The present invention relates to improvements in sheet separators of the comb type particularly applicable for the preliminary separation of successive sheets of a pile preparatory to the feeding off of sheets by any suitable forwarding mechanism. The combing type of separator has the advantage of being the most positive form of sheet separators.

The present invention comprises sheet separating combing means for effecting a preliminary partial separation of sheets, a sheet individualizing moving device and cooperating means for engaging the combed partially separated or relatively shifted sheets for the purpose of holding the top sheet in its combed partially separated condition during the action of the individualizing sheet moving device.

In the preferred embodiment of the invention the combing means, the individual sheet moving device and the combed sheet holding means are arranged to cooperate upon a corner of a pile of sheets. One or more arch-restricting feet may be employed to restrict the arching of the top sheets of the pile under the action of the sheet combing means. The combing means preferably take the form of the well-known combing wheel, while the individual sheet moving device is preferably in the form of the well-known suction separating element. With the improved combed sheet holding means, preferably in the form of a spring finger, arranged to engage the stepped or fanned-out edge of the combed portion of the pile, the upper sheets of the pile are retained in their combed and arched condition between said spring finger and an arch confining foot so that the suction or other form of individual sheet moving device can more readily take hold of the top sheet without disturbing the under sheets, said spring finger retaining its engagement with the combed portion of the pile to hold the top arched sheet in its combed partially separated condition while it is engaged and raised by said suction or other sheet moving device, the edge of the top engaged sheet slipping from under the spring finger which then directly engages the next under sheet and prevents the under sheet or sheets from further movement with the top sheet.

In order that the invention may be fully understood it will first be described with reference to the accompanying drawings and the novelty afterwards pointed out in the annexed claims.

In said drawings Figure 1 is a plan view of a portion of a paper feeding machine equipped with the improved preliminary separating mechanism;

Figure 2 is a side view of the same;

Figure 3 is a vertical sectional view taken on the line 3—3 of Figure 1, the comb wheel being in action;

Figure 4 is a similar view taken on the line 4—4 of Figure 1, the comb wheel being elevated and the suction device being lowered from the position of these parts shown in Figure 1;

Figure 5 is a similar view taken on the line 5—5 of Figure 1, the comb wheel and the short arch-restricting foot being elevated from the position shown in Figure 1, and the suction device holding the top combed sheet raised from the pile;

Figure 6 is a similar view taken on the line 6—6 of Figure 1, the main pile holding clamp and the long arch-restricting foot being in engagement with the pile while the other elements of the mechanism are raised away from the pile, and the suction device holding the top combed sheet raised from the pile;

Figure 7 is a detail vertical sectional view taken on the line 7—7 of Figure 1;

Figure 8 is a side elevation illustrating the shapes and relative positions of the controlling cams upon the camshaft of the mechanism;

Figure 9 is a detail plan view illustrating the spring finger in engagement with the combed portion of the pile of sheets;

Figure 10 is a detail elevation illustrating the action of the comb wheel and spring finger upon the pile of sheets.

It will be understood that the present invention, as illustrated in the accompanying
drawings, is shown as one of a pair of preliminary separating mechanisms, usually mounted upon a supporting frame above the rear of a pile of sheets in an automatic feeding machine. While only one of the pair of mechanisms is illustrated in the drawings, it will be clearly understood by those skilled in the art that two of such mechanisms are usually employed for operating upon a pile of sheets of large dimensions, whereas a single mechanism is ample for the preliminary separation of sheets of small dimensions. It will also be understood that the invention is not necessarily restricted to its use as a preliminary separator mechanism of an automatic pile feeder, but may be effectively employed as a part of other forms of sheet separating mechanism.

In the drawings, 1 represents one of the usual rearward-projecting side bars of the rigid frame of an automatic paper feeding machine. These bars 1 are usually formed with rack teeth 2 with which mesh pinions 3 carried upon a shaft 4 that extends from side to side of the machine and carries a hand wheel 5. The shaft 4 is journalled in side frames of which one is shown at 6. These side frames 6 are connected by transverse frame bars 7 and 8 forming a carriage which can be adjusted upon the bars 1 by rotation of the hand wheel 5 in a manner well understood.

10 is a shaft suitably journalled in the side frames 6 and in bearings in the auxiliary frame 75 hereinafter referred to. This shaft 10 carries upon its outer end a sprocket wheel 11 over which travels a sprocket chain 12 driven from any suitable source of power (not shown). This shaft 10 is formed with a longitudinal spline groove 13 by which a series of cams hereinafter referred to are adjustably keyed.

15 is a second longitudinally splined shaft journalled in the main frame 6 and the auxiliary frame 75, said shaft 15 carrying at its outer end a worm gear 16 which meshes with and is driven by a worm 17 mounted upon the shaft of an electric motor 18 supported upon bracket 19 of the side frame 6.

20 is a comber-supporting rock-arm upon which is freely journalled the comb wheel 21 carrying upon its shaft a pinion 22 which is in constant mesh with a gear 23 splined upon the shaft 15 between suitable confining sleeves or bushings. The comber rock-arm 20 has a projecting heel 24 carrying an anti-friction roller 25 which operates in peripheral engagement with a controlling cam 26 adjustably keyed to the shaft 10 above referred to.

The comb wheel 21 is constantly rotated at a rapid rate and is periodically moved into engagement with the pile of sheets indicated at 26 supported upon any suitable table or platform 27.

28 is a pile holding clamp mounted on the lower end of a vertically movable tubular rod 29 supported in guide brackets 30 and having an expansible spiral spring 31 confined between the upper bearing bracket 30 and a collar 32 mounted upon the rod 29.

This spring 31 presses clamp 28 into engagement with the pile of sheets for holding them after the preliminary separation while the sheet is being fed from the pile by the feeding off devices. An arm 33 is secured to the rod 29 above the upper guide bracket 30 and an anti-friction roller 34 is journalled in arm 33 and runs in peripheral contact with the controlling cam 35 which is adjustably keyed upon the shaft 10.

Freely journalled upon the frame 8 is a rock-arm 36 that projects toward the pile of sheets and carries a spring finger 37 that is designed to engage the combed sheets adjacent to the point of engagement of the combing wheel for the important purposes hereinafter explained. This rock-arm 36 carries an arm 38 having anti-friction roller 39 which operates in peripheral contact with the controlling cam 40, a spring 41 connecting rock-arm 36 with frame 75 to cause the same to follow the cam.

Cooperating with the comb wheel 21, the pile holding clamp 28 and the spring finger 37 above described, are the suction separating element 54 and the cooperating stop members 45 and 66 which restrict the extent of the arching of the sheets under the action of the comb wheel. These elements are arranged in a group opposite to the comber and main pile holding clamp and spring finger, as will now be explained.

Freely journalled upon the frame 7 is a sleeve 43 having adjustably secured to one end an arm 44 carrying a pile-engaging foot 45 which is preferably rubber shod. The other end of this sleeve 43 has a rearwardly projecting arm 46 connected by a spring 47 with auxiliary frame 75 and pivotally connected at 48 with a pitman 49 formed at its opposite end with a guide yoke 50 which rides upon the shaft 10 and carries in its end an anti-friction roller 51 which operates upon the periphery of the controlling cam 52 adjustably keyed to the cam shaft 10.

Freely journalled upon the sleeve 43 above referred to is a second sleeve 53, to one end of which is adjustably mounted a rocker arm 54 in the form of a tubular member carrying at its free end the usual rubber suction cup 55 and having at its supported end a nipple 56 to receive the flexible air tube 57 leading from any source of suction. The rocking sleeve 55 which supports the suction device just referred to carries at its end opposite the suction device a short arm 58 pivoted at 59 to a pitman 60 having a guide yoke 61 riding upon the cam shaft 10 carrying an anti-friction roller 62 which operates in pe-
 peripheral engagement with the controlling cam 63 adjustably keyed to the cam shaft 10. A spring 64 connects the yoke end of pitman 60 to the frame 75 to cause it to follow its controlling cam. A screw stud 61a is threaded through one end of guide yoke 61 in position to engage shaft 10 and by its adjustment determine the limit of movement of suction device 54, 55, toward the arched portion of the combed sheets.

Freely journaled upon the sleeve 53 of the suction device is a rocking sleeve 65 carrying a short pile engaging foot 66 which is preferably rubber shod, and having an upwardly presented rock-arm 67 pivoted at 68 to a pitman 69 formed with a guide yoke 70 which rides upon cam shaft 10 and carries an anti-friction roller 71 operating in peripheral engagement with the controlling cam 72 adjustably keyed to the cam-shaft 10. A spring 73 connects the yoke end of pitman 69 with the frame 75 to cause it to follow its controlling cam.

The auxiliary frame above referred to comprises a bent frame 75 having oppositely presented U-shaped ends formed with bearings through which project shafts and bars 4, 7, 8, 10 and 15 referred to. This auxiliary frame 75 confines the operative parts of the mechanism above described in related groups and by loosening the set-screws 76 which secure the auxiliary frame to the supporting bars 4 and 8 the auxiliary frame can be adjusted upon said bars 4 and 8 to place the separating mechanism in the desired position most convenient for operating upon a particular job, the cams and comber driving gear sliding upon their supporting shafts to which they are adjustably splined.

The operation of the improved mechanism will be clear from the following brief explanation. When the comb wheel 21 is lowered by its controlling cam 25 as indicated in Figure 3 of the drawings, the main pile holding clamp 28 and the suction device 54 are raised from the pile while the auxiliary holding feet 45 and 66 are in engagement with the pile to restrict the arcing of the combed sheets, and the spring finger 37 is in engagement with the stepped combed edges of the sheets to hold them in combed condition when the comber ceases its work. When the comb is raised as shown in Figure 4 of the drawings, the suction device 54 lowers upon the arched combed sheets and takes hold of the top sheet as shown in said figure, while the arch is confined between the short retaining foot 66 and the spring finger 37. The suction device 54 then moves upwardly from the pile and raises the engaged part of the top sheet, as shown in Figure 5 of the drawings, the edge of the top sheet being thereby pulled from beneath the spring finger 37 which retains its engagement with the arched combed sheets while the short retaining foot 66 is raised to free the raised portion of the top sheet over to the longer auxiliary retaining foot 45. With the top sheet separated and raised by the suction device and the pile held by retaining foot 45, the spring finger 37 is momentarily raised from the pile to allow the remaining arched sheets to straighten out and resume their normal position flat upon the pile, which action is immediately followed by the pile holding clamp 28 moving down into engagement with the pile preparatory to holding the same in place while the top sheet is fed off. As the clamp 28 engages the pile it is customary to blow air through the clamp beneath the raised portion of the top sheet, at which time auxiliary retaining foot 45 is raised to allow the air to spread beneath the entire surface of the top sheet as the feed off devices take it and move it from the pile. The winding of the sheet is frequently assisted by air blown from additional air pipes.

I claim:

1. The combination with means for imparting a combing separating action to a pile of sheets, and a sheet moving separator element to engage and move the top sheet of said combed pile, of means engaging the combed portion of the pile to hold the combed sheets in combed condition for the action of said sheet moving separator element.

2. The combination with means for combing a portion of a pile of sheets, and a sheet-moving separator element arranged to engage and move the top combed sheet of said pile, of a yielding member engaging the combed portion of the pile to hold the combed sheets in combed condition while said sheet-moving separator element moves the top sheet.

3. The combination with means for imparting a combing separating action to a pile of sheets, and a suction separator element arranged to engage and move the top sheet of said combed pile, of means engaging the combed portion of the pile to hold the combed sheets in combed condition for the action of said suction separator element.

4. The combination with means for combing an arch in a pile of sheets, and a suction separator element arranged to engage the top arched sheet of said pile, of a yielding member engaging the combed portion of the pile to hold the combed sheets in combed condition for the action of said suction separator element.

5. The combination with means for combing an arch in a portion of a pile of sheets, and a suction separator element arranged to engage the arched portion of the top sheet and raise it from said pile, of means engaging the combed portion of the pile to hold the combed sheets in arched condition for the action of said suction separator element.
6. The combination with means for combining an arch in a portion of a pile of sheets, and a suction separator element arranged to engage and raise the arched portion of the top sheet of said pile, of means engaging the combed portion of the pile to hold the combed sheets in arched condition for the action of said suction separator element, and a pile holding foot arranged near one edge of said pile.

7. The combination with means for combining an arch in a pile of sheets, and a suction separator element arranged to engage and raise the top arched sheet of said pile, of a yielding member engaging the combed portion of the pile to hold the combed sheets in combed condition for the action of said suction separator element, a pile holding foot arranged adjacent said yielding member, and means for blowing air under the sheet raised by said suction device.

8. The combination with means for combining an arch in a pile of sheets, and a suction separator element arranged to engage and raise the top arched sheet of said pile, of a spring finger arranged to engage the fanned-out edge of said combed portion of the pile, said spring finger serving to temporarily hold said arched portion of the pile for the action of said suction separator element, and to prevent movement of the under sheets when the edge of the top sheet is pulled from beneath said finger and raised by said suction element.

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