Sept. 1, 1942. S. A. HUFFMAN 2,294,407

SHEET HANDLING MECHANISM

Filed Oct. 13, 1939 3 Sheets-Sheet 1

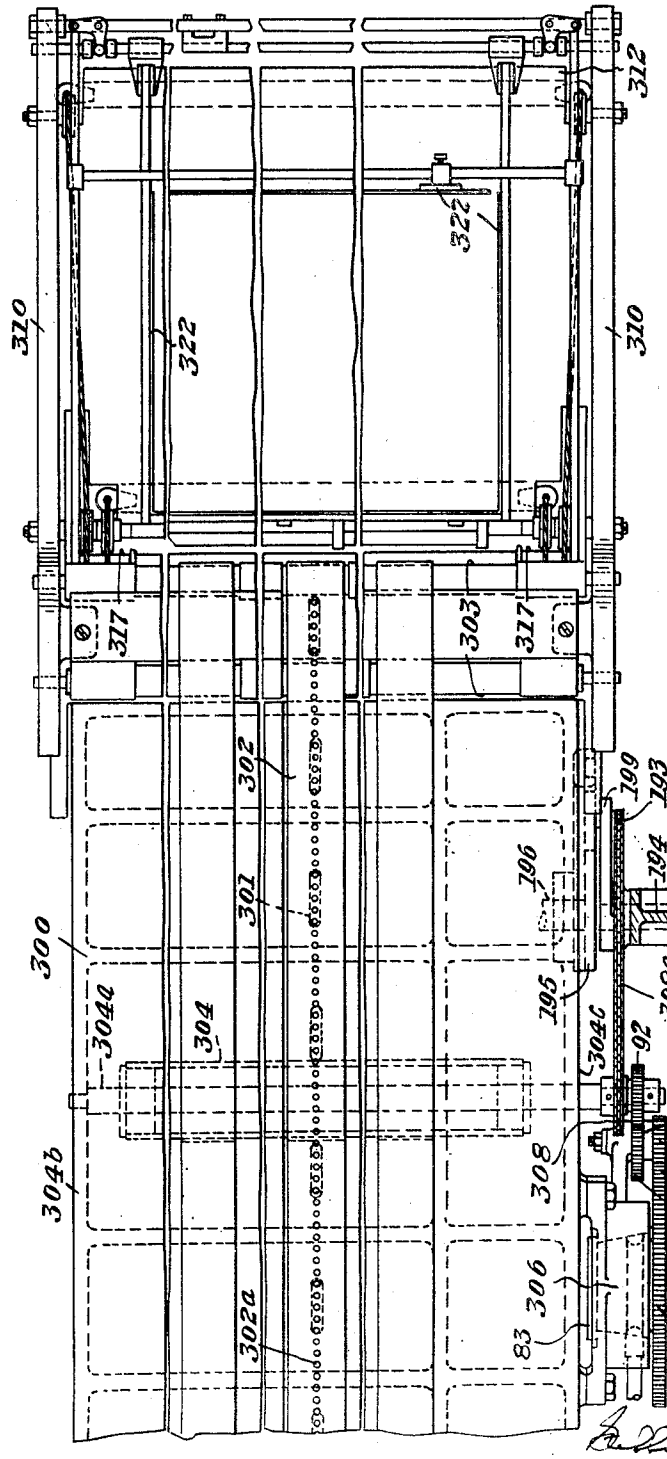

Fig. 1.

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SHEET HANDLING MECHANISM

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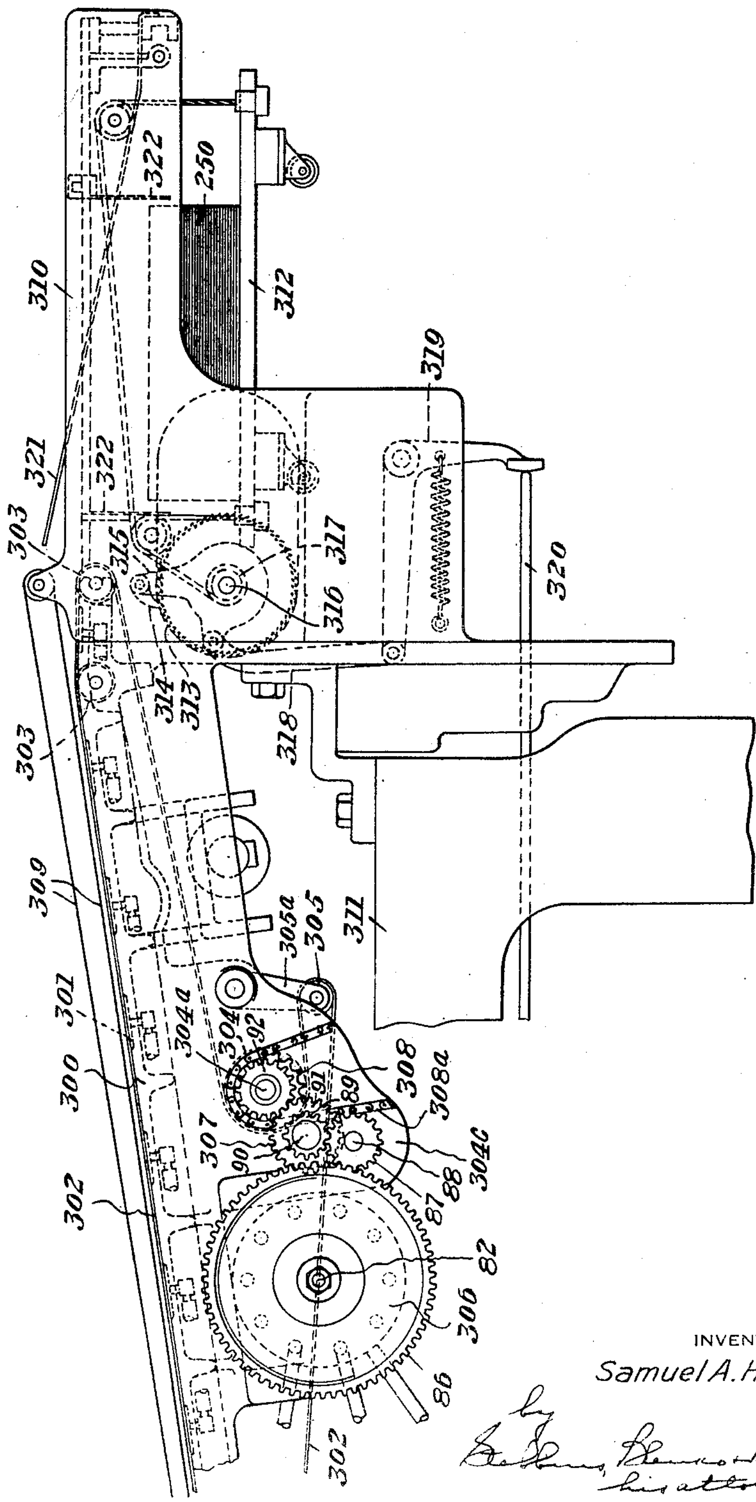
Fig. 2.



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Sept. 1, 1942. S. A. HUFFMAN 2,294,407

SHEET HANDLING MECHANISM

Filed Oct. 13, 1939 3 Sheets-Sheet 3

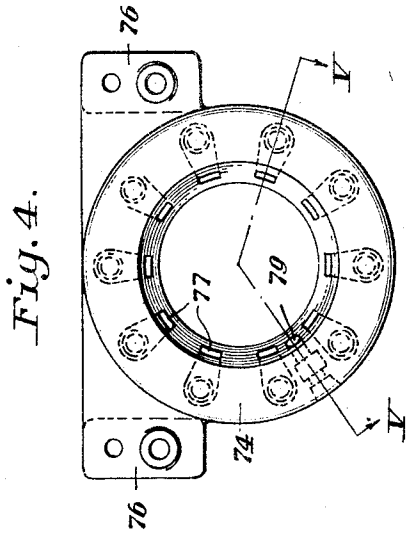

Fig. 4.

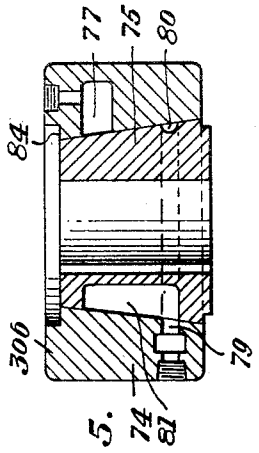

Fig. 5.

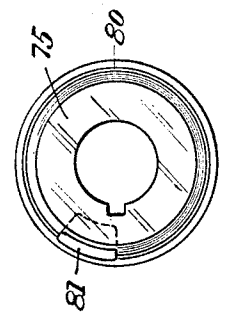

Fig. 6.

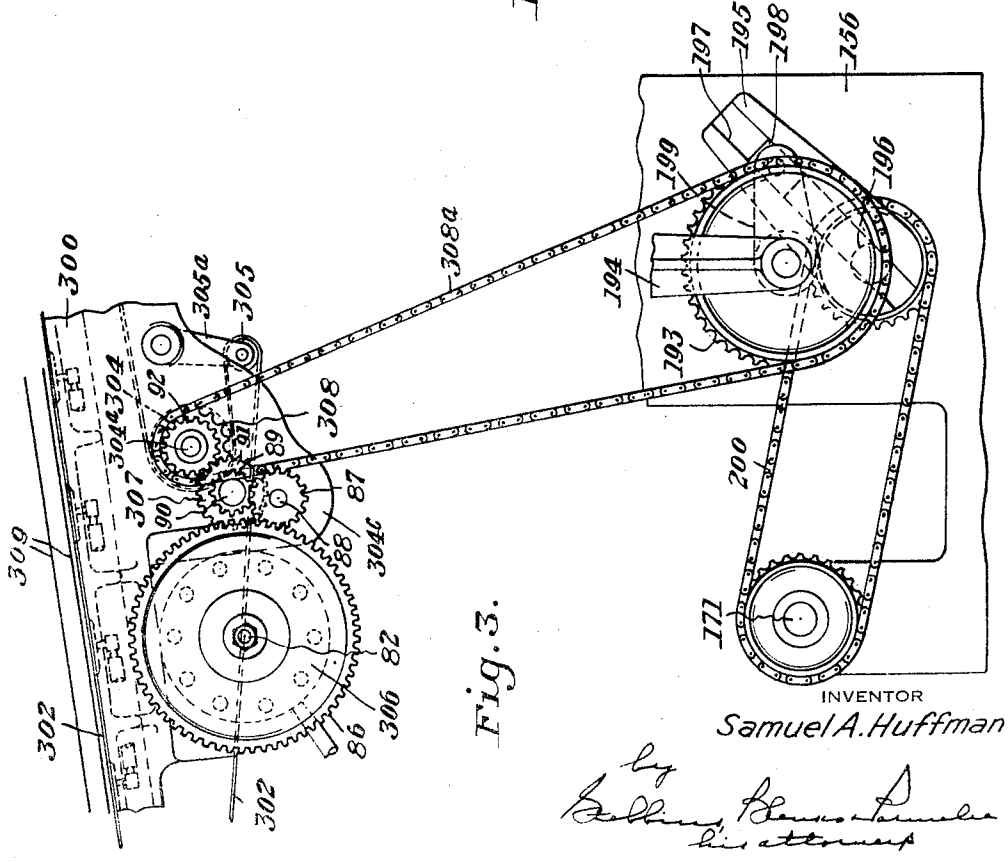

Fig. 3.

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UNITED STATES PATENT OFFICE

2,294,407

SHEET HANDLING MECHANISM

Samuel A. Huffman, Avalon, Pa., assignor to Miller Printing Machinery Co., Pittsburgh, Pa., a corporation of Pennsylvania

Application October 13, 1939, Serial No. 299,309

4 Claims. (Cl. 271—74)

This invention relates to the art of handling sheets, for example the handling of sheets singly from a processing machine (such as a printing press or the like) and disposing of them in suitable condition for further handling. This application is in part a continuation of my copending application Serial No. 199,167.

The problem of handling sheets is encountered in various industrial operations. The best known of such applications is the feeding of sheets to a printing press and the delivery of sheets therefrom. This invention is particularly adapted to such application and will be described with special reference to the delivery of sheets from a printing press, although the invention is not limited to this application but has other uses as well.

Sheet handling mechanisms for printing presses have heretofore included reciprocating members of considerable mass. Any attempt to operate such equipment at high speed introduces objectionable stress, shock and vibration. It is an object of the invention, therefore, to improve generally on sheet handling mechanisms as known heretofore, anad particularly to avoid reciprocating parts to a large degree, thus permitting high speed operation without the aforementioned objectionable stress, shock and vibration. In accordance with the invention I employ endless belts for advancing sheets successively. The belts travel over a suitably formed table or other support and I provide vacuum means for progressively holding a sheet in contact with the travelling belts. The application of vacuum to the sheet at each point in its path of travel is controlled automatically to insure the desired movement without crumbling or other injury to the sheet.

The invention may take numerous different forms, and the following detailed description will cover only one of the numerous possibilities. The form of the invention to be described herein with reference to the accompanying drawings is a conveyor adapted to receive sheets successively from a printing press and deliver them to a suitable pile support.

In the drawings:

Figure 1 is a plan view of a conveyor mechanism adapted to receive sheets after passing through a press and deliver them to a suitable pile support;

Figure 2 is a side elevation thereof;

Figure 3 is a fragmentary elevational view showing the driving means for the perforated belt and for the vacuum control valve;

Figure 4 is an elevation of the stator of a rotary valve employed to control the vacuum applied progressively to the sheets for holding them in contact with the conveyor belt;

Figure 5 is a sectional view through the stator and rotor of the valve taken along the line V—V of Fig. 4; and

Figure 6 is an elevation of the rotor of the valve.

The principle of the invention is applicable to the delivery of sheets singly after processing in any sort of machine such as a printing press, and piling them accurately on a suitable support. Such a structure is shown in the drawings. As there shown, a delivery board **300** has vacuum ports **301** spaced therealong adapted to cooperate with a perforated belt **302**. The belt **302** is trained about guide sheaves **303**, a driving sheave **304** and a tightener sheave **305**. The driving sheave **304** is mounted on a shaft **304***a* so as to rotate therewith. The shaft **304***a* is journalled in side arms **304***b* and **304***c* to which the delivery board **300** is secured. The tightener sheave **305** is mounted on links **305***a* pivoted to the side arms **304***b* and **304***c*. Keyed to the shaft **304***a* is a sprocket **308** through which the shaft is driven at variable speed by a sprocket chain **308***a* which in turn is operated by mechanism now to be described.

A sprocket **193** is journaled on a bearing bracket **194** dependent from a portion **156** of the side frame. The sprocket chain **308***a* meshes with the sprocket **193**. A crank **195** is journaled on a shaft **196** extending laterally from the side frame portion **156** and has a slide **197** thereon and which reciprocates a block **198**. A crank **199** carried by the sprocket **193** has a pivotal connection with the block **198**. The crank **195** is driven from a constant speed drive shaft **171** by a chain and sprocket drive **200**.

It will be apparent that the elements just described cause the sprocket **193** to move at maximum angular velocity when the throw of the crank **195** is a maximum, i. e., when the crank extends substantially upward. Similarly, the sprocket **193** moves at its minimum angular velocity when the crank **195** extends downwardly. The variation in the speed of the sprocket **193** is caused by the eccentricity between its axis and that of the crank **195**.

The sprocket chain **308***a* meshing with the sprockets **308** and **193** constitutes the means whereby the former is driven from the latter. By means of the mechanism just described the sprocket chain **308***a* is driven at variable speed

and the parts of the drive mechanism are so dimensioned and arranged that the belt 302 travels at its minimum speed when vacuum is applied to the port 301 nearest the right hand end of the delivery board 300 in a manner presently to be described. By this means a sheet advanced by the belt 302 is decelerated almost to a standstill on approaching the right hand end of the delivery board.

In order to cause the belt 302 to advance a sheet delivered thereto over the delivery board 300 to a pile indicated at 250 from the cylinder of a press or other mechanism (not shown) disposed at the left of the delivery mechanism, I provide means for applying vacuum progressively to the ports 301. The belt 302 has a series of longitudinally spaced perforations 302a through which vacuum applied to the ports 301 causes a sheet delivered to the board 300 to be held against the belt 302 by atmospheric pressure. I provide a rotary valve for controlling the application of vacuum to the ports 301 in a manner such that the point at which vacuum is applied at any instant will coincide substantially with the position of the leading edge of a sheet moving along the board at that instant. The valve is shown in Figs. 4 through 6 and is indicated generally in Figs. 1 through 3 by the numeral 306. The valve comprises a stator 74 and a rotor 75. The stator has feet 76 whereby it is secured to pads formed on the side of the board 300. The stator has a tapered bore and the rotor is correspondingly shaped for cooperation therewith. Ports 77 are spaced circumferentially of the bore through the stator. Hose connections (not shown) extend between fittings screwed into tapered holes in the stator 74 and the board 300, communicating respectively with the ports 77 and the ports 301. A main vacuum port 79 formed in the stator 74 is similarly connected to a vacuum pump (not shown).

An annular groove 80 is formed in the rotor 75 and is so positioned axially thereof as to overlie the port 79. A recess 81 formed in the rotor communicates with the groove 80 and is adapted successively to overlie the ports 77 on rotation of the rotor. By this means the ports 301 are successively connected to the vacuum pump as the recess 81 passes over the ports 77 to which the ports 301 are connected. As shown in Fig. 6, the recess 81 is wide enough to overlie two adjacent ports 77 simultaneously. This insures that at least one of the ports 301 will have vacuum applied thereto at all times, or, in other words, that before vacuum is cut off from one port it will be applied to the next succeeding port. Continuous traction of the belt 302 on the advancing sheet is thus assured.

The rotor 75 is keyed to a shaft 82 having a flange 83 engaging a bearing surface 84 on the stator 74. The shaft 82 carries a gear 86 meshing with a pinion 87 keyed to a stub shaft 88. The pinion 87 meshes with a pinion 89 keyed to a stub shaft 90. Also keyed to the stub shaft 90 is a pinion 91 which meshes with a pinion 92 keyed to the shaft 304a. Thus the rotor 75 of the valve 306 is driven from the shaft 304a in timed relation with the delivery of sheets to the left hand end of the board 300. Hold-down tapes 309 may be driven at the same speed as the belt 302 by a drive (not shown) deriving its power from the shaft 304a.

Pile supporting frame members 310 are carried on a base 311 which may be the side frames of a printing press if the delivery is installed in connection with this particular type of sheet processing machine. A pile support 312 is suspended from the members 310 by cables and pulleys. Automatic lowering means for the support 312 include a ratchet wheel 313 adapted to be advanced periodically by pawl 314 on an oscillating crank 315. The ratchet wheel is geared to a shaft 316 through suitable reduction gearing (not shown) and the cables suspending the support 312 are wound on drums 317 on the shaft. The crank 315 is oscillated by a link 318, a bell crank 319 and a push rod 320. The latter is reciprocated by any suitable means in timed relation with the delivery of sheets.

Sheets delivered to the board 300 are moved therealong by the belt 302 because of the application of vacuum successively to the ports 301, thus serving to hold the leading edge of each sheet tightly against the traction belt. When the leading edge of the sheet reaches the end of the board 300, it is beyond the zone of the last vacuum port 301 and is thus free to move away from the belt. Deflector members 321 guide the sheets downwardly onto the pile as they are discharged from the end of the delivery board. The frame members 310 are provided with the usual jogger box 322 and operating mechanism therefor whereby the sheets are piled accurately and squarely.

It will be seen from the above description that the travelling vacuum belt provides a very effective means for delivering sheets successively after processing to a pile support for stacking. I find it particularly advantageous to operate the belt at variable speed and so timed relatively to the movement of the articles being delivered thereto as to receive such articles while the belt is moving at approximately the same speed as that at which the articles are themselves moving when delivered to the belt. This is preferably approximately the maximum speed of movement of the belt during its variable speed movement and preferably the articles are carried by the belt and their speed is reduced while they are being so carried and they are discharged or delivered from the belt at the delivery end thereof when the belt is moving relatively slowly and preferably when its speed is approximately the minimum. This is of particular advantage in the delivery of sheets from a printing press or similar mechanism to a pile as the sheets are moving at fairly high speed when delivered from the press and must be brought to a stop when delivered to the pile. Preferably the maximum speed of the belt is approximately equal to the speed of delivery of the sheets from the press and the minimum speed of the belt is reached during each cycle at approximately the time when a sheet is delivered from the delivery end of the delivery mechanism.

Although I have illustrated and described herein but a preferred form of the invention, it will be understood that changes in the construction and operation disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. A sheet delivery for a printing press comprising a continuously driven belt conveyer upon which the sheets are adapted to be discharged at relatively high speed from the printing press, means for driving the conveyer at relatively high speed when a printed sheet is delivered to it and for thereafter rapidly decelerating the movement of the conveyer for delivering the

printed sheet therefrom at a relatively low speed, and means for applying suction progressively effective in timed relation to the movement of the conveyer for holding down the printed sheet against the conveyer so as to prevent curling and skidding of the printed sheet on the conveyer as the movement of the conveyer is decelerated.

2. Sheet conveying apparatus comprising a continuously driven belt conveyer upon which sheets are delivered at a relatively high speed, means for driving the conveyer at approximately the speed of a sheet as delivered to it and then rapidly decelerating the movement of the conveyer so as to deliver the sheet therefrom at a relatively low speed, and means for applying to the sheet a suction progressively effective in timed relation to the movement of the conveyer so as to hold down the sheet against the belt and prevent curling and skidding of the sheet on the conveyer as the movement of the conveyer is decelerated.

3. Sheet conveying apparatus comprising a continuously driven belt conveyer upon which sheets are delivered at one speed, means for driving the conveyer at a speed approximating that of a sheet as it is delivered to the conveyer and for thereafter rapidly changing the speed of the conveyer to deliver the sheet therefrom at a different speed, and means for applying to the sheet a suction progressively effective in timed relation to the movement of the conveyer for holding down the sheet against the conveyer so as to prevent curling and skidding of the sheet on the conveyer as the speed of the conveyer is changed.

4. Sheet handling mechanism for handling sheets in connection with a printing press or the like comprising a variable speed belt conveyer upon which sheets are adapted to be moved and means for applying suction progressively effective in timed relation to the movement of the conveyer for holding down the sheets against the conevyer so as to prevent curling and skidding of the sheets on the conveyer as the speed of movement of the conveyer changes.

SAMUEL A. HUFFMAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,294,407. September 1, 1942.

SAMUEL A. HUFFMAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 37, for "tapered" read --tapped—; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of October, A. D. 1942.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)