

Feb. 20, 1962

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3,022,068

SHEET FEEDING AND REGISTERING MECHANISM

Filed Dec. 3, 1958

5 Sheets-Sheet 1

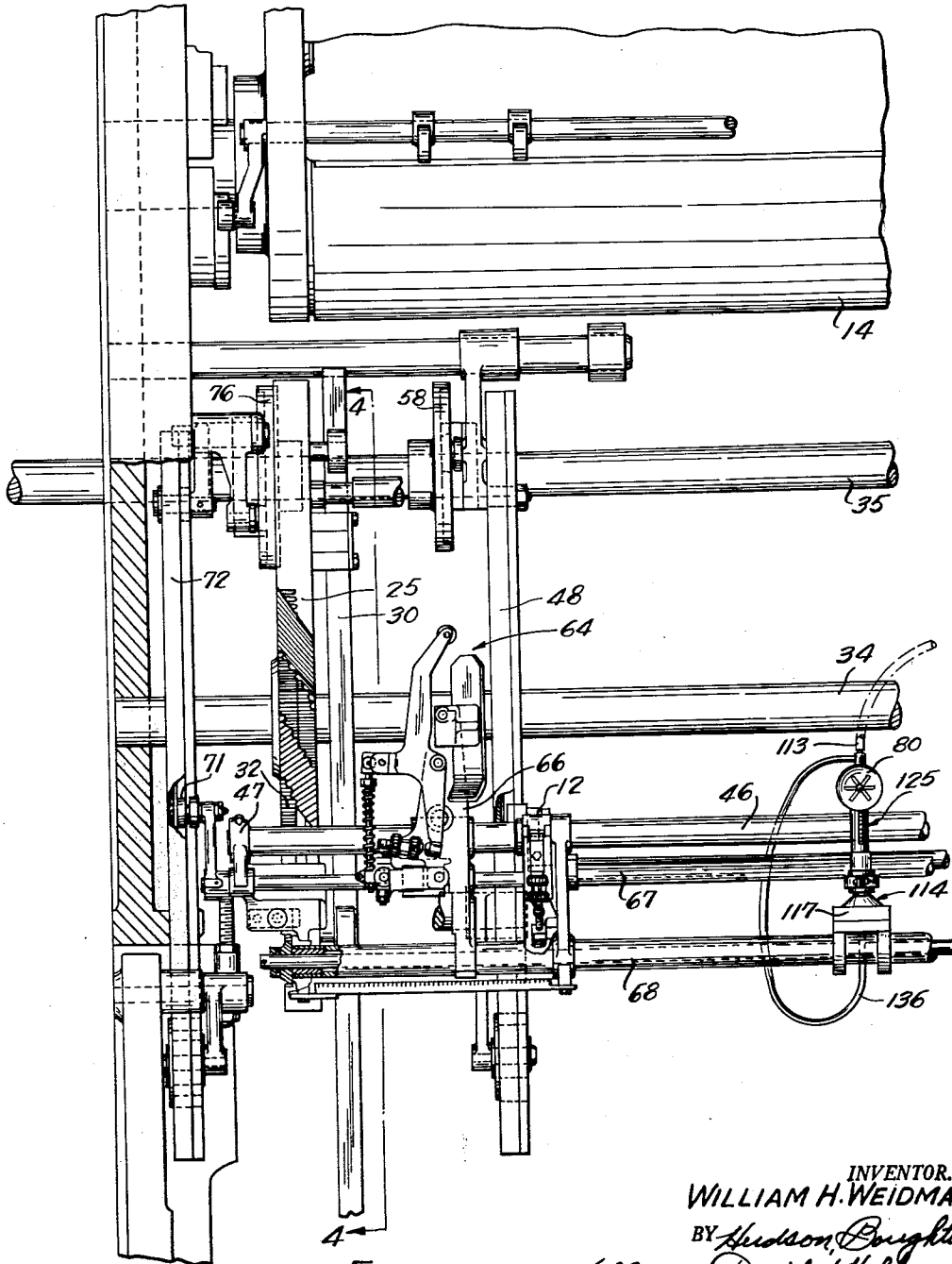


FIG. 2

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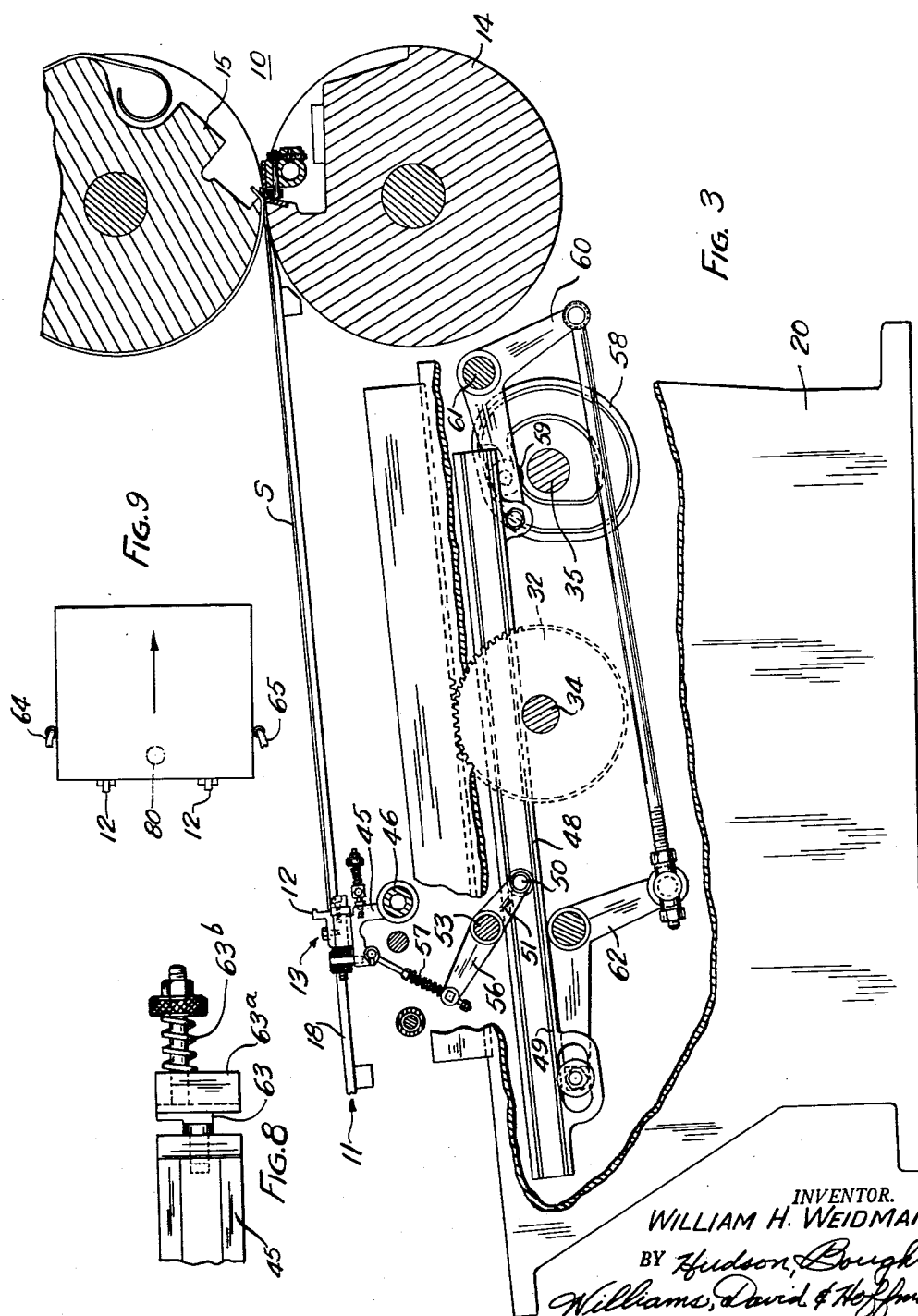
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5 Sheets-Sheet 2



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5 Sheets-Sheet 3

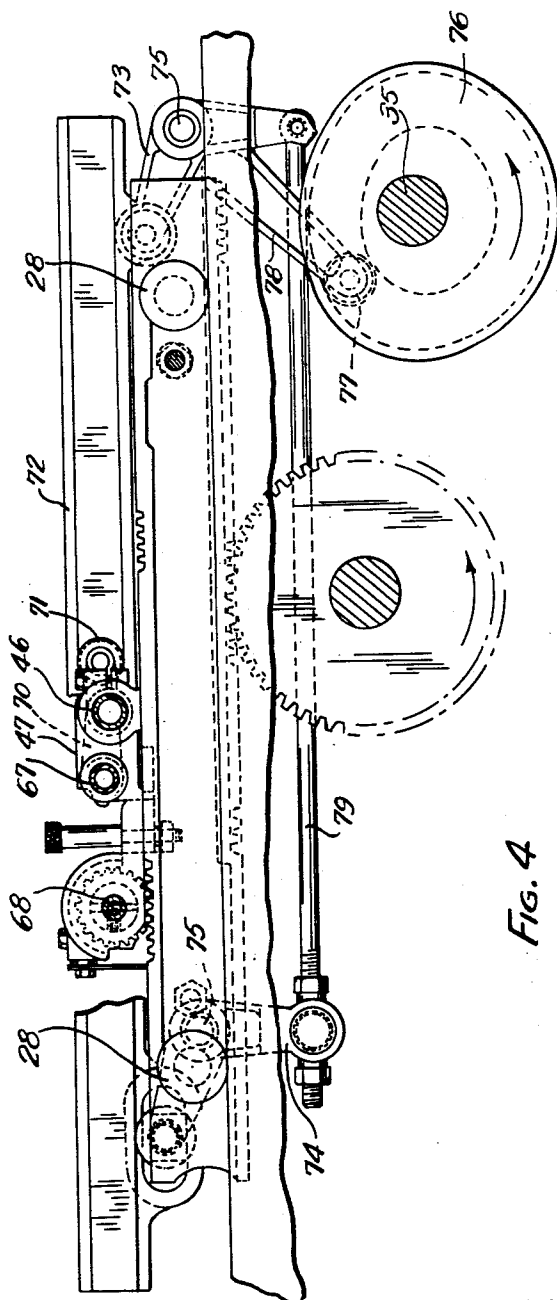


FIG. 4

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SHEET FEEDING AND REGISTERING MECHANISM

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5 Sheets-Sheet 4

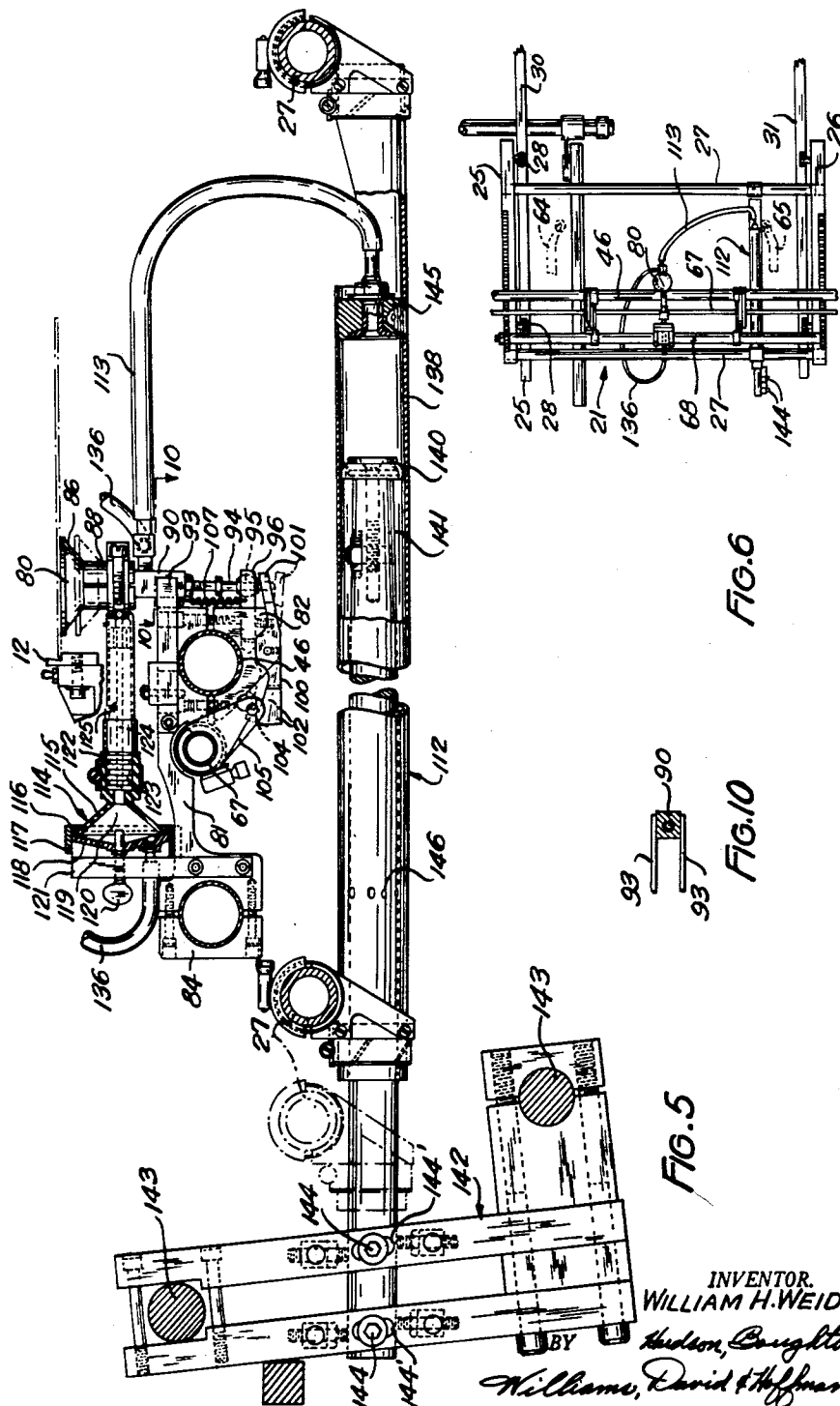


FIG. 6

FIG. 10

FIG. 5

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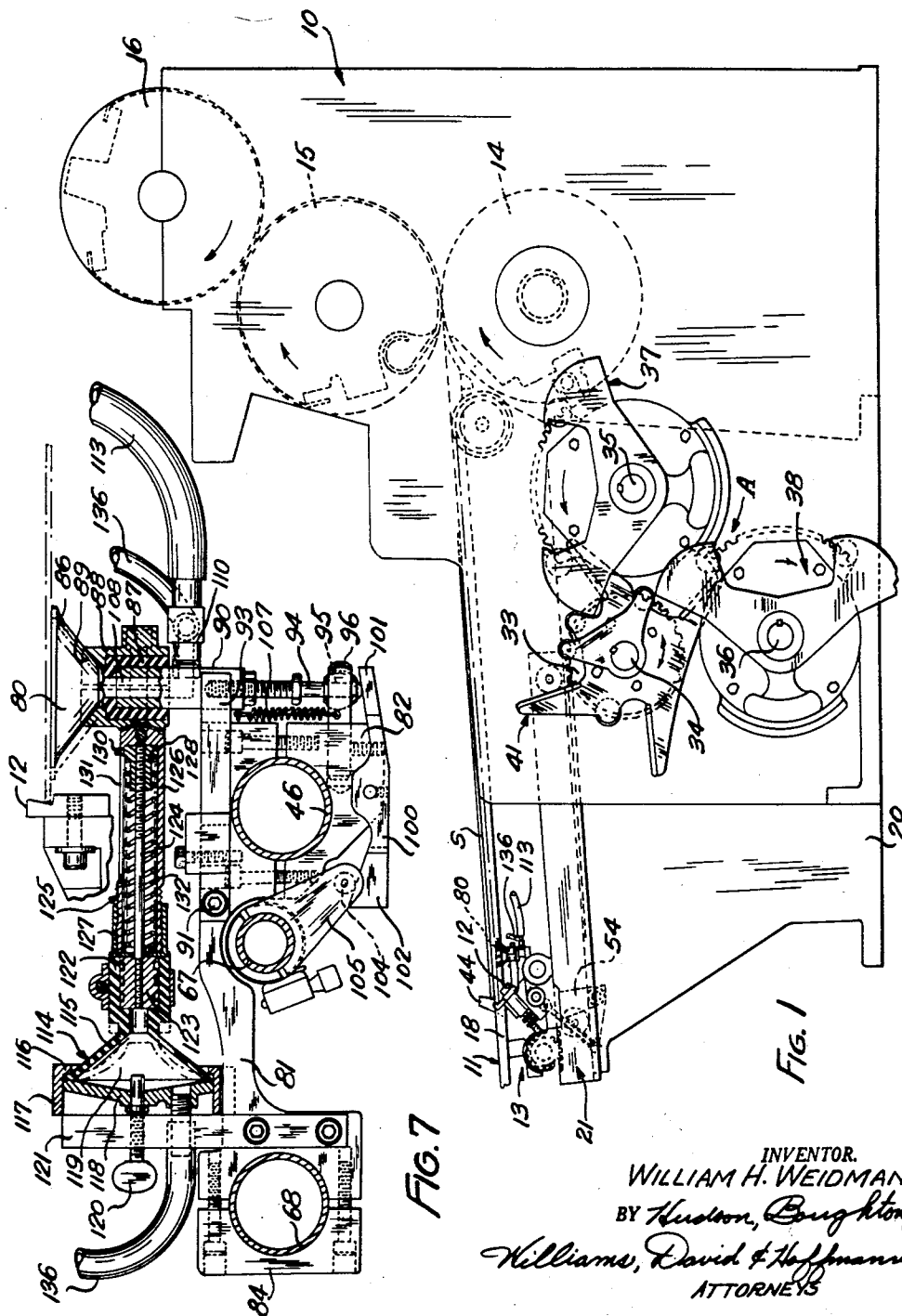
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SHEET FEEDING AND REGISTERING MECHANISM

Filed Dec. 3, 1958

5 Sheets-Sheet 5



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1

3,022,068

## SHEET FEEDING AND REGISTERING MECHANISM

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Filed Dec. 3, 1958, Ser. No. 777,956

5 Claims. (Cl. 271—55)

The present invention relates to a sheet feeding and registering mechanism.

A feeding and registering mechanism for feeding sheets to a sheet-handling machine commonly comprises a carriage which is reciprocated to successively advance sheets to the sheet-handling machine. In certain types of feeding and registering mechanisms, an element is to be actuated or rendered effective in relationship to the movement of the carriage in one direction. In one type of feeding and registering mechanism a sheet gripping sucker advanceable with the sheet being fed has a vacuum applied thereto to effect a gripping of the sheet being fed and then is moved by a vacuum actuator to effect a registering movement of the sheet.

An important object of the present invention is to provide in a sheet feeding and registering mechanism an improved, simplified manner and means for controlling or actuating a vacuum, or other fluid pressure responsive, element in relationship to the operation of the mechanism to effect the feeding of sheets.

Another object of the present invention is to provide a new and an improved feeding and registering mechanism in which the reciprocation of a carriage to effect the advancing of the sheets to be fed also effects the reciprocation of a pump in communication with a fluid pressure responsive device, which pump is reciprocated with the carriage so that the action of the device is controlled in relationship to the reciprocation of the carriage.

A still further object of the present invention is to provide in a feeding and registering mechanism a new and improved, simplified means for providing and controlling the application of a vacuum to a vacuum responsive element, such as a sheet-gripping sucker advanceable with the sheet being fed, in relation to the operation of the mechanism.

A further object of the present invention is to provide a new and an improved feeding and registering mechanism in which the reciprocation of a carriage for advancing the sheets to be fed also effects reciprocation of a vacuum pump to apply a vacuum to a vacuum element during the movement of the carriage in one of its directions of movement, the pump operating to break the vacuum when the carriage reaches a predetermined position as it is moving in the direction which provides a vacuum.

The present invention further contemplates the provision of a new and an improved feeding and registering mechanism wherein a sheet-gripping sucker is adapted to grip a sheet and move the latter in a direction different from the direction of sheet movement and is actuated to move the sheet only after the sealing of the sucker against the sheet.

The invention still further contemplates the provision of a new and an improved feeding and registering mechanism wherein a sheet-gripping sucker supported for movement in a plurality of directions while in engagement with the sheet is actuated in one direction by a vacuum actuator of a construction which permits the movement of the sucker in a plurality of other directions even though the actuator is connected to the sucker by a linkage which does not in itself provide for movement of the sucker relative to the actuator in the other directions.

Further objects and advantages of the present invention will be apparent from the following detailed description

2

of the preferred embodiment thereof made with reference to the accompanying drawings in which:

FIG. 1 is a side elevational view of a metal decorating unit and a back-gauge type feeding and registering mechanism embodying the present invention and adapted to feed sheets to the metal decorating unit;

FIG. 2 is a fragmentary plan view of one side of the feeding and registering mechanism of FIG. 1 but also including side-gauges for the sheets being fed and showing the carriage thereof in an advanced position;

FIG. 3 is a view similar to FIG. 1 but having parts thereof cut away to show the mechanism for operating the back-gauges of the mechanism;

FIG. 4 is a vertical sectional view through the feeding and registering mechanism taken approximately along line 4—4 of FIG. 2;

FIG. 5 is a vertical sectional view through the carriage showing the sheet sucker embodied therein for moving a sheet against the back-gauges of the carriage;

FIG. 6 is a simplified plan view of the carriage of the feeding and registering mechanism with the side-gauge structure omitted and other details of structure omitted to provide a simplified showing of the structure of the carriage and the relative positions of the back-gauges, side-gauges and sheet gripping sucker, the carriage being shown in its retracted position;

FIG. 7 is an enlarged view of a portion of FIG. 5 with certain parts thereof shown in section;

FIG. 8 is a detailed view of a back-gauge stop;

FIG. 9 is a schematic plan view showing the relationship of the side-gauges, back-gauges and sheet gripper element of the described mechanism; and

FIG. 10 is a sectional view taken approximately along line 10—10 of FIG. 5.

Referring to the drawings, the present invention is shown as incorporated in a back gauge type sheet feeding and registering mechanism shown and described in Patent No. 2,797,094 to Howard J. Seel. The drawings and description of the present invention include the structure of the sheet feeding and registering mechanism shown in the aforesaid patent necessary for a complete understanding of the structure and operation of the present invention and its manner of cooperation with the other parts of a sheet feeding and registering mechanism and reference is made to the aforesaid patent for those details of structure and operation not necessary for an understanding of the present invention.

Referring to the drawings, sheets S to be delivered to a sheet handling machine 10 are moved in succession onto a feed table 11 where they are engaged by a pair of back-gauging pushers, or back-gauges, 12 of a back-gauge type feeding and registering mechanism 13 and are pushed thereby along the feed table 11 in a feed direction to the sheet handling machine. The sheet handling machine shown is a metal decorating press having an impression cylinder 14, a blanket cylinder 15 and a plate cylinder 16. The feed table 11 registers with the nip of the impression and blanket cylinders and the sheets are delivered in proper registration with respect to these cylinders by the back-gauge feeding and registering mechanism 13. The feed table 11 is comprised of a plurality of spaced longitudinally extending bars or rails 18 (only one of which appears in the drawing) along which the sheets S are pushed by the back-gauges 12, the back-gauges being disposed between the bars. The bars 18 are supported above spaced side frames 20 which support a carriage 21 that carries the back-gauges 12. The carriage 21 is reciprocable and is moved toward the sheet handling machine 10 through a feed stroke to advance the sheets S, and away from the sheet handling machine to return the back-gauges 12 to the beginning of their

feed stroke. The carriage is shown in an advanced position in FIG. 2 and in a retracted position in FIG. 6.

The carriage 21 is comprised of a pair of spaced racks 25, 26 which form parts of opposite side members of the reciprocating carriage and which are tied together by front and back tie rods 27. The racks 25, 26 and, in turn, the carriage 21, are supported for reciprocatory movement toward and from the sheet handling machine 10 by front and rear wheels 28 on each rack which roll on rails 30, 31 disposed respectively adjacent the racks 25, 26. The carriage 21 is reciprocated by pinion gears 32, 33 which mesh respectively with the racks 25, 26. The pinion gears 32, 33 are fixed to a common shaft 34 supported by the side frames 20 and are oscillated to reciprocate the carriage by a rotary-to-reciprocating Geneva motion mechanism A shown in FIG. 1. To reciprocate the carriage 21, the shaft 34 and, in turn, the pinions 32, 33 are driven through the mechanism A from the machine drive. The mechanism A includes forward motion shaft 35 and a reverse motion shaft 36 supported by the side frames 20 parallel to shaft 34. The shafts 35, 36 rotate in opposite directions and are intergeared with the cylinders 14, 15, 16 which are intergeared with each other and driven from the machine drive. The Geneva mechanism A includes a pair of drive mechanisms 37 and 38 mounted on oppositely rotating shafts 35 and 36 respectively. Each of the drive mechanisms 37 and 38 cooperates at a different time with a driven member 41 of the Geneva mechanism, which member 41 is mounted on shaft 34. Drive mechanism 37 acts to first accelerate the carriage forwardly, move it at a constant speed through gearing for a given period, and then decelerate it. Drive mechanism 38 serves the identical function to move the carriage rearwardly on its return stroke. The mechanism A does not, per se, form a part of this present invention and has not, therefore, been described in detail. Reference is made to the aforesaid Seel patent and to Patent No. 2,659,237 to James R. Wood for the details of structure and operation of the mechanism A. It is to be understood that other suitable mechanisms may be utilized to reciprocate the carriage 21.

As the carriage 21 is reciprocated toward and away from the sheet handling machine 10 to feed the sheets S, the back-gauges 12 are projected above the upper surface of the bars 18, upon which the sheet S to be fed is supported, at the beginning of the feed movement of the carriage 21 and are retracted at the end of the feed movement to a position below the upper surface of the bars 18 and are retained in the latter position for the return movement of the carriage. This enables the next sheet to be delivered onto the feed table 11 while the carriage 21 is being returned. Pushers 44 of a preliminary advancing means shown in the aforesaid Seel patent are indicated in FIG. 1. These pushers deliver a sheet into position on the table 11 to be taken by the back-gauges 12.

The back-gauges 12 are each supported on an L-shaped bracket 45 and the brackets 45 are rockably supported on a tubular shaft 46 which extends transversely of the carriage 21. The opposite ends of the shaft 46 are supported by respective brackets 47 which are carried by the top of the side members of which the adjacent racks 25, 26 are a part. As described in the aforesaid Seel patent, the brackets 47 are movable along the top of the side members formed in part by the racks 25, 26 to adjust the position of the back-gauges 12 along the carriage for different length sheets.

The back-gauges 12 are rocked between a position below the top of the feed table 11 and a position wherein they project above the top of the table to engage a sheet by raising and lowering a channel member 48 which extends parallel to the path of movement of the carriage 21 and is disposed below the carriage and the left-hand back-gauge 12 as is shown in FIG. 2. The channel member 48 has a channel 49 therein which receives a roller 50 carried by one end of a rocker arm 51 on the

carriage 21. The rocker arm 51 is fixed to a rock shaft 53 extending between depending flanges 54 of the bracket members 47. The rock shaft 53 is connected to raise and lower the brackets 45 carrying the back-gauges 12 through a respective lever 56 for each bracket, the lever 56 being fixed to the rock shaft 53 for rotation therewith and each lever being connected at its outer end to the corresponding bracket 45 by a yieldable tie connection 57. Referring to FIG. 3, it can be seen that when the channel member is raised, the back-gauges 12 are lowered through the operation of the rock shaft 53 and when the channel member is lowered, the back-gauges are raised. The raising and lowering of the channel member 48 is done in timed relation to the reciprocation of the carriage 21 by a cam 58 fixed to the shaft 35 and a cam follower 59 which co-operates with the cam 58 and which is connected to an arm of a bell crank lever 60 supported by a rock shaft 61, which arm is also pivoted to the forward end of the channel member 48, the other end of the channel being connected to one arm of a bell crank lever 62. The rocking of crank 60 by the cam 58 also rocks the lever 62 by reason of a tie connection and effects the raising and lowering of the channel member 48 and, in turn, the back-gauges 12.

In the illustrated embodiment, the bracket 45 when raised, engages a stop member 63 carried by the carriage 21, as is shown in FIG. 8. The stop member 63 is carried by a body member 63<sup>a</sup> fixed to the frame of carriage 21. The stop member preferably includes offset portions which are selectively positionable to interpose stop portions of different thickness between the bracket 45 and the body member 63<sup>a</sup>. The stop member 63 is clamped against the body member 63<sup>a</sup> by a spring 63<sup>b</sup> operating on a rod extending from the stop member 63 through the body member 63<sup>a</sup>.

In addition to the back-gauges 12, the carriage 21 includes side registering gauges 64, 65 disposed adjacent the opposite sides of the carriage. The side registering gauges 64, 65 are supported on respective brackets 66 which are carried by the shaft 46 and by tubular shafts 67, 68 disposed rearwardly of the shaft 46, the shaft 67 being intermediate the shafts 46 and 68; the shafts 67, 68 are supported by the brackets 47 and the shaft 67 is rotatably supported by the brackets and is oscillatable to effect operation of the side gauges 64, 65. The oscillation of the shaft 67 effects operation of the side-gauges 64, 65 through mechanism fully shown and described in the aforesaid Seel patent and which does not, per se, form a part of the present invention and the description thereof will, therefore, not be repeated. Suffice it to say that when the shaft 67 is oscillated in a clockwise direction, as viewed in FIG. 2, the side-gauges 64, 65 are operated to side register a sheet on the carriage 21 and when oscillated in the opposite direction are returned to an inactive position.

The shaft 67 is oscillated to operate the side-gauges by operation of a crank lever 70 fixed to the left-hand end of the shaft as the latter is viewed in FIG. 2. The crank lever 70 has a roller 71 at its outer end which is received by a channel member 72 supported by bell crank levers 73, 74, see FIG. 4. The channel member 72 extends parallel to the line of movement of the carriage 21 and the bell crank levers 73, 74 are supported by shafts 75 supported by the left side frame 20. The bell crank levers 73, 74 are oscillated to raise and lower the channel member 72 to oscillate the shaft 67 by means of a cam 76 fixed to the shaft 35 and co-operating with a cam follower 77 fixed to the free end of a rock arm 78 having its other end fixed to the shaft 75 supporting the bell crank lever 73. Upon rocking of the rock arm 78, the shaft 75 supporting the lever 73 is oscillated and this, in turn, oscillates the bell crank lever 73 since the latter is fixed to the shaft 75 for oscillation therewith. The bell crank lever 73 is connected to, in turn, oscillate the bell crank lever 74 through a tie rod

79. As fully described in the aforesaid Seel patent, the channel 72 is operated to effect side registering at a predetermined point in the feed movement of the carriage.

The structure and operation of the sheet feeding and registering mechanism, as thus far described, are the same as that shown and described in the aforesaid Seel patent and as fully disclosed therein. The movement of the carriage 21 may be such that the back-gauges 12 engage the sheet to be advanced as they are being accelerated, at the beginning of their feed stroke, to a constant speed period in which they are moving the sheet at a uniform speed which is preferably the speed of the sheet handling machine.

In addition to the above described structures, the carriage 21 is provided with a means for gripping the sheet and for applying a force which urges the sheet toward and against the back-gauges. In the preferred and illustrated embodiment, the sheet gripping element is a flexible rubber sucker 80 which is disposed just forwardly of the back-gauges 12 and substantially halfway therebetween. The sheet gripping sucker 80 is adapted to engage the underside of the sheet being pushed by the back-gauges 12 and is carried by a bracket 81 clamped to the shafts 46, 68. The bracket 81 extends between the shafts 46, 68, passing over the shaft 67, and is clamped to the shaft 46 by a clamp block 82 having a semicylindrical recess for receiving the shaft 46. The bracket 81 is clamped to the shaft 68 by a clamp block 84 disposed on the opposite side of the shaft from the bracket 81.

The sucker 80 is of conventional construction and includes a head 86 generally frusto-conical in shape. The sucker has a lower tubular end 87 which fits over the upper end of a vertical push rod 90. A tubular member 88 surrounds the lower end of the sucker and provides a frusto-conical recess 89 forming a seat for the head 86. The member 88 is preferably made of two semicylindrical halves, which are fastened together by means of screws, which clamp and tightly seal the cylindrical lower end of the sucker 80 to the upper end of the rod 90. The rod 90 extends downwardly from the member 88 between a pair of leaf springs 93 fastened to the bracket 81 by screws 91. The springs 93 engage the opposite sides of the rod 90. An adjustable tappet rod 94 is threaded into the lower end of the push rod 90 and extends downwardly therefrom through a ball pivot member 95 supported for limited, angular, universal movement in a bracket member 96 carried by the clamp block 82. The bracket member 96 is adjustable transversely of the tappet rod 94 for squaring the sucker 80 relative to the sheets. The tappet rod 94 is axially slidable in the ball-type pivot member 95, and the push rod 90 is axially movable relative to the leaf springs 93 so that the leaf springs 93 and the pivot member 95 support the push rod 90 and the sucker 80 for vertical reciprocatory movement and it will also be noted that these elements will allow universal ball-type movement about the pivot of the ball-type member 95.

The sucker 80 is moved up and down, as indicated in FIG. 5, between an inactive position and a position wherein it is adapted to engage the underside of the sheet being fed by the back-gauges 12 by the operation of a rocker 100 pivoted to the underside of the clamp block 82 and having an arm 101 disposed to engage the lower end of the tappet rod 94. The rocker 100 has a second arm 102 which extends outwardly on the opposite side of its pivot connection to the clamp block 82 from the arm 101 and the upper side of which is adapted to be engaged by a roller 104 on the end of an arm 105 clamped to the shaft 67. The oscillation of the shaft 67 will oscillate the arm 105 to effect movement of the rocker 100 about its pivot to move the arm 101 thereof upwardly or permit its movement downwardly, depending upon the direction of movement of the rocker 100. If the arm 101 is moved upwardly, the sucker 80 is raised

to a sheet engaging position and if moved downwardly, the sucker 80 moves to an inactive position. The shaft 67 is shown in FIG. 5 as rocked to its limit in its clockwise direction, in which position the sucker is raised. Preferably, the sucker 80 is biased toward its inactive position by a spring 107 connected between the push rod 90 and the bracket 96 which supports the ball pivot 95.

A vacuum is applied to the sucker 80 to cause it to grip the sheet when the sucker is in its active position. To this end, the push rod 90 is provided with an L-shaped bore 108 having an axial portion which communicates with the opening in the tubular end 87 of the sucker head 86 and a radially extending portion 110, to which a vacuum pump 112 is connected by a flexible conduit 113. When the sucker 80 is moved to its active position and vacuum is applied to the sucker, the sucker 80 seals against the sheet and grips the same.

After the sucker 80 grips the sheet, a force is applied to the sucker 80 tending to move the same opposite to the direction of feed movement to snug the sheet against the back-gauges 12. To this end, a vacuum actuator 114 is provided and is connected to the sucker 80 to urge the same in a direction opposite the direction of feed movement. The actuator 114 is comprised of a diaphragm 115 which is preferably of the same construction and material as sucker 80. It is generally frusto-conical in shape and the outer periphery is clamped against the inside surface of an annular shoulder 116 at one end of a sleeve or cup-shaped member 117 by a clamp plate 118. A centrally located thumb screw 120 is threaded into an upstanding bracket 121 and forces the plate 118 into clamping position. The plate 118 forms with the inside of the diaphragm 115 a closed chamber 119 and the plate 118 has an opening therein through which a vacuum connection is made to the inside of the chamber 119 for purposes to be shown presently. The diaphragm 115 has a cylindrical portion 122 formed on the outer side thereof which receives an internally threaded plug 123 into which a rod 124 is threaded to form a force-transmitting connection for transmitting the movements of the diaphragm to the sucker 80. The rod 124 extends outwardly from the plug 123 and is part of a yieldable preload connection 125 between the vacuum actuator 114 and the sucker 80. The preload connection 125 further includes a sleeve member 126 having one end pivoted about a horizontal axis to the tubular support member 88 and a cap 127 threaded onto the other end of the sleeve member. The cap 127 is positioned adjacent the outer end of the cylindrical portion 122 and the rod 124 extends freely through the cap 127 into the sleeve member 126 and threads into a slidable member 128 disposed within the sleeve member 126 and having a portion 130 extending outwardly through an elongated opening 131 in the sleeve member 126. A spring 132 is disposed about the rod 124 between the block 130 and the inside of the cap 127 so that, if the rod 124 is pulled to the left, as the latter is viewed in FIG. 5, the force will be transmitted through the slidable member 128, the spring 132, the cap 127 and the sleeve 126 to the tubular member 88 and sucker 80. The spring is preloaded differently for various types of stock and is adapted to yield when the force of the sucker pulling a sheet against the back-gauges 12 exceeds the force of the spring. When this occurs, there will be a separation of the cap 127 and the plug 123, and the sucker will urge the sheet against the back-gauges with only so much force. Adjustment of preload force may be accomplished by loosening the thumb screw 120 and rotating the freed diaphragm in the proper direction relative to the nonrotatable member 128 to thread the rod 124 into or out of the slidable member 128, to increase or decrease the preload of the spring.

The vacuum connection to the chamber 119 of the vacuum actuator 114 includes a conduit 136 which communicates with the conduit 113 adjacent the member 83

and, in turn, with the vacuum pump 112. Until the sucker 80 seals against the sheet, there is no effective vacuum applied to the actuator, but after the sucker seals, a vacuum will be applied to the chamber 119 through conduit 136 and the diaphragm will collapse to provide a force tending to move the sucker 80 rearwardly toward the back-gauges 12. This will cause the sheet gripped by the sucker 80 to be snugged into engagement with the back-gauges with the proper force required. The movement required of the sucker 80 to snug the sheets against the back-gauges is very small and has been indicated for purposes of illustration in an exaggerated manner in FIG. 7.

In accordance with one feature of the present invention, the vacuum pump 112 for providing the vacuum for the sucker 80 and the vacuum actuator 114 and for controlling the operation thereof in relationship to the movement of the carriage is disposed below the tie rods 27 and is comprised of a cylinder 138, a stationary piston 140, and a piston rod 141. The pump is similar to a bicycle-type pump and the cylinder member 138 is an elongated tubular member and is supported between the tie rods 27. The outer end of the piston rod 141 is fixed to a bracket 142 carried by shafts 143 forming part of the stationary feeder frame. The shafts 143 are disposed rearwardly of the carriage 21 and the piston rod 141 extends parallel to the direction of feed movement of the carriage, the piston rod being connected to the bracket by bolts 144 received in elongated holes 144'. The holes 144' are spaced horizontally and the position of the rod 141 can be adjusted by adjusting the position of the bolts in the holes 144'. When the carriage 21 is in its rearwardmost position, the cylinder 138 is substantially entirely telescoped over the stationary piston rod 141 and piston 140, as indicated in phantom in FIG. 5, and as the carriage 21 moves in a feed direction, the cylinder 138 moves with the carriage to increase the distance between the piston 140 and the forward end of the cylinder 138. The conduit 113 is connected through the closed end wall of the cylinder 138 at the forward end thereof so as to communicate with the space between the forward end wall and the piston 140. The forward end wall of the cylinder 138 is formed by a rubber plug 145. As the cylinder is moved forwardly relative to the piston head 140, a vacuum is developed between the rubber plug 145 and the piston 140 and this vacuum is applied to operate the sucker 80 and the vacuum actuator 114. The pump 112 includes means for breaking the vacuum in the sucker 80 and the actuator 114 when the carriage 21 reaches a predetermined point in its feed stroke. To this end the cylinder 138 is formed with blow holes 146 in that part of the cylinder 138 which is moved past the piston head 140 as the carriage 21 reaches the point in its feed movement where the sucker 80 is to lose its grip on the sheet. This is preferably just after the sheet has been picked up by the sheet handling machine. As the blow holes 146 pass the piston 140, they place the space between the plug 145 and the piston 140 in communication with atmosphere to destroy the vacuum causing the loss of the grip of the sucker 80 on the sheet being fed and the return of the diaphragm 115 to a non-collapsed position. The sucker 80 then drops to its inactive position by reason of the action of the spring 107, the rock arm 105 having been returned to the dotted position shown in FIG. 5.

In the illustrated feeding and registering mechanism, the sucker 80 is moved to sheet-gripping position simultaneously with the actuation of the side-gauges to side register the sheet being fed. It will be recalled that the shaft 67 is oscillated to effect operation of the side-gauges and that the shaft 67 also effects movement of the sucker 80 to its active position. Preferably, this occurs a short time after the back-gauges 12 first engage the sheet to be fed and registered, and, in the type of feeding and registering mechanism shown and described in the present

application and in the aforesaid Seel patent, it preferably takes place at about the beginning of the uniform motion of the feed stroke. Obviously, however, by change in design, the timing of operation of the sucker and side-gauging may be varied. It will be noted that the gripping of the sheets by the sucker 80 and its action in holding the sheets against the back-gauges overcome certain side-gauging problems. Normally, the side gauges are operated to push the sheet sideways to register the same by applying or pushing force to the side or sides of the sheet. This force will often tend to cock the sheet around its center of gravity and pull the rear edge from the back-gauge. The gripping of a sheet, preferably adjacent the rear edge thereof, and the holding of it in engagement with the back-gauges, overcome this problem.

It will be noted that since the support for the sucker 80 and the flexible nature of the diaphragm 115 allows the sucker considerable freedom of movement, the action of the sucker in gripping the sheet will not interfere with side registration of the sheet. Because of the flexible nature of the diaphragm 115 it is not necessary to provide the tie connection between the actuator 114 and the sucker 80 with a universal joint to enable the sucker to move in a universal manner. Furthermore, since the sheet is preferably gripped at one point halfway between the back-gauges 12, the sheet will be free to pivot universally to facilitate proper registration against the back-gauges 12, while registration is being accomplished.

It can be seen from the foregoing that the reciprocation of the carriage 21 also effects the reciprocation of the pump 112 to control and actuate the vacuum actuator 114 and the sucker 80 in relationship to the movement of the carriage 21. When the carriage starts its forward stroke the pump 112 is operated to apply a vacuum to the sucker 80 and to the motor 114, which is effective after a sheet seals against the sucker 80 to effect a collapsing of the diaphragm 115 and movement of the sucker 80. The diaphragm 115 will flex to permit limited universal movement of the sucker 80. While the pump 112 has been described as a vacuum pump, it will be understood that the reciprocation of the pump could provide a pressure for operating or controlling a pressure actuator in relation to the movement of the carriage.

The sucker 80 has been shown as adapted to grip the sheet and move it toward the back-gauges. A gripping element corresponding to the sucker 80 could be utilized to grip the sheet and then move it against the side-gauge member carried by the carriage to effect side-gauging and a side-gauging movement could also be imparted to sucker 80 by mounting the vacuum actuator for moving the sucker rearwardly to exert a force on the sucker 80 which has a side-gauging component or by using separate actuating means, such as a second vacuum actuator, for urging the sucker sideways of the carriage.

While, in the illustrated embodiment, a single sucker has been shown, it will be understood that other type grippers might be used and that a plurality of suckers or grippers can be utilized where suitable. Furthermore, other suitable means different from a vacuum actuator may be utilized to effect relative movement of the sucker and back-gauge.

While the preferred embodiment of the present invention has been described in considerable detail, it will be understood that the present invention may be used with other feeding and registering mechanisms and that modifications, constructions and arrangements may be made within the ability of those skilled in the art and it is hereby my intention to cover all such modifications, constructions and arrangements which fall within the ability of those skilled in the art and the scope and spirit of the present invention.

Having thus described my invention, what I claim is:

1. In a sheet handling mechanism, a sheet gripping element to be moved in first and second angularly related directions, means supporting said element for movement

9

in said first and second angularly related directions, a fluid pressure responsive actuator comprising a closed chamber and a flexible diaphragm forming one wall of said chamber, said diaphragm constituting the movable element of said actuator and being actuated in response to different fluid pressures on the opposite sides thereof, and a mechanical linkage connected at one end to said diaphragm and at the other end to said sheet gripping element to move said sheet gripping element in said first direction upon movement of said diaphragm in one direction, said mechanical connection being movable laterally in said second direction and rigid to forces in said second direction and said diaphragm yielding to accommodate movement of said linkage and sheet gripping element in said second direction.

2. In a sheet-handling mechanism, a sheet-gripping element to be moved in first and second angularly related directions, means supporting said element for movement in said first and second angularly related directions, a vacuum actuator comprising a closed chamber and a flexible diaphragm constituting a movable wall of said chamber and having a first position when said chamber is at atmospheric pressure and movable inwardly of said first position in response to a vacuum in said chamber, a laterally movable mechanical linkage connected at one end to said diaphragm and extending outwardly therefrom and substantially rigid to transverse forces applied thereto, said linkage being connected at its other end to said element to move the latter in said first direction upon movement of said diaphragm inwardly, and said diaphragm yielding to accommodate movement of said linkage and element in said second direction.

3. In a feeding and registering mechanism for advancing a sheet along a path and comprising a plurality of gauge members for registering different edges of the sheet

10

as the sheet is advanced, a sheet-gripping element advanceable with the sheet and supported for limited movement in angularly related directions toward said gauge members, an actuator comprising a closed chamber responsive to fluid pressure and a flexible diaphragm forming a wall of said closed chamber, said diaphragm being actuated in response to different pressures on the opposite sides thereof, and a laterally movable mechanical linkage connected at one end to said diaphragm and at its other end to said element to move said element toward one of said gauge members upon movement of said diaphragm in one direction, said mechanical connection being rigid to forces in the direction of movement of said element toward said other gauge member and said diaphragm yielding to accommodate movement of said linkage and said element in a direction toward said other gauge member.

4. In a feeding and registering mechanism as defined in claim 3 wherein said actuator is a vacuum actuator and said element is a vacuum sheet-gripping sucker.

5. In a feeding and registering mechanism as defined in claim 3 wherein said linkage is expansible in said one direction and includes means yieldably opposing expansion of said linkage and means adjustable to determine the load at which said linkage yields.

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