimeographing machine which is so constructed as to provide a continuous movement of the material through the machine.

A further object of this invention is to provide a feed mechanism of this kind which is so constructed that it may be used with various types of impression rollers, the device being of such construction that the impression roller may be positioned to engage the paper either from above or below as the paper is being moved through the machine.

A further object of this invention is to provide in a vacuum feeding mechanism of this kind, means for periodically cutting off the vacuum to the feeding mechanism.

A further object of this invention is to provide a vacuum feeding mechanism of this kind which is so constructed that it may be readily adjusted to accommodate different widths of paper.

A further object of this invention is to provide an endless carrier in the form of a chain which is formed with suction openings and a stationary shoe which is adapted to confront the chain at one side thereof so as to hold the paper against the chain in order that the paper may move with the chain.

A still further object of this invention is to provide in a device of this kind, an improved means for holding the suction shoe or manifold in contact with one side of the chain so that the suction shoe may be maintained in operative engagement with the chain during the movement of the chain.

A further object of this invention is to provide in a device of this kind, an improved suction operated sheet lifting device for lifting a sheet of paper from a supply stack and delivering the sheet to the suction carrier.

To the foregoing objects and to others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and illustrated in the accompanying drawings wherein are shown embodiments of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a fragmentary side elevation of a duplicating machine having a conveying means constructed according to an embodiment of this invention.

Figure 1A is a continuation of one end of Figure 1.

Figure 2 is a fragmentary top plan of the device.

Figure 3 is a fragmentary sectional view taken on the line 3-3 of Figure 1A.

Figure 4 is a sectional view taken on the line 4-4 of Figure 2.

Figure 5 is a sectional view taken on the line 5-5 of Figure 2.

Figure 6 is a sectional view taken on the line 6-6 of Figure 5.

Figure 7 is a front elevation of the sheet lifting cam.

Figure 8 is a fragmentary sectional view taken on the line 8-8 of Figure 5.

Figure 9 is a sectional view taken on the line 9-9 of Figure 2.

Figure 10 is a plan view of the suction controlling valve.

Figure 11 is a sectional view taken on the line 11—11 of Figure 9 with the valve removed.

Figure 12 is a sectional view taken on the line 12—12 of Figure 2.

Figure 13 is a sectional view taken on the line 13—13 of Figure 12.

Figure 14 is a fragmentary sectional view taken on the line 14—14 of Figure 2.

Figure 15 is a fragmentary vertical section through the air nozzle associated with the sheet lifting means.

Figure 16 is a longitudinal section taken through one of the lifting members.

Figure 17 is a fragmentary side elevation of a modified form of this invention.

Figure 18 is a continuation of one end of Figure 17.

Figure 19 is a fragmentary sectional view taken on the line 19—19 of Figure 1.

Referring to the drawings, and first to Figures 1 to 16 and Figure 19, the numerals 20 and 21 designate generally a pair of endless chains constructed according to an embodiment of this invention which are trained over pairs of grooved wheels 22 and 23. The wheels 22 are fixed to a shaft 24 which is journaled in a pair of horizontally disposed frame bars or members 25 and 26. Preferably, the wheels 22 are secured to the shaft 24 by means of a set screw 27 so that the two wheels 22 may be adjusted toward or from each other so as to space the two chains 20 and 21 the desired distance apart.

There are two wheels 23 similar to the wheels 22 which are fixed to a drive shaft 28 which is operated by a suitable driving mechanism (not shown) and the two wheels 23 may be adjusted toward or from each other in the same manner as the adjustment of the two wheels 22. The frame bars 25 and 26 are secured to a pair of vertically disposed frame members 29 and 30, which are carried by a frame structure generally designated as 31.

A vertically shiftable table 32 is carried by the frame structure 31 and this table 32 may be vertically shifted by a well known mechanism which will periodically shift the table 32 vertically, such a mechanism being of the type similar to that shown in Patent No. 1,924,908 which issued August 29, 1933.

A plurality of sheets 33 are adapted to be positioned on the table 32, and upon upward movement of the table 32, the sheets 33 are adapted to be moved toward the lower runs of the suction chains or conveying means 20 and 21. These chains 20 and 21 are spaced apart a distance such that when the uppermost sheet 33 is in contacting relation with the undersides of the lower runs of the chains 20 and 21, these chains will engage the sheet closely adjacent each side edge.

The chains 20 and 21 are of like construction, being shown in greater detail in Figure 13. The chain 20 is here shown as comprising a plurality of pivotally connected links which are provided with a concave recess 35 at one end and a convex projection 36 at the opposite end. The convex projection 36 is adapted to engage in the convex recess of an adjacent link 34, and the links are connected together in pairs by means of pins 37. The link member 34 also includes a suction head 38 which is formed with a flat face 39 and right angularly disposed opposite ends 40. The head 38 of one link is adapted to have the right angularly disposed opposite ends 40 thereof positioned in contacting or abut-

ting relation to an adjacent link so that the connected links 34 will be held in a straight line. The under faces 39 of the heads 38 are disposed in horizontal alignment and each link member 34 includes a suction passage 41 opening downwardly through the flat face 39 of the head 38 and a laterally extending passage 42 communicates at its inner end with the vertical passage 41 and opens through the outer face 43 of the link body 34.

Each link member 34 is formed in its inner face 44 with a horizontally disposed channel 45 which in the present instance is of V-shape configuration in transverse section, and a chain supporting bar 46 which is formed with a V-shaped outer edge 47 which engages in the channel 45. The bar 46 not only constitutes a chain supporting bar, but also constitutes a pressure bar by means of which the outer face 43 of each link 34 is held in contacting relation with a suction manifold 48. The suction manifold 48 extends horizontally of the lower run of the chain 20 and is supported in contacting relation with the outer face 43 of each link 34 by means of vertically disposed manifold supporting bars 49, which are adjustably carried by transversely disposed frame bars 50. The manifold 48 is open on its inner side and is provided with spaced apart partitions 48^b, 48^c and 48^d and thereby form independent suction chambers with which the suction conduits are adapted to communicate. The chambers of the manifold 48 communicate with the openings 42 of each chain link.

The bars 50 are secured transversely between the frame members 25 and 26 and it will be understood that there may be as many of these frame bars 50 and supporting members 49 as may be considered necessary. The supporting members 49 as shown in Figure 14 are provided adjacent their upper ends with a slot 51 which slidably receives a supporting member 50 and preferably the slot 51 opens through one side of the supporting member 49 as shown at 52. A set screw 53 is threaded through the upper end of the supporting member 49 and engages against the upper edge of the supporting bar 50 so that the supporting member 49 may be adjustably secured along the length of the horizontal supporting member 50.

The depending supporting member 49 at its lower end is provided with a downwardly opening slot 54 through which a bolt 55 engages. The bolt 55 is secured at its inner end to the manifold 48 and the manifold 48 is vertically adjusted and held in adjusted position by means of a holding nut 56 which is threaded onto the bolt 55.

The lower run of the chain 20 is slidingly held in contacting relation with the inner open face of the manifold 48 by means of a plurality of L-shaped bar supporting members 57. The bar supporting members 57 have a depending leg 58 which is secured by a fastening means 59 to the bar 46 and the upper horizontally disposed leg 60 of the supporting member 57 loosely engages through an opening 61 formed in the depending manifold supporting member 49.

The opening 61 is positioned above the slot 54 and a spring 62 is positioned about the horizontal leg 60 of the supporting member 57 and is tensioned against the supporting member 49 by means of a spring tensioning nut 63. The spring 62 provides a means whereby the pressure bar and chain supporting member 46 may be yieldingly held against the lower run of the chain 20 in order that the outer faces of the links

34 may be held in sliding contact with the inner open side of the manifold 48.

A suction controlling member generally designated as 70 is secured to a horizontally disposed supporting bar 71 which extends transversely between the frame members 25 and 26. The controlling member 70 comprises a housing formed of a lower housing body 72 and an upper housing body 73. The two bodies 72 and 73 are secured together by means of a bolt 74 which extends axially through the housing members 72 and 73. A suction head 75 is secured to the upper housing member 73 and is fastened thereon by means of a bolt 76 which may be formed as a reduced extension of the bolt 74.

The upper housing member 73 is provided with a central opening 77 communicating with the suction head 75 and the opening 77 communicates with the interior of the housing member 73. The lower housing member 72 as shown in Figure 11 has formed therein a pair of arcuate suction channels or passages 78 and 79, which are concentric to the axis of the housing 70 and preferably the arcuate passage 78 is of greater length than the passage 79. A nipple 80 is carried by the lower housing member 72 and communicates through an upwardly extending passage 81 with the arcuate passage 78. A second nipple 82 is carried by the lower housing member 72 and communicates through a passage 83 with the passage 79.

A disc-shaped valve member 84 is rotatably mounted within the housing 70, the lower face of the valve member 84 rotatably engaging the inner upper face of the lower housing 72 as shown in Figure 9. The valve member 84 is rotatably carried by the bolt 74, the bolt 74 being provided with a head 85 which engages in a recess 86 formed axially of the valve member 84. The valve member 84 is provided with an arcuate port 87 therethrough, which is disposed closely adjacent the marginal edge of the valve member 84 and which upon rotation of the valve member 84, as will be hereinafter described, is adapted to register with the ports 78 and 79 successively. The valve member 84 is provided on the marginal edge thereof with gear teeth 88, which mesh with a worm 89 which is rotatable on a valve driving shaft 90. The worm gear 89 is rotatable in a pair of housing parts 91 and 92 carried by the housing members 72 and 73, respectively, and preferably the worm gear 89 is formed at one end thereof with a reduced part 93 which extends through a wall 94 formed at one end of the housing parts 91 and 92. A clutch plate 95 is carried by the reduced part 93 of the worm gear 89 and a clutch lining or facing 96 is secured to the outer face of the plate 95.

The shaft 90 is journaled adjacent one end thereof through a bearing 97, which is carried by the frame member 25, and a knurled knob or wheel 98 is fixed to one end of the shaft 90 adjacent the bearing 97. Preferably, the shaft 90 is formed with a reduced stub shaft or extension 99 which is rotatably disposed through the reduced part 93 and extends outwardly beyond the clutch element 95. A tapered clutch element 100 is formed between the shaft 90 and the reduced stub shaft 99 and in one position the clutch element 100 is adapted to engage a complementary clutch element 101, which is formed with the worm gear 89. The clutch element 100 is of frusto-conical configuration and the clutch element 101 is formed with a complementary

frusto-conical inner face so that when the shaft 90 is pushed inwardly, the clutch element 100 will engage the clutch element 101 and permit manual turning of the worm gear 89 in order that the operation of the table 32 may be properly timed with the other mechanism. A sleeve shaft 102 is loosely disposed on the stub shaft 99 and is journaled through a bearing 103 which is fixed in laterally disposed relation to the supporting bar 71. One end of the sleeve 102 is formed with a clutch element 104 having a clutch face 105 confronting the clutch face 96. A spring 106 is positioned about the sleeve 102, one end of the spring 106 bearing against one side of the bearing 103 and the opposite end of the spring 106 bearing against the adjacent face of the clutch element 104 so as to constantly urge the clutch element 104 in the direction of the clutch element 95. The opposite end of the sleeve 102 has a disc-shaped clutch element 107 secured thereto which is provided on its outer face with a clutch tooth 108.

The plate 107 is provided with an axial opening 109 through which a reduced shaft extension 110 loosely engages. The extension 110 is smaller in diameter than the stub shaft 99 and a shoulder 111 is formed adjacent the inner side of the plate 107 within the sleeve 102. In this manner, the outer end of the stub shaft 99 is adapted to engage the shoulder upon endwise movement of the shaft 90 and the stub shaft 99 to the left as viewed in Figure 4 so that the sleeve 102 with the clutch elements 104 and 107 are adapted to be moved to the left upon endwise movement of the shaft 90 to the left.

A drive shaft 112 is journaled in a bearing 113 which is carried by the frame member 26 and the inner end of the drive shaft 112 has secured thereto a clutch element 114 which is complementary to the clutch element 107. The clutch element 114 is provided with a radial recess 115 within which the key or radial projection 108 is adapted to engage. A spring 116 is positioned about the shaft 112, one end of the spring 116 bearing against the bearing 113 and the other end of the spring 116 engaging against the clutch element 114 so as to constantly urge the clutch element 114 in the direction of the clutch element 107.

The clutch member 114 on its inner face is formed with a socket 117 within which the outer end of the stub shaft extension 110 is adapted to engage so that when the shaft 90 is moved endwise to the left, the extension 110 is adapted to push the clutch element 114 and the drive shaft 112 to the left and out of engagement with the clutch element 107. The drive shaft 112 is provided with splines 118, and a driving gear 119 is splined onto the shaft 112 and engages the splines 118. The gear 119 is adapted to be connected to a suitable source of power supply (not shown) so that the drive shaft 112 can be operated at the desired speed. It will also be understood that the gear 119 may be one element of a train of gears which is connected with a power device.

In practice the clutch means 100 and 101 are adapted to be engaged after the clutch elements 107—114 and 95—104 have been successively disengaged, so that the worm gear 89 may be rotated to the desired degree in order to advance the valve member 84. Initially the endwise movement of the shaft 90 to the left will disengage the two clutch elements 107 and 114 and

continued movement of the shaft 90 to the left will bring the outer end of the stub shaft 99 into engagement with the shoulder 111 of the clutch element 107 so that the sleeve 102 will also be pushed to the left and thus effect disengagement of the two clutch elements 95 and 104. At this time, the two clutch elements 107 and 114 are also held in disengagement relative to each other, and further movement of the shaft 90 to the left will bring the clutch element 100 in engagement with the clutch element 101, so that the worm gear 89 may be rotated independently of the rotation of the drive shaft 112.

The suction head 75 has connected therewith a suction supply pipe 120 which is adapted to be connected to a suction fan or the like and the nipple or coupling member 80 has connected therewith a longitudinally extending suction pipe or hose 121. A plurality of laterally extending branches 122, 123 and 124 are connected with the longitudinal suction member 121 and the branches 122, 123 and 124 are connected with nipples 122^a, 123^a and 124^a, respectively, carried by the two suction manifolds 48. A valve member 125 is mounted in the suction member 121 adjacent one end thereof, and a valve member 126 is interposed in the branches 123. In this manner, the forward branches 122 may be cut off from the suction line 121 and in like manner, the next succeeding branch 123 may also be cut off from the suction line 121. The cutting off of the branches 122 and 123 will cut off suction to different sections of the manifolds 48 so that the suction manifolds may be adjusted as to their effectiveness in proportion to the lengths of the sheets of paper which are being moved through the machine. Preferably that portion 48^c of the manifold 48 which extends forwardly from the partition 48^d is provided with continuous suction from a suction line 129 connected to the suction source. The branches 122, 123 and 124 are preferably formed of flexible material so that the manifolds 48 may be adjusted toward or away from each other depending on the positions of the two chains 20 and 21 which are adapted to be adjusted with the different widths of paper.

The paper sheets 33 are adapted to be lifted one at a time from the top of the pile on the table 32 by means of a pair of sheet lifting manifolds 127 and 128 which are disposed between the two pressure and guide bars 46. The suction manifolds 127 and 128 have flexible conduits 130 and 131 connected therewith.

The lifting manifold 127, which is shown in more detail in Figure 16, comprises an elongated body 64 which is formed with a plurality of longitudinally extending passages 65. The passages 65 are separated by means of partitions 66 and a nipple 67 is secured to the top wall of the manifold 127 and communicates with a passage 65. There are as many nipples 67 as there are passages 65 so that the suction as will be hereinafter described may be cut off from selected passages 65. The lower wall 68 in the manifold 64 is formed with a plurality of openings 69 which communicate with the longitudinal passage 65 and the passages 69 open through the lower face of the manifold 127 and confront the table 32.

A valve 132 is interposed in the conduit or pipe 130 and a valve 133 is interposed in the pipe or conduit 131. The conduits 130 and 131 are connected to the suction member 82, so that when the valve port 87 is in registry with the port 79, air will be drawn upwardly through the two suction manifolds 127 and 128, and the topmost

sheet of paper 33 on the pile carried by the vertically movable table 32 will be lifted from the table. The two manifolds 127 and 128 are connected together by means of a pair of crossed links 134 and 135. The links 134 and 135 at their intersecting points are pivotally secured together by means of a bolt 136. The manifold 127 on its inner side has secured thereto a pair of inwardly projecting ears 137 and 138, and the manifold 128 has secured to the inner side thereof a pair of inwardly projecting ears 139 and 140.

The link 134 is provided at each end thereof with a pair of elongated slots 141 and 142 through which fastening members 143 and 144, respectively, engage. The fastening member 143 is threaded into the ear 137 and the fastening member 144 is threaded into the ear 140. The link 135 has a pair of slots 145 and 146 adjacent the opposite ends thereof through which fastening members 147 and 148, respectively, engage. The fastening member 147 is threaded into the ear 139 and the fastening member 148 is threaded into the ear 138.

A U-shaped member generally designated as 149 has a bight 150 thereof secured to the bolt 136 and the opposite parallel legs 151 extend upwardly on opposite sides of a slide 152. A pivot member 153 extends through the parallel members 151 and the slide 152. The slide 152 is vertically slidable between the guide members 154 which are fixed to the confronting faces of a pair of supporting bars 155. The supporting bars 155 are secured at their opposite ends to the frame bars 25. A U-shaped bearing plate 156 engages about the supporting bars 155 being secured thereto by fastening means 157.

The bearing member 156 provides a means for holding the bars 155 against spreading. A bearing 158 is carried by the bearing plate 156 and a slide operating shaft 159 is journaled through the bearing 158. A disc or annular plate 160 is secured to a reduced stub shaft 161 carried by the shaft 159 and the plate 160 is formed with an eccentrically disposed annular cam track 162. The slide 152 has secured thereto a roller 163 which is mounted on a pin 164 so that rotation of the shaft 159 will effect vertical reciprocation of the slide 152. The shaft 159 is adapted to be connected to a suitable source of power supply preferably timed in such a manner that the manifolds 127 and 128 will be held in an elevated position at the time the valve port 87 is out of registry with the port 79.

When the valve port 87 is in registry with the port 79, the slide 152 is adapted to be lowered to an operative position slightly below the lower runs of the two chains 20 and 21.

An impression roller 165 is disposed forwardly of the table 32 and beneath the lower runs of the chains 20 and 21, and a pressure roller 166 is disposed between the two chains 20 and 21 and engages about the impression roller 165 so as to hold a sheet 33 in contact with the impression roller 165. The impression roller 165 as shown in Figure 3 is mounted on a hollow shaft 167 which is formed with interior splines 168 and one end of the hollow shaft 167 is formed with a tapered bearing member 169.

The impression roller 165 is detachably mounted on the hollow shaft 167, the shaft 167 being provided with a fixed collar 170 adjacent one end thereof and a nut 171 is threaded onto the opposite end of the shaft 167 and holds the impression roller 165 tightly on the shaft 167. The hollow shaft 167 has mounted therein an impres-

sion roller drive shaft 172 which has a gear 173 fixed to one end thereof. The gear 173 is adapted to be connected to a gear train or power means whereby the shaft 172 may be operated at the desired speed.

The shaft 172 has fixed thereto a collar 174 against which the adjacent end of the hollow shaft 167 is adapted to engage. A conical pinion 175 is adapted to engage in the tapered bearing part 169 of the shaft 167 and the pinion 175 is carried by a horizontally disposed supporting bar 176. The pinion 175 is adapted to hold the shaft 167 against the collar 174. The bar 176 at one end thereof is swingably or hingedly mounted as at 177 on a depending frame member 178 and the opposite end of the bar 176 engages against a second frame bar 179 and is tightly held thereagainst by a wing nut 180.

By mounting the impression roller as shown in Figure 3, this roller may be readily removed for replacement of the impression means carried thereby. The impression roller 165 may have mounted thereon a stencil or may be provided with type similar to the type used in a multi-graph machine.

As shown in Figure 1A, the ends of the two manifolds 48 terminate inwardly from the adjacent ends of the frame bars 25 and 26 and at a point inwardly from the point where the chains 20 and 21 engage with the wheels 23. In this manner, the suction of the manifolds 48 will be cut off from the chains 20 and 21 adjacent the wheels 23 so that air may enter the passages 42 and 41, respectively, in order to release the sheet 33 from the carriers or chains 20 and 21. The imprinted sheet is then adapted to gravitatingly drop down onto a receiver 181 carried by a supporting bar 182 which is fixed to the frame of the machine.

The receiver 181 is formed on opposite sides thereof with upwardly extending sheet guide members 183 so that the imprinted sheets will stack evenly on the receiver 181. At a point closely adjacent the table 32 and immediately below the lower runs of the two chains 20 and 21, I have mounted an air nozzle generally designated as 184. The nozzle 184 is adapted to be connected by means of a pipe 185 to a source of air pressure so that the air ejected from the nozzle 184 will be forced in a horizontal line beneath the sheet of paper which is lifted from the stack of paper on the table 32. The nozzle 184 is shown in greater detail in Figure 15 and comprises a substantially L-shaped body 186 having one side thereof substantially horizontal and the opposite side vertical and this latter side connected to the pressure pipe 185. The horizontal side of the body 186 has mounted therein a pair of L-shaped baffle members 187 and 188, which have one side thereof vertical and extending partly into the vertical leg of the L-shaped body 186. The baffle members 187 and 188 are provided in order to split the stream of air being discharged from the nozzle 184. The nozzle 184 is provided in order to prevent the lifting of more than one sheet of paper from the table 32 by means of the lifting manifolds 127 and 128.

In Figures 17 and 18, there is disposed a slightly modified form of suction conveying means which includes a pair of endless sheet conveying chains 20^a similar in every detail to the chains 20 and 21, and the chains 20^a are trained about grooved wheels 22^a and 23^a. The wheels 22^a and 23^a are fixed to shafts 24^a and 28^a which are journaled in frame members 25^a. A table 32^a

is vertically movable in a frame structure 31^a and the chains 20^a have disposed on the outer sides thereof a pair of suction manifolds 48^a. The manifolds 48^a are connected to a suction housing 70^a formed with controlling means similar in every detail to the structure shown in Figures 9 to 11, inclusive.

A pair of sheet lifting manifolds 127^a are disposed between the two chains 20^a and are connected by flexible ducts 130^a to the suction controlling member 70^a. The structure shown in Figure 17, which is associated with the two chains 20^a is similar in every detail to the structure shown in Figures 1, 2, 9, 10, 11, 12, 13 and 19. A second pair of suction chain members 20^b are trained about a pair of grooved wheels 22^b and 23^b and the upper runs of the two chains 20^b are positioned slightly below the horizontal plane of the lower runs of the chains 20^a. The rear termini of the chains 20^b are disposed rearwardly from the wheels 23^a so that the upper chains 20^a will deliver the sheet of paper to the uppermost runs of the chains 20^b. A pair of suction manifolds 48^t similar to the manifolds 48 are disposed in operative relation with the upper runs of the chains 20^b, being supported by supporting members 49^b from horizontally disposed transversely extending supporting bars 50^b.

The supporting bars 50^b are carried by frame bars 25^b. In the present instance, the impression roller 165^a is disposed above the upper runs of the two chain members 20^b and the pressure roller 166^a is disposed between the upper runs of the chains 20^b in a position to tightly hold the sheet of paper positioned on the upper runs of the chains 20^b against the impression roller 165^a. A receiver 181^a is disposed forwardly from the two wheels 23^b and below the upper runs of the chains 20^b, so that the imprinted sheets released from the upper runs of the chains 20^b will drop downwardly onto the receiver 181^a. In other respects, the structure shown in Figures 17 and 18, is similar in every detail to the structure shown in Figures 1 to 16, inclusive.

In the use and operation of this device, the sheets of paper are positioned on the vertically shiftable table 32 and initially the sheet lifting manifolds 127 and 128 will be lowered slightly below the lower runs of the chains 20 and 21 and then raised so as to deliver the top-most sheet of paper to the lower runs of the chains 20 and 21. The manifolds 127 and 128 are made effective by rotation of the valve member 84 and registry of the port 87 with the port 79. When the manifolds 127 and 128 are raised by upward movement of the slide 152, the port 87 will be rotated so as to communicate the suction of this port with the conveyor port 78. At this time the suction will be communicated to the chain manifolds 48 which are positioned outwardly of the lifting manifolds 127 and 128. The suction of the manifolds 48 will be communicated through the ports 42 and 41, respectively, to the chain links 34 so as to tightly hold the marginal edges of the paper sheet against the under faces 39 of the links 34. The chains 20 and 21 are continuously movable so that as soon as the paper sheet comes into engagement with the lower runs of the chains 20 and 21, the sheet will be carried along with these chains and at that time the suction of the manifolds 127 and 128 is cut off by means of the valve member 84, and the air ejecting nozzle 184 may be made effective so as to force a draft of air beneath the lifted sheet or if desired the draft of air

may be continuous. In this manner, if more than one sheet of paper has been lifted by the manifolds 127 and 128, these extra sheets of paper will be released by the air ejected from the nozzle 184. The paper sheet which is held by the chains 20 and 21 will be carried along until the sheet comes into engagement with the impression roller 165 and the pressure roller 166.

The suction manifolds 48 extend beyond the impression roller 165 and the pressure roller 166 so that the chains 20 and 21 will pull the paper sheet through the two rollers 165 and 166. After the paper sheet has passed beyond the impression and pressure rollers, the suction or vacuum is released so that the sheet may drop onto the receiver 181.

The structure hereinbefore described may be used as an attachment for a duplicating machine so that the sheets of paper will be positively moved through the machine at an even rate.

It will be understood that if desired a second impression roller may be substituted for the pressure roller 166 so that this apparatus may be used to print both sides of a sheet of paper at one time, or if desired a second impression roller and associated pressure roller may be used in a position inverted or reversed from the first rollers. This latter arrangement will merely require a lengthening of the suction manifolds and of the carrier chains.

What I claim is:

1. A flexible sheet moving means comprising an endless movable carrier having a plurality of openings, a stationary suction means disposed in a position to provide a constant suction through certain of said openings to thereby hold a sheet against said carrier and means intermittently cutting off suction to certain others of said openings.

2. A flexible sheet moving means comprising a horizontally movable endless carrier having a plurality of openings, a stationary suction means disposed in a position to provide a constant suction through certain of said openings whereby to hold a sheet against said carrier and means intermittently cutting off suction to certain others of said openings.

3. A flexible sheet moving means comprising a horizontally movable endless carrier having a plurality of openings, a stationary suction means disposed in a position to provide a suction through certain of said openings whereby to hold a sheet against said carrier, a vertically movable sheet delivery means for delivering a sheet to said carrier and means alternately cutting off suction from said stationary suction means and said sheet delivery means.

4. A duplicating machine of that type including an impression member and a pressure member for holding a sheet in contact with said impression member; and a pair of endless carriers positioned at opposite ends of said members for moving a sheet between said members.

5. A duplicating machine of that type including an impression member and a pressure member for holding a sheet in contact with said impression member; an endless carrier means having a portion thereof positioned at opposite ends of said members for moving a sheet between said members, and stationary means operatively connected with said carrier for holding a sheet in contact with said members.

6. A duplicating machine of that type including an impression member and a pressure member for holding a sheet in contact with said im-

pression member; an endless carrier means having a portion thereof positioned at opposite ends of said members for moving a sheet between said members, stationary means operatively connected with said carrier for holding a sheet in contact with said members, and means for delivering a sheet to said carrier.

7. A flexible sheet moving means comprising a pair of spaced apart endless chains constituting a carrier means, each link of said chain having an opening communicating through two faces thereof, a pair of stationary suction manifolds each disposed adjacent one run of said chains and communicating with said openings at one end thereof, and means connecting said manifolds to a source of suction supply.

8. A flexible sheet moving means comprising a pair of spaced apart endless chains constituting a carrier means, each link of said chain having an opening communicating through two faces thereof, a pair of stationary suction manifolds each disposed adjacent one run of said chains and communicating with said openings at one end thereof, means connecting said manifolds to a source of suction supply, and a suction manifold means movable at right angles to said one run of said chains for delivering a sheet thereto.

9. A flexible sheet moving means comprising a pair of spaced apart endless chains constituting a carrier means, each link of said chain having an opening communicating through two faces thereof, a pair of stationary suction manifolds each disposed adjacent one run of said chains and communicating with said openings at one end thereof, means connecting said manifolds to a source of suction supply, and a suction manifold means movable at right angles to said one run of said chains for delivering a sheet thereto.

10. A flexible sheet moving means comprising a pair of spaced apart endless chains having the opposite runs thereof horizontally disposed, each link of said chain having an L-shaped opening communicating at one end through the horizontal face thereof and communicating at the opposite end thereof through a vertical face, a stationary suction manifold for each chain disposed in confronting relation to said vertical face, and means yieldably holding said manifold in contacting relation to said vertical face.

11. A flexible sheet moving means comprising a pair of spaced apart endless chains having the opposite runs thereof horizontally disposed, each link of said chain having an L-shaped opening communicating at one end through the horizontal face thereof and communicating at the opposite end thereof through a vertical face, a stationary suction manifold for each chain disposed in confronting relation to said vertical face, means yieldably holding said manifold in contacting relation to said vertical face, and a vertically movable means for delivering a sheet to one run of said chain.

12. A flexible sheet moving means for feeding a sheet to a printing couple comprising a horizontally movable carrier, stationary manifold means disposed in operative relation with respect to said carrier, a vertically movable sheet delivery means, means connecting said manifold means and said delivery means with a source of suction, and timed means interposed in said connecting means for progressively cutting off and communicating said delivery means and said manifold means with respect to the source of suction.

13. A flexible sheet moving means for feeding

a sheet to a printing couple comprising a horizontally movable carrier, stationary manifold means disposed in operative relation with respect to said carrier, a vertically movable sheet delivery means, means connecting said manifold means and said delivery means with a source of suction, and timed means interposed in said connecting means for progressively cutting off and communicating said delivery means and said manifold means with respect to the source of suction, said timed means including means for varying the cutting off and communicating off of suction in said delivery means and said manifold means relative to said carrier.

14. In a duplicating machine having an impression member, and a pressure member; horizontally movable suction means for moving a sheet in the direction of said members, a vertically shiftable supply sheet elevator, and a vertically movable sheet delivery means for lifting a sheet from said elevator upon advance of the latter and delivering the same to said suction means.

15. In a duplicating machine having an impression member, and a pressure member; horizontally movable suction means for moving a sheet in the direction of said members, a vertically shiftable supply sheet elevator, a vertically movable sheet delivery suction means for lifting a sheet from said elevator upon advance of the latter and delivering the same to said horizontally movable suction means, and means for cutting off the suction from said delivery means when the sheet has been delivered to said horizontally movable suction means.

16. In a duplicating machine having a rotatable cylindrical impression member, and a second rotatable cylindrical member opposing said first member; an endless carrier positioned at opposite ends of said members for moving a sheet between said members.

17. An endless conveyor for use with a suction manifold comprising a plurality of pivotally connected links, each link having a suction passage opening through two faces thereof.

18. An endless conveyor for use with a suction manifold comprising a plurality of pivotally connected links, each link having an L-shaped suction passage opening through adjacent angularly disposed faces thereof.

19. An endless suction conveyor comprising in combination a plurality of pivotally connected links, each link having a suction passage opening through two faces thereof, and a suction manifold disposed in a position for communication with one end of said passage.

20. An endless suction conveyor comprising in combination a plurality of pivotally connected links, each link having a suction passage opening through two faces thereof, a suction manifold disposed in a position for communication with one end of said passage, and tensionable means holding said manifold in contact with one face of each link on one run of said conveyor.

21. An endless suction conveyor comprising in combination a plurality of pivotally connected links, each link having a suction passage opening through two faces thereof and also having a longitudinally disposed groove in the face thereof opposite one end of said passage, a suction manifold disposed in confronting position to said one end of said passage, and means engaging in said groove holding said manifold in substantial contact with the face of a link opposite from said groove.

22. An endless suction conveyor comprising a pair of endless chains, each chain including a plurality of pivotally connected links and each link having a suction passage opening through two faces thereof, means supporting said chains for adjustment relative to each other, a suction manifold for each chain disposed in confronting position to one face thereof and one end of each passage, and means supporting said manifold relative to one run of said chains.

23. A conveyor link comprising a link body having means at each end thereof for pivotal connection with adjacent links, said body having at least one pair of adjacent faces thereof flat and said body having a passage disposed between the ends thereof and opening through said flat faces.

24. A conveying means for sheet material comprising a pair of simultaneously operable endless conveyor members including ported units for conveying the sheet, suction means having sets of compartments, each set opening into the ports of the units of a run of a conveyor member, and said suction means including spaced valved controlled means for selectively closing said compartments to a suction source.

25. A conveying means for sheet material comprising a pair of simultaneously operable endless conveyor members including ported units, a section head, a pair of suction manifolds each provided with compartments and each correlated with the ports of the units of a run of each member for holding a sheet in contact with said members, spaced selectively controlled independent valved conduits each leading from said head to a compartment of a manifold, a second pair of suction manifolds for delivering a sheet to said runs and each provided with compartments, and spaced selectively controlled valved conduits each leading from said head to a compartment of a manifold of said second pair of manifolds.

26. In combination, an endless sheet moving means, a stationary suction means operatively connected to said sheet moving means for holding a sheet in contact with the latter, suction means for delivering the sheet to be held by said sheet moving means, and said stationary suction means having spaced selectively controlled means for intermittently rendering it ineffective for a portion of the length of the travel of said sheet moving means.

27. An endless suction conveyor comprising in combination, a plurality of pivotally connected links, each link having a suction passage opening through two faces thereof, a suction manifold disposed for communication with one end of said passage, and a tensionable means for holding said manifold in contact with one of the said faces of each link on one run of the said conveyor, said means having a part extending into another face of each link of such run and providing a combined support and guide for the link.

28. A conveyor means for sheet material comprising a pair of simultaneously operable endless conveyor members including ported units, and a suction manifold for each member engaging one run of a member and having a length less than said one run whereby atmospheric air entering the ports of said units beyond an end of a manifold will release a sheet from a member.