

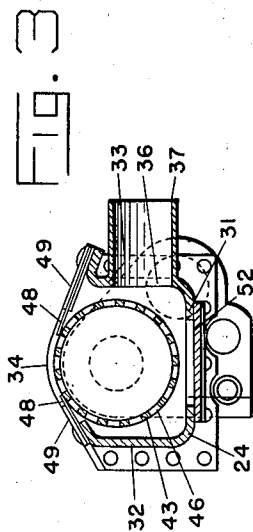
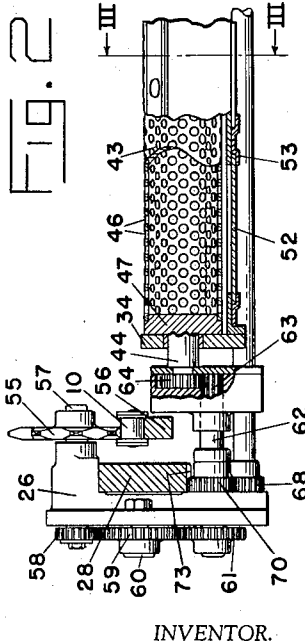
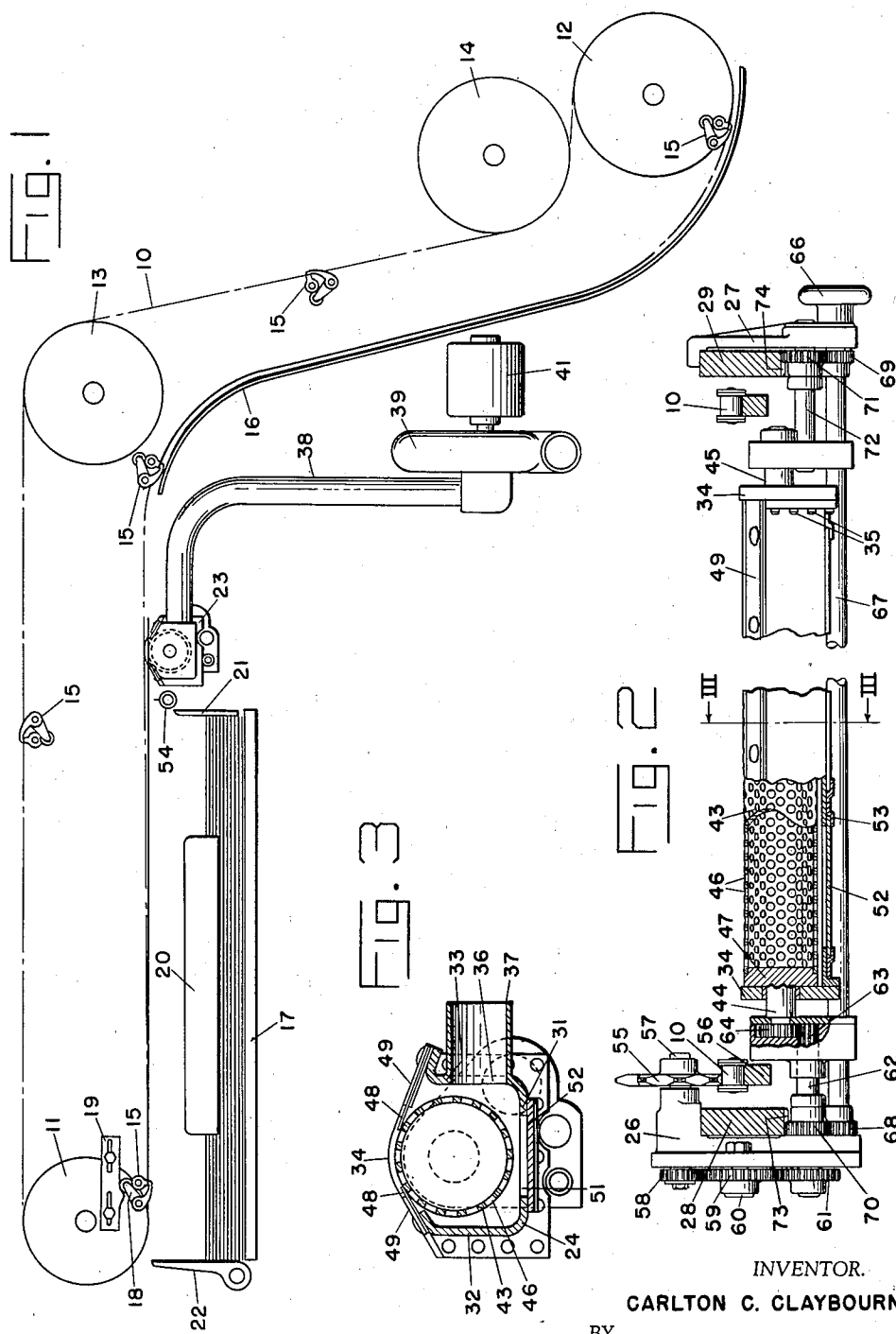
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VACUUM SLOW DOWN DEVICE FOR SHEET DELIVERY MECHANISM

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VACUUM SLOW DOWN DEVICE FOR SHEET DELIVERY MECHANISM

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This invention pertains to sheet delivery mechanism and has reference in particular to an improved sheet decelerating device for controlling and effectively retarding sheets upon their release from a high speed conveyor for delivery in precise, superposed relation on a delivery table.

In the operation of modern, high speed printing presses, it is common practice to utilize various types of suction devices to control the individual sheets upon their release from the grippers of the fast moving delivery conveyor for deposit upon the delivery pile. These mechanisms function to retard the sheets and present their leading edges gently against the delivery pile guides so that the incoming sheets can be jogged and accurately aligned with the stack of preceding sheets. The known devices, however, are all relatively inefficient, primarily because they are made to operate on a relatively low volume, high vacuum principle and they invariably comprise a series of relatively small suction members, either rollers or fingers, or both, which are arranged in widely spaced relation across the path of the sheets. Such widely spaced small members present a minimum surface area for controlling the sheets and because the devices are adapted to displace a minimum volume of air, they are at times incapable of consistently engaging and thereafter maintaining adequate control of the sheets even when auxiliary blowers or compressed air jets are provided to force the trailing portion of the sheets into contact with the sheet engaging surfaces of said members. Furthermore, in order to maintain the requisite high vacuum, the respective sheet engaging members must be provided with relatively small apertures which become clogged very easily in an atmosphere contaminated with anti-offset spray and/or paper dust. This condition is prevalent in most pressrooms, particularly in the area adjacent to the delivery pile, and thus the respective devices are rendered inoperative after a relatively short period of operation and require frequent shut downs for cleaning purposes.

It is a primary object of the present invention therefore to provide an efficient, economical sheet retarding mechanism which overcomes the above mentioned disadvantages.

Another object is to provide sheet retarding means which is adapted to displace a large volume of air at a low vacuum whereby the sheets can be effectively controlled without auxiliary blowers or compressed air jets.

Another object is the provision in a sheet retarding mechanism of a suction roller having a surface which extends across the full width of the sheet path so as to provide a maximum surface area to engage and control the sheets.

Still another object is to provide a mechanism which is so constructed and arranged as to be relatively self-cleaning and whereby clogging of the control apertures therein is effectively eliminated.

With these and various other objects in view, the invention may consist of certain novel features of construc-

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tion and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the invention, and wherein like reference characters are used to designate like parts—

Figure 1 is a schematic view in side elevation showing the invention as embodied in a conventional chain delivery mechanism;

Figure 2 is an enlarged front elevation of the sheet retarding mechanism with parts broken away to illustrate structural details; and

Figure 3 is a sectional view taken along line III—III of Figure 2.

The present invention may be used to advantage with virtually any type of sheet delivery conveyor whereby sheets are conveyed at relatively high speeds and must be quickly decelerated upon their release therefrom for deposit upon a suitable delivery table. For purposes of illustration, however, it is disclosed in conjunction with a conventional chain delivery mechanism for conveying printed sheets from the impression cylinder of a printing press to a delivery pile.

The particular delivery mechanism illustrated essentially comprises a pair of endless chains 10 which are spaced apart approximately the width of the printing press and are adapted to travel about corresponding sprockets 11 and 12 at each end thereof. In addition, the upper or return run of each chain is guided by idler sprockets 13 and 14, whereas the lower runs thereof are supported by suitable tracks in a manner well known. A plurality of gripper assemblies 15, which are supported on transverse shafts mounted at spaced intervals between the respective chains, are adapted to convey the sheets in a curvilinear path over the sheet guard 16 from the impression cylinder of the press, not shown, to a position above the delivery table 17. At this point the gripper opening cam lever 18 engages the node portion of a cam 19 mounted on the delivery conveyor frame, and the sheet is released for deposit onto the delivery table. As the sheet settles onto the pile, the side joggers 20 and rear joggers 21 function in a known manner to align the sheet with the front pile guides 22 and with the previously delivered sheets on the table.

Although the mechanism whereby the delivery conveyor is driven has not been shown, it will be understood that it is connected in the usual manner to the printing press and thus is driven at the same lineal speed as the impression cylinder. The sheets, therefore, are traveling at a relatively high speed when they are released by the grippers 15 and must be decelerated immediately upon their release and before the leading edge thereof strikes the front guides 22 so that they can be stacked in precise, superposed relation on the delivery table. If they are not retarded, thin sheets are apt to crumble and roll up when they strike the front guide, whereas, stiff sheets will rebound in an erratic manner and the leading edges thereof may become damaged. In either case, it is virtually impossible to stack the sheets with any degree of precision.

In order to control and effectively retard each sheet upon its release by the conveyor grippers for deposit upon the delivery pile, a suction device, indicated in its entirety at 23 in Figure 1, is provided adjacent the rear edge of the delivery table and below the horizontal path of the sheets. In the embodiment shown, the suction device comprises a vacuum chamber 24 which extends transversely across the full width of the sheet path and which is supported in brackets 26 and 27 adjustably mounted on the horizontally disposed side bars 28 and 29 of the conveyor frame. The vacuum chamber is formed from a substantially U-shaped channel member

having a bottom wall 31, and spaced, vertical side walls 32 and 33, and each end thereof is effectively sealed by a plate 34 which is secured in position by means such as the bolts 35. At least one and preferably two or more exhaust ports 36 are provided in the side wall 33 of the vacuum chamber, each of which is formed with a projecting collar or nipple 37. Flexible ducts 38 are fastened to the respective nipples and connect the vacuum chamber with the suction side of a high capacity blower 39 which may be driven at the required speed by suitable means such as the electric motor 41.

Mounted within the vacuum chamber 24 is a suction or sheet control roller 43, the journals 44 and 45 of which are rotatably mounted in the end plates 34 of the vacuum chamber and in a manner that the periphery of the roller projects above the respective side walls 32 and 33. In its operative position the periphery of the suction roller is arranged to be substantially tangent to the horizontal path of the sheets and it is adapted to be rotated in the same direction as, but at a reduced speed with respect to the conveyor so as to effectively control and retard the sheets upon their release by the delivery grippers. The main body portion of the suction roller is comprised of a hollow cylinder which is provided with relatively large, closely spaced, perforations or apertures 46 over its entire periphery and the ends of the cylinder are effectively sealed by means of discs 47 formed integral with the respective journals. Preferably, the apertures in the roller surface should occupy about half the total area thereof so that a large volume of air can be drawn through the roller whereby to effectively control the sheets as they are drawn thereover.

In order to restrict the movement of air to the apertures in the roller, the spaces between the respective side walls of the chamber 24 and the roller periphery are sealed to the atmosphere by means of thin flexible strips 48 which are mounted between backing plates 49. The respective assemblies are secured along the top edges of the side walls of the vacuum chamber in a manner that the projecting edges of the strips bear against the roller periphery. The strips are arranged to engage the roller periphery on each side of the vertical center line thereof whereby a predetermined arc of the roller periphery is exposed adjacent to the sheet path and thus a maximum area of the roller's surface, extending the full length thereof, is available for engagement with the sheets.

From the description thus far, it will be evident that when the device is in operation the blower 39 is adapted to displace a relatively large volume of air, all of which must pass through the apertures 46 in the exposed portion of the suction roller 43. It will also be noted that the air will be drawn inwardly toward the axis of the roller through the apertures 46 in that portion of the roller periphery which is exposed, whereas, it will be drawn outwardly through the apertures in the enclosed portion of the roller and thence through the tubes 38 to the blower 39. Moreover, as the roller 43 rotates, the respective apertures pass successively from the exposed portion to the enclosed portion, and so forth, so that the direction of air passing through the apertures is intermittently reversed at regular intervals while the device is in operation. This is an important factor which renders the suction device substantially self-cleaning and precludes clogging of the openings with spray particles or paper dust. Not only do the relatively large diameter apertures tend to preclude the possibility of particles becoming lodged therein, but the constant reversal of the air travelling therethrough will effectively dislodge any particles that may adhere along the edges and thus prevent them from accumulating and eventually clogging the aperture.

Although the major portion of such particles will be blown out through the blower in the normal course of operation, it is inevitable that some will collect on the bot-

tom of the vacuum chamber. To facilitate the removal of such particles after extended periods of operation, a series of access openings 51 are provided in the bottom wall of the vacuum chamber. These openings are normally closed by cover plates 52 which are slidable in the guide channels 53 formed on the bottom surface of the vacuum chamber so that they can readily be removed and replaced for cleaning purposes.

It will be evident that when the delivery mechanism is in operation and the sheets are being conveyed by the conveyor grippers toward the delivery pile, the body portion of each sheet is drawn over the suction roller in a path substantially tangent thereto. As the tail end of the sheet passes around the curved end of the guide 16, however, it tends to flutter and wave in an erratic unpredictable manner under the influence of centrifugal force and normal air turbulence and thus is difficult to control. Heretofore in order to overcome this condition, it has been essential to provide auxiliary blowers above the sheet path and adjacent the end of the guide 16 whereby to reduce the extent of fluttering of the sheets and to force the trailing portions thereof down into engagement with the control surface of the retarding means.

With the present invention, the need for such auxiliary equipment is completely eliminated. The blower 39, as stated herein, is capable of displacing a large volume of air, all of which obviously must be drawn through the apertures in the exposed portion of the roller 43. This has the effect of creating a relatively strong, downwardly directed current of air in the area immediately above the suction roller and which is sufficient in itself to maintain control of the trailing portion of each sheet and to draw the sheet downwardly into contact with the roller surface, whereupon suction within the roller will maintain control of the sheet until it has been decelerated and deposited on the pile.

Although the blower 39 is effective to displace a large volume of air, it is incapable of creating a high vacuum, even though the trailing portion of a sheet may close off all of the apertures in the exposed portion of the roller. Thus, while the suction is adequate to maintain the sheet in contact with the roller surface, it is not great enough to prevent the sheet from slipping relative thereto while its leading edge is still engaged by the delivery grippers. Consequently, there is no danger that the sheet will be torn or pulled out of the conveyor grippers during the period when its leading edge is engaged by the grippers and its trailing end is under control of the suction roller. Upon its release by the grippers, however, the suction is effective to immediately retard the sheet to the surface speed of the roller, continued rotation of which will advance the sheet onto the pile where it is jogged into position by the side and rear jiggers.

With some paper, particularly light weight coated stock, static electricity in the sheet may cause the tail end thereof to cling to the vacuum chamber and thus interfere with the delivery of the following sheets. To preclude this condition, a static eliminator 54 may be provided between the vacuum chamber and the rear jiggers 21 to discharge the static charge in the sheet so that it will settle onto the pile and can be jogged into position in an orderly fashion.

The suction roller 43 is adapted to be driven at its reduced speed with respect to the chain conveyor and in the same direction therewith by means of a sprocket 55 which is rotatably mounted in the bracket 26 so as to mesh with the lower run of the delivery conveyor chain 10 at a point where it is supported on the guide or track 56. The sprocket shaft 57 is rotatably mounted in the bracket 26 and carries at its free end a gear 58 which is adapted to transmit rotary motion through an idler gear 59 rotatably mounted on the stud 60, to a gear 61 secured to the end of the shaft 62. The latter is rotatably mounted in the bracket 26 and is provided at its free end with gear teeth 63. A gear 64, mounted on the end of

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the roller journal 44, is adapted to mesh with the gear teeth 63 and thus transmit rotary motion through the journal to the roller 43. Therefore, when the delivery conveyor is in operation, the suction roller will be driven at a speed proportional thereto and this speed may be readily varied to meet specific requirements by changing the ratio of the respective drive gears.

The sheet retarding unit is also mounted so as to be adjustable longitudinally in the path of the sheet in order to accommodate any sheet size within the maximum and minimum limits of the press. Such adjustments are accomplished by means of a hand wheel 66 which is secured to the end of a transverse shaft 67 rotatably mounted in the brackets 26 and 27. Gears 68 and 69, mounted adjacent the respective ends of said shaft, are adapted to mesh with the respective idler gears 70 and 71 rotatably mounted on their respective supporting shafts 62 and 72 and which in turn are arranged to mesh with racks 73 and 74 formed in the bottom edges of the respective side bars 28 and 29. Thus it will be seen that when the handwheel 66 is rotated, the respective gears and racks coact to impart relative motion to the brackets 26 and 27 and thereby to the suction device, whereby to vary its position with respect to the delivery table and in accordance with a specific sheet size.

Adjustability of the suction device longitudinally in the sheet path has the further advantage in that it makes possible adjustment of the control roller whereby to vary the retarding effect upon each sheet in accordance with the weight of the stock being processed. In other words, the position of the suction roller can be adjusted with respect to the point at which the leading edge of a sheet is released by the conveyor grippers and which is determined by the position of the cam 19, to thereby increase or decrease the length of time of engagement of the suction roller with the sheet after it has been released by said grippers.

The position of the suction roller should be such that each sheet will be effectively retarded and then advanced off the suction roller approximately within the time interval as determined by the space between succeeding sheets so that the trailing portion of a preceding sheet will not cover any portion of the suction roller and thereby adversely affect its controlling action upon the next succeeding sheet.

To supplement the adjustability of the suction roller, cam 19 also is adjustable whereby to advance or retard the point of release and, moreover, the surface speed of the roller can also be adjusted to thereby vary its retarding effect by changing the ratio of the drive gears. These various adjustments provide flexibility whereby any size and weight of stock, within the normal limits of the press, can be delivered at maximum press speed and adequately controlled for deposit upon a delivery pile in an accurately aligned stack. Moreover, the ability of the device to operate efficiently for unlimited periods of time permits increased production by eliminating frequent shut downs for maintenance purposes.

The present invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will of course be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a sheet delivery mechanism the combination comprising an endless conveyor, grippers on said conveyor for conveying sheets in a predetermined path and for releasing the sheets at a point of delivery, a vacuum chamber over which the sheets are drawn prior to their release by said grippers, a hollow cylinder having a multiplicity of perforations distributed about its periphery, means mounting said cylinder for rotation within said chamber and in a manner that a minor segment of its

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periphery is exposed adjacent said path for engagement with the sheets, suction means for evacuating said chamber whereby air is drawn inwardly through the perforations in the exposed portion of said cylinder and outwardly through the perforations in the enclosed portion thereof to thereby maintain the body of each succeeding sheet in intimate contact with the exposed segment of said cylinder while the sheet is still being conveyed by said grippers, and means for rotating the cylinder in the same direction but at a reduced surface speed with respect to said conveyor whereby said cylinder is effective to retard each sheet upon its release by said grippers.

2. In a sheet delivery mechanism the combination comprising, an endless conveyor, grippers on said conveyor for conveying sheets in a predetermined path and for releasing the sheets at a point of delivery, a vacuum chamber mounted below the path of the sheets and extending across the full width thereof, a hollow cylinder having a multiplicity of perforations distributed about its periphery, means mounting said cylinder for rotation within said chamber and in a manner that a minor segment of its periphery is exposed adjacent said path for engagement with the sheets, suction means for evacuating said chamber whereby air is drawn inwardly through the perforations in the exposed portion of said cylinder and outwardly through the perforations in the enclosed portion thereof to thereby maintain the body of each sheet in intimate contact with the exposed segment of said cylinder, and means for rotating the cylinder whereby its exposed surface travels in the same direction as, but at a reduced speed with respect to said conveyor whereby said cylinder is effective to retard each sheet upon its release by said grippers.

3. In a sheet delivery mechanism the combination comprising, an endless conveyor, grippers on said conveyor for conveying sheets in a predetermined path and for releasing the sheets at a point of delivery, a vacuum chamber mounted transversely below the path of the sheets and extending across the full width thereof, said chamber comprising a channel member having a bottom wall and vertically projecting side walls, a hollow cylinder having perforations distributed about its entire periphery, said cylinder being coextensive with said chamber, means mounting said cylinder for rotation about a fixed axis in said chamber and in a manner that a portion of its periphery extends above said side walls, means secured to each side wall and adapted to engage the surface of said cylinder to thereby seal said chamber from the atmosphere and whereby a minor segment of the cylinder periphery is exposed adjacent said path for engagement with the sheets, suction means for evacuating the chamber whereby air is caused to flow inwardly through the perforations in said exposed portion of the cylinder and outwardly through the perforations in the enclosed portion thereof, and means for rotating said cylinder whereby its exposed surface travels in the same direction as, but at a reduced speed with respect to said conveyor whereby said cylinder is effective to retard each sheet upon its release by said grippers.

4. In a sheet delivery mechanism the combination comprising, an endless conveyor, grippers on said conveyor for conveying sheets in a predetermined path and for releasing the sheets over a delivery pile, a vacuum chamber mounted transversely below the path of the sheets and extending across the full width thereof, said chamber comprising a channel member having a bottom wall and vertically projecting parallel side walls, a hollow cylinder having perforations distributed about its entire periphery, means mounting said cylinder for rotation about a fixed axis in said chamber and in a manner that a portion of its periphery extends above said side walls, a resilient blade secured to each side wall, said blades being coextensive with said chamber and adapted to engage the surface of said cylinder to thereby seal said chamber from the atmosphere, the free edges of said blades being

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spaced from each other whereby to expose a minor segment of the cylinder periphery adjacent said path for coaction with the sheets, suction means for evacuating said chamber whereby air is caused to flow inwardly through the perforations in the exposed portion of said cylinder and outwardly through the perforations in the enclosed portion thereof, the resultant downward current of air being adapted to maintain the body of each sheet in intimate contact with the cylinder, and means for rotating said cylinder at a reduced surface speed with respect to said conveyor, whereby said cylinder is effective to retard each sheet upon its release by said grippers.

5. In a sheet delivery mechanism the combination comprising, an endless conveyor, having grippers for conveying sheets in a predetermined path and for releasing them at a point of delivery, a vacuum chamber over which the sheets are drawn by said conveyor, hollow cylinder mounted for rotation in said chamber and in a manner that a minor segment of its peripheral surface extending the full length thereof is exposed adjacent said path for coaction with the sheets, said cylinder being perforated about its entire periphery, suction means for evacuating said chamber whereby air is caused to flow inwardly through the perforations in the exposed portion of said cylinder and outwardly through the perforations in the enclosed portion thereof, the resultant movement of air

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being effective to maintain the body of each sheet in intimate contact with the exposed segment of said cylinder, and drive means for rotating said cylinder at a reduced speed with respect to said conveyor whereby the movement of air through said perforations is intermittently reversed as the perforations travel from the exposed position to the enclosed position of said cylinder and whereby said cylinder is effective to retard each sheet upon its release by said grippers.

6. Mechanism as set forth in claim 5, additionally including means for operatively connecting the drive means with the endless conveyor whereby the drive means for rotating the cylinder is in turn driven by the conveyor.

7. Mechanism as set forth in claim 5, additionally including manually operable means for effecting bodily movement of the vacuum chamber and cylinder as a unit and in a direction parallel to the path of the sheets whereby the chamber and cylinder can be adjusted with relation to the size of the sheets and the point of release of said sheets by the conveyor.

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