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METHOD FOR CONTROLLING THE HEIGHT OF A PILE OF DELIVERED SHEETS

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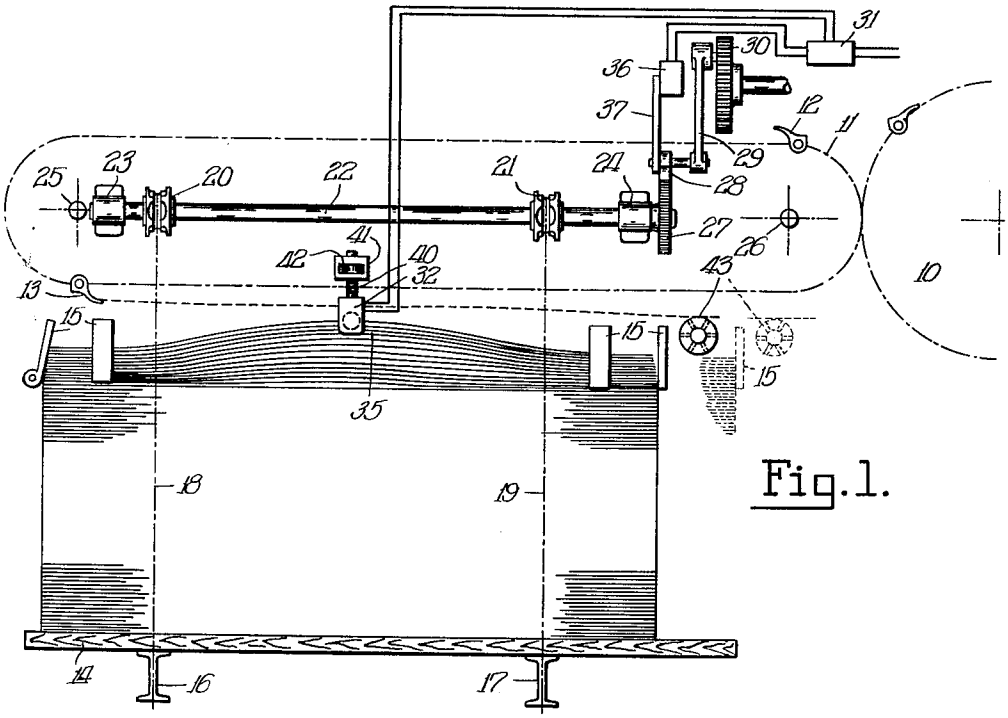


Fig. 1.

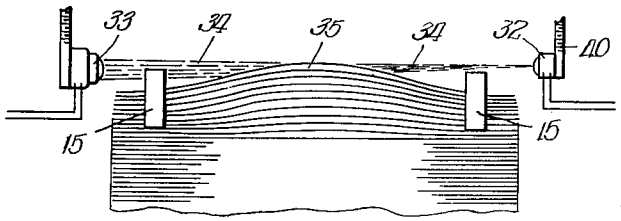
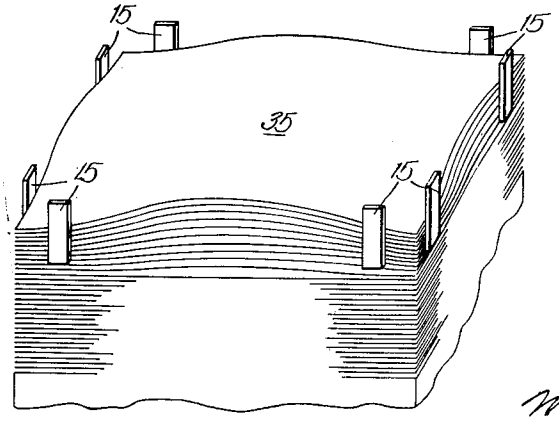


Fig. 3.

Fig. 2.



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METHOD FOR CONTROLLING THE HEIGHT OF A PILE OF DELIVERED SHEETS

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1 Claim. (Cl. 271—88)

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This invention relates to the art of delivering sheets of paper or the like from printing presses operating on large sheets and capable of producing printed sheets in excess of 6,000 per hour.

More specifically the invention pertains to a novel method of controlling the height of a pile of delivered sheets by means of an electronic device.

Heretofore, it has been common practice in sheet delivering machinery, to automatically control the movement of a sheet receiving member, such as a delivery table, by means of mechanical feeler devices which are intermittently applied to contact the top edge of a more or less firmly stacked pile of delivered sheets to thereby initiate motion of mechanism for maintaining the top of the pile at a predetermined level.

In machines which handle and deliver sheets at speeds not exceeding 4000 sheets per hour, such conventional means do operate satisfactorily because at these speeds a sheet, after having been deposited by the sheet carrier of the delivery means, can soon flatten out on the stack of previously delivered sheets. In other words, the air which is trapped between each individual sheet as it floats down onto the stack after having been released, has ample time to escape from beneath a sheet so that the sheet can settle on the stack and flatten out before a successive sheet is released by the delivery mechanism. Consequently a substantially firm and unyielding support along the margin of the pile is maintained unto which the mechanical pile height controlling means may be applied, without disturbing the alignment of sheets while they are floating down onto the previously stacked and aligned sheets.

This condition changes, however, when the above quoted rate of delivering sheets is increased to say 6–7 thousand sheets per hour, particularly so when large sheets of comparatively light stock are involved. At such increased speeds, a considerable number of sheets after having been released by the delivery mechanism, remain suspended for a comparatively long period before all of the air between them can escape beyond the margins of the sheets. Not only do the sheets build up a marked bulge over the middle portion of the delivered pile but they also present a fluffed margin around all four sides and at the corners of the sheets.

Mechanical feelers which operate by contacting the top edge of the pile of sheets must be applied and retracted quickly between each delivered sheet in order to allow the sheets to deposit

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themselves unto the pile and come to rest in accurate alignment with the previously deposited sheets. By increasing the rate of delivering sheets, the time avaliable for applying and retracting the feelers becomes correspondingly decreased resulting in consequent difficulties for maintaining proper adjustments of the mechanical parts involved.

I have found furthermore that by applying any conventional mechanical pile height controlling means to the margin or elsewhere of a stack of sheets in such suspended, i. e. floating condition, the position of the individual sheets as they float down becomes disturbed, and as a result it is impossible to true up the sheets and obtain a smooth delivery pile in which the sheets are accurately aligned.

For numerous and obvious reasons it is highly desirable and in many cases essential that the delivered sheets be stacked in accurate superimposed relation. For example, much labor and time is saved in label jobs where the pile of delivered printed sheets is transferred to a power paper cutting machine in order to cut out the individual labels.

Another instance which demands accurate stacking of delivered sheets occurs in multicolor printing where sheets are run through a press several times to receive consecutive impressions.

Realizing these and other facts, the primary object of my invention is to provide a novel method, including the use of electronic control means, whereby the stated requirements may be accomplished without in any manner interfering with the delivered sheets while they are floating down onto their support.

A further object of the invention is to include in this novel method the steps of directing a beam of light across the top of a delivered bank of floating sheets and to actuate the pile height controlling mechanism upon complete interception of said beam by the uppermost one of a still floating bank of sheets delivered by the sheet conveyor.

Other objects of the invention will be apparent from the following description and appended claim.

One preferred means whereby the basic principle of my novel method may be accomplished is illustrated in the accompanying drawings in which:

Figure 1 is a diagrammatic illustration depicting the delivery end of a printing press with which my invention is associated;

Figure 2 is a perspective view of the delivery

pile, showing to a slightly exaggerated degree the bulge which builds up when large sheets are delivered at speeds above 4000 sheets per hour; and

Figure 3 is a fractional elevation of the delivery pile taken from the left of Figure 1 and illustrating the manner in which a photoelectric device and its associated source of light may be arranged to project a beam of light across the top of a delivered bank of floating sheets.

It will be understood that among the problems which my invention accomplishes, is that of keeping the highest point of the delivered pile of sheets sufficiently low to avoid interference with the sheet conveyor and with the oncoming sheet.

Referring now to Figure 1 of the drawings, 10 indicates in broken lines a sheet carrying member such as a transfer reel or cylinder of a printing press from which sheets carried thereby are transferred to an endless sheet carrier 11 also depicted in broken lines and provided with sheet engaging grippers 12, 13, whereby the sheets are taken over and conveyed from the member 10 and deposited onto the sheet receiving table 14. Conventional sheet jogging devices or blades 15 are provided to operate in the usual manner for the purpose of accurately aligning the delivered sheets as they accumulate on the table 14 to form a stack. Some, or all of these jogger blades are imparted intermittent motion to and from the delivered pile of sheets by mechanism well known in the art.

Preferably, and as indicated in Figure 1, the joggers 15 which are arranged along the front edge of the pile, are inclined so that the leading edge of the oncoming, bulged sheets will be engaged by them in order to align the sheets. This arrangement might also be applied with advantage to any or all of the other jogger blades 15.

As is well known in the art, the table 14 is preferably supported by I-beams 16, 17, which are suspended by means of link chains 18 and 19 respectively, indicated in broken lines, and which chains pass around chain pulleys 20 and 21 mounted on a shaft 22 which may be supported in any convenient manner by bearings 23 and 24 arranged on the frame of the delivery mechanism.

Any well known and convenient friction or clutch mechanism, not shown, may be employed to hold the shaft 22 against unintended rotation.

The conveyor or sheet carrier 11 includes a pair of endless delivery chains such as are widely used in sheet delivery mechanism of printing presses and similar machinery. These chains are driven in any approved manner through the intermediary of chain sprockets, not shown, and arranged at each end of the conveyor in bearings denoted at 25 and 26 respectively.

The means whereby the sheet receiving table 14 is lowered to thereby maintain the top of the delivery pile on the table at a substantially constant elevation comprises a ratchet mechanism which includes a ratchet wheel 27 and associated pawl 28, which latter is intermittently actuated to advance the ratchet wheel 27 and therewith rotate the shaft 22. The pawl 28 is reciprocated by means of a connecting arm 29 pivoted to the pawl and to a crank pin provided on a gear 30. The latter has a driving connection with any operating part of the press to rotate it continually.

It will be understood that so long as the pawl 28 remains in engagement with the ratchet wheel 27, the shaft 22 which carries the chain pulleys 20 and 21 will be rotated intermittently and thereby the table 14 will be lowered correspondingly. It is therefore necessary, in order to maintain the top of the pile of sheets delivered onto the table 14 at a substantially constant elevation, to disengage the pawl 28 from the ratchet wheel 27 and therewith interrupt the lowering of the table 14 until sufficient sheets have been deposited onto the delivery pile to necessitate a further lowering of the table.

Heretofore this intermittent lowering of the sheet receiving table has been controlled by such means as mechanical pile height detecting mechanism, ratchet set wheel and hand operated lowering mechanism, all well known in the art and which were applied to the edge of a pile of sheets in a manner that when a predetermined height of the pile was built up by the oncoming delivered sheets, the delivery table lowering means would be actuated.

As indicated herein, when sheets are delivered at a rate surpassing 4000 sheets per hour, the air trapped between the individual sheets cannot escape correspondingly quick beyond the margin of the sheets, and as a consequence a "fluffy" bank comprising a large number of floating sheets develops. Furthermore, in the middle portion of such bank of floating sheets a high bulge builds up, see Figure 2 in particular, which shows in perspective a bank of still floating and separated sheets and the high bulge 35 which is being developed. I have found that under such conditions the conventional mechanical means such as have heretofore been used for controlling the height of a pile of delivered sheets cannot be applied because they disturb the position of the sheets while they are floating down onto the pile of previously delivered and stacked sheets, and therefore it is impossible to obtain a neat and accurately aligned pile of sheets.

Because of this fact it becomes necessary to provide some means which shall not disturb the position of the still floating individual sheets and to apply such means preferably to the central portion of the bulge of the floating sheets rather than to the edge or margin of the pile of sheets.

While it will be understood that the means whereby such object could be readily accomplished may include mechanically or pneumatically operated devices, I have conceived the provision of photoelectric elements which can be applied very conveniently and which have proven most reliable in operation.

In Figures 1 and 3 I have illustrated schematically a suitable photoelectric device and manner of applying it to the delivery of a printing press. This device includes a switch box 31 through which electric energy is furnished to the photoelectric cell 32 and to the light projector 33.

My preferred arrangement of the cell 32 and projector 33 is such that a beam of light 34 is directed across the central portion of the bulge 35 of a bank of floating sheets and in a manner that when the bulge has reached a predetermined height, see Figure 3, the beam 34 will be completely intercepted.

If for any reason it is found desirable, a plurality of photoelectric cells and associated parts may be disposed over the entire top of a pile so as to operate in conjunction for the purpose of accomplishing the objects of my invention.

As indicated herein the pawl 28 is held out of engagement with the ratchet wheel 27 until it

becomes necessary to again lower the table 14 upon the pile of sheets thereon, i. e. the top of the bulge reaching a predetermined level. I propose to accomplish this by means of a solenoid 36 which remains energized so long as the light beam 34 is not completely intercepted by the delivered sheets. Operatively associated with this solenoid is a connecting rod 37 which in turn is pivotally attached to the pawl 28 and functions to hold the pawl out of engagement with the ratchet 27 until the beam 34 becomes completely intercepted during the acting stroke of the pawl.

This renders the solenoid inoperative, permitting the rod 37 to drop and the pawl and ratchet mechanism 28—30 to assume its function of rotating the shaft 22 to thereby lower the table 14 sufficiently to re-establish a completely or at least partially unintercepted beam of light across the top of the bulge 35, whereby the solenoid again becomes energized to disengage the pawl 28 from the ratchet 27 and consequently retain the table 14 in its lowered position.

I have found that the height of the bulge 35 varies, depending on the weight of stock and size of sheets to be handled. Therefore it is desirable to provide some means whereby the photoelectric cell 32 and preferably also the projector 33 may be adjusted up and down. This can be accomplished by a simple device such as I have indicated in Figure 1 and may include a threaded stem which extends through a bore provided in a bracket 41. This bracket is formed with a slot to accommodate an adjusting nut 42 screwed onto said stem 40, so that by turning the nut the photoelectric cell can be raised or lowered. A similar arrangement could be provided for likewise adjusting the projector 33.

In order to illustrate how the sheets are deposited unto the delivery pile by the endless conveyor 11 I have indicated in broken lines the position of a sheet just after it has been released by the grippers 13 and while the trailing edge of the sheet is still controlled by a conventional suction roller 43 or the like.

It is assumed that the sheets shown in Figure 1 are of average size, in which event the cell 32 and projector 33 are located at substantially the center between the ends of the sheets. When larger sheets are handled then of course the suction roller 43 and associated parts will be moved further back, as indicated in broken lines in Figure 1, and likewise when smaller sheets than the average size are to be delivered, the roller 43 and associated part must be moved a corresponding distance toward the front of the pile. I have found that by arranging the photoelectric

cell 32 and projector 33 off-center with relation to other than average size sheets, these elements will function equally well without modifying their off-center position.

While I have chosen to illustrate and describe one preferred means whereby the advantages of my invention may be realized, it will be understood that I may resort to any modification of elements and arrangements thereof without departing from the basic principle set forth herein and recited in the appended claim.

I claim:

In the method of delivering large sheets of light-weight paper at high speeds from a sheet processing machine to an adjustable sheet support, comprising the steps of conveying the sheets from said machine to a position immediately above said support, engaging the rear end of each sheet by restraining means immediately prior to their release by the conveying means to tauten the sheets in the direction of their travel and to retard their forward movement, releasing said sheets by said conveying means to drop them onto said support, said sheets, because of their light weight and the rapid speed of delivery, having a tendency to build up a bulge in the center due to the air trapped thereunder as they descend onto the support, directing a beam of light across the bulge formed by still floating sheets, applying said beam in a direction where it will be completely intercepted, at times, by the uppermost portion of said bulge, as new sheets are being delivered, impinging said beam onto an electronic control device, the complete interception of said beam by said bulge causing the operation of said control device to thereby lower said support until partial interception only of said beam, is again established, and finally positioning the settled sheets by jogging means after the air has escaped from thereunder.

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