United States Patent

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[54] **METHOD AND APPARATUS FOR COUNTING OVERLAPPED SHEETS DURING CONVEYANCE THEREOF**
10 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **235/98**
[51] **Int. Cl.** **B61l 1/16**
[50] **Field of Search** 235/98, 98.4, 98.5

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ABSTRACT: The invention is a method and apparatus for counting sheets of paper, cardboard or the like material which includes feeding successive sheets along a line of movement in overlapped condition, at a position along such line of movement and solely in accordance with the continued in-line movement of the fed sheets detecting successive overlaps and initiating a counting impulse responsive to each successive detected overlap.

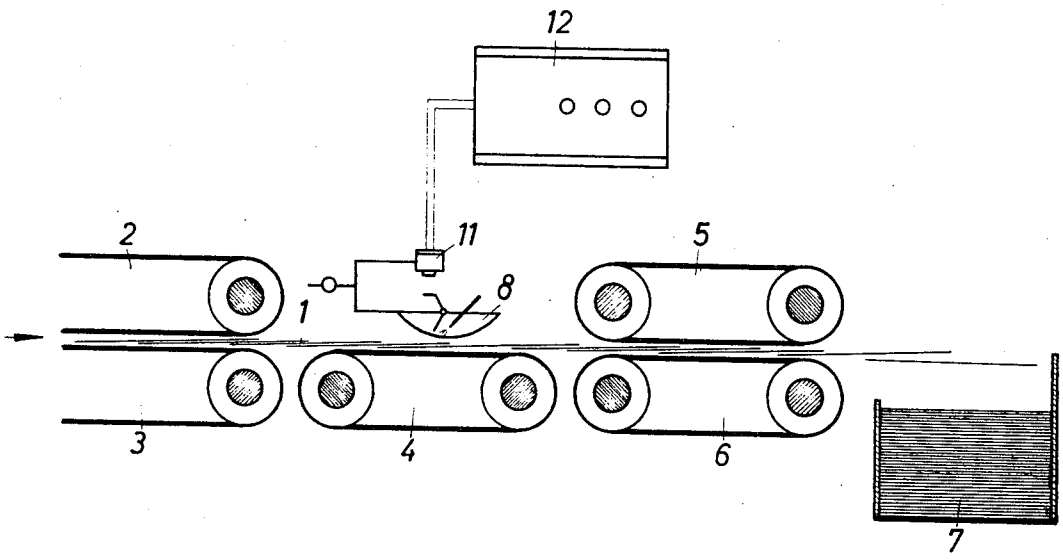


Fig.1

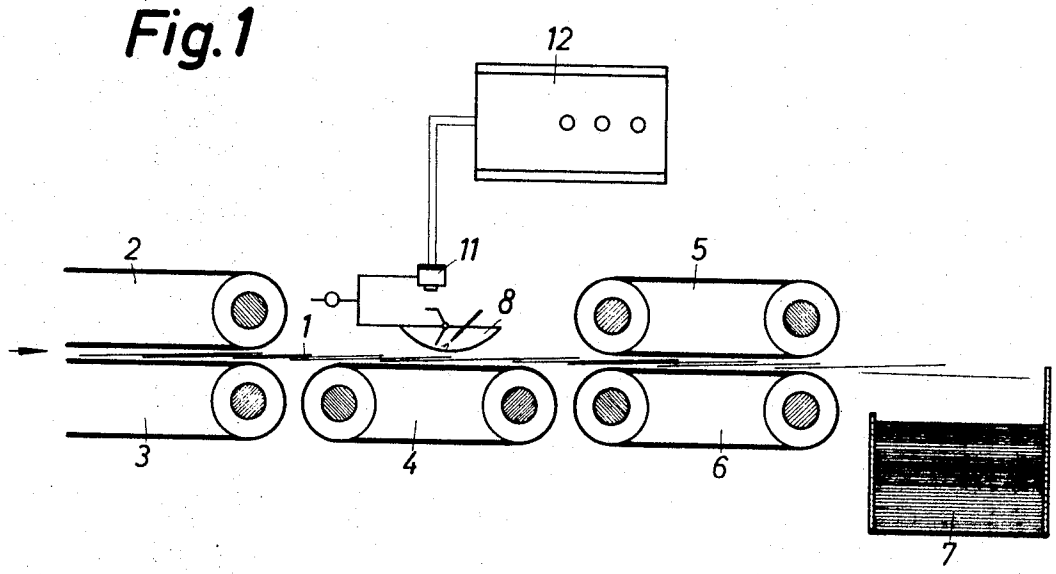


Fig.2

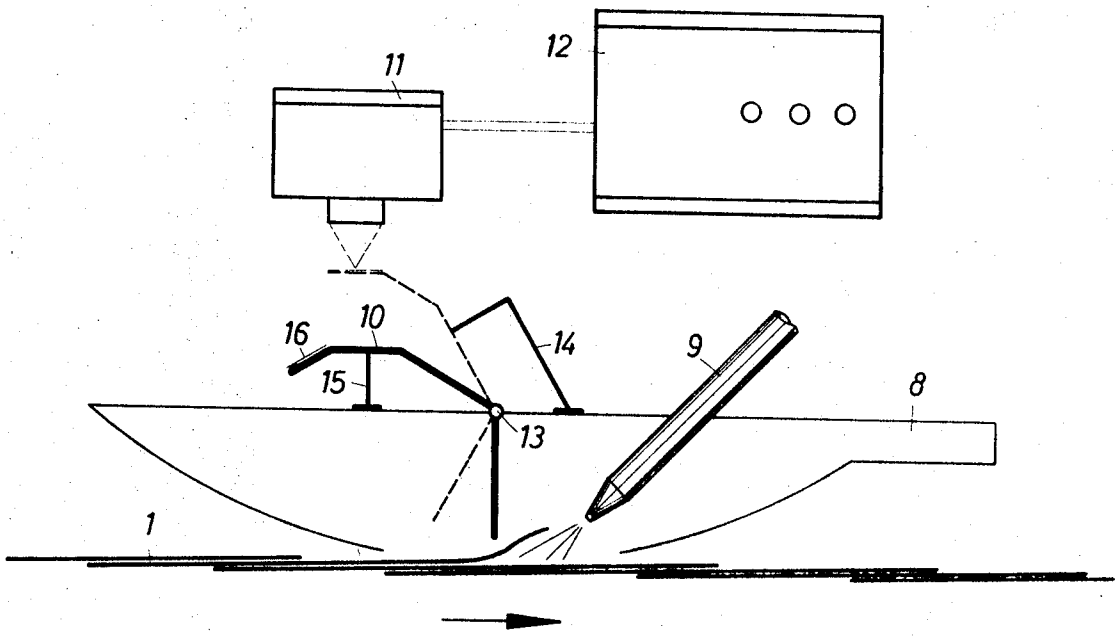


Fig. 3

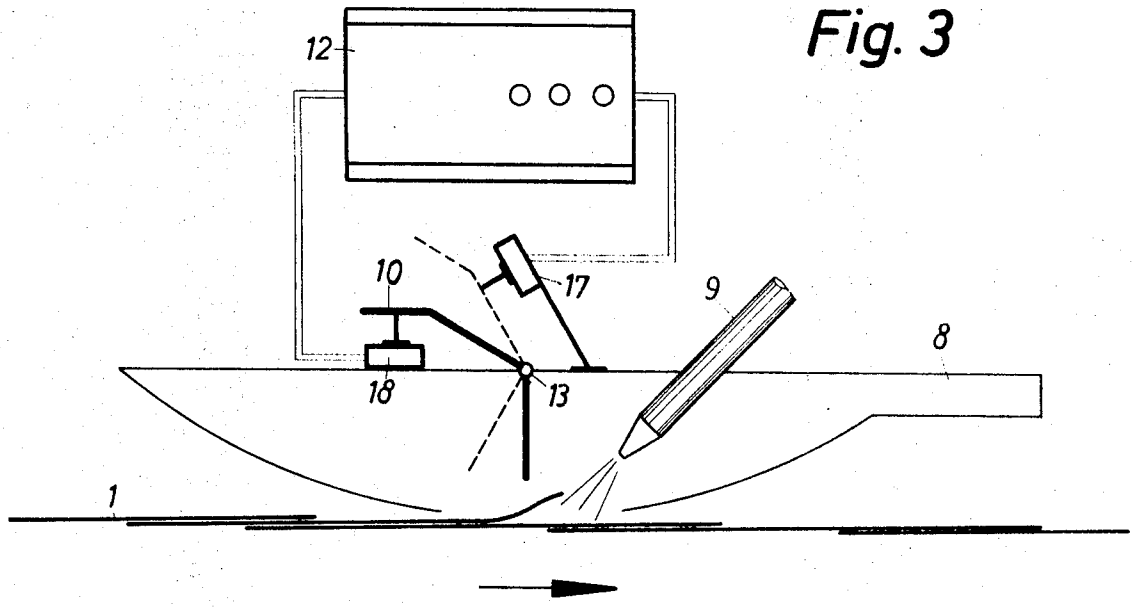
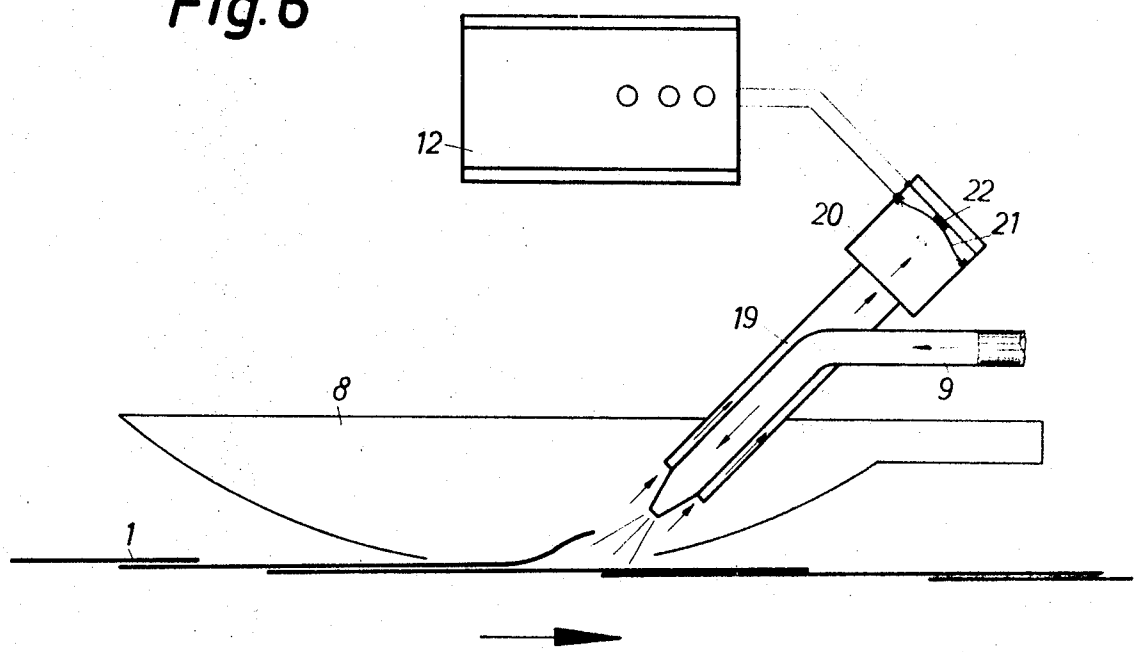


Fig. 6



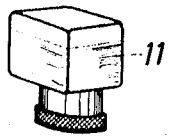


Fig. 4

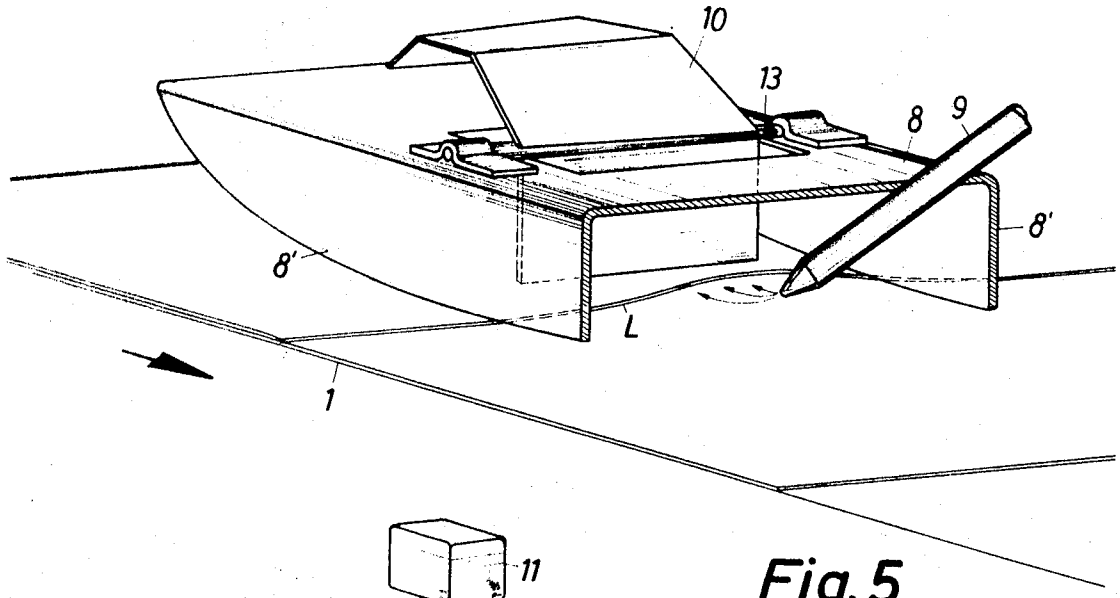
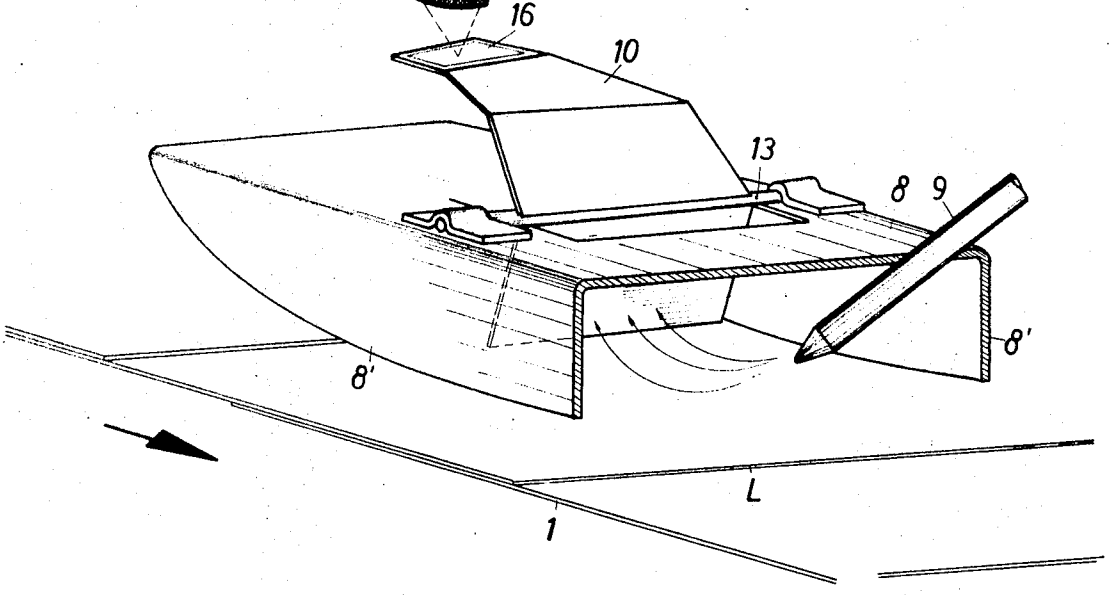


Fig. 5



METHOD AND APPARATUS FOR COUNTING OVERLAPPED SHEETS DURING CONVEYANCE THEREOF

This invention relates to a method and means for counting material which is being conveyed in overlapped fashion, such as sheets or packages of sheets made of paper, cardboard or the like material.

In sheet forming and associating mechanisms that utilize transverse cutters which operate at relatively high speed on an advancing web, the formed sheets after having been cut transversely generally advance or are fed in overlapped condition and are then stacked in a magazine or layboy. The movement of the sheets in overlapped condition results in a deposit speed as will be required for perfectly depositing the sheets and thus assure formation of stacks having absolutely straight side edges.

One known arrangement of this type is exemplified in U.S. Pat. 2,266,972 to Matthews dated Nov. 11, 1941 and entitled "Sheet Feeding And Stacking Method And Machine." Nevertheless, difficulties arise in connection with the counting of sheets which are being conveyed or transported in such overlapped condition. The danger of damaging or marking the sheets precludes a mechanical counting through means touching or engaging the sheets. Likewise, the counting of the sheets in dependence upon the cutting sequence is also precluded inasmuch as defective sheets which are ejected in this type of machine must not be included in the count. If a counting device were arranged immediately after the ejection or severing point and before the overlapping device, the result would be a relatively long distance of movement for the counted sheets within which various disturbances may appear, thus making it necessary to remove individual sheets. This would result in the counted number of sheets no longer corresponding in number to those deposited on the stack.

Therefore it is an object of this invention to provide a method and an apparatus for effecting the counting of sheetlike material, which is transported in overlapped fashion, such as sheets or sheet packages made of paper, cardboard or the like material which avoids mechanical touching of the sheets to be counted.

Therefore it is a main object of this invention to provide a method of and means for counting sheets or sheetlike material of paper, cardboard or the like material which includes feeding such sheet material in overlapped condition along a line of movement, at a position along such line of movement and merely in accordance with the continued inline movement detecting successive overlaps in the fed sheets and initiating a counting impulse responsive to each detected overlap.

The invention has for a further object to provide a method of and means for counting sheets or sheetlike material of paper, cardboard or the like material which includes feeding such sheet material in overlapped condition along a line of movement, directing a stream of air against oncoming overlapped sheets, creating a differential pressure condition in an area on opposite sides of the leading edge of each overlapped sheet, successively detecting such differential pressure condition and initiating a counting impulse in response to each detected differential pressure condition.

It is a further object to provide a method of and apparatus for counting sheets or sheetlike material of paper, cardboard or the like material including feeding sheets along a path or line of movement in overlapped condition beneath a movable control for a counting mechanism, during such feeding moving the successive overlapped sheets past an air jet to lift the leading edge of successive overlapped sheets so that the air can escape beneath such lifted leading edge and not influence the movable control and continuing the feeding movement so that when such leading edge has moved past the air jet the air from the jet impinges on top of the passing overlapped sheet and is effective to blow against the movable control to move the same to cause a counting impulse to be initiated for successive passing overlapped sheets.

In order to accomplish the latter object, it is proposed, through this invention, that the counting of advancing overlapped sheets be performed with the aid of an air blast jet which is directed against the sheet path or line of movement from above. As each one of the front edges of the sheets makes its passage, the air blast jet directed against the sheet half activates a counting device, whereby the effectiveness of the air blast jet with respect to a member acting upon the counting device is influenced by each one of the front or leading edges of the sheets.

In order to carry out the method, one form of apparatus is used having a blast nozzle which is directed against the line of movement of and thus against the oncoming leading or front edges of the sheets, said blast nozzle having associated with it a member acting upon the counting device. The member acting upon the counting device is preferably a two armed swinging lever whereof one arm is arranged in the effective area of the air jet or blast from the nozzle and the other arm is arranged in the effective area of an impulse sender which is connected with the counting device. Moreover, one arrangement is such that the lever arm arranged in the effective area of an impulse sender, which is in the form of a photoelectric cell, includes a reflector which enters into the focus of the photoelectric cell as a result of being acted upon by the air blast jet, whereupon said photoelectric cell sends an impulse to the counting device.

In another inventive embodiment, two electrical contacts are provided for as impulse senders within the swinging area of the lever arm, said contacts being connected with the counting device and being touched alternately by the lever arm. The release of an impulse to the counting device takes place in this embodiment only if both electrical contacts are touched successively by the lever arm.

As a further embodiment of the invention, the arrangement can also be such that the blast nozzle has associated with it a device for measuring the pressure differences arising during the passage of the frontal sheet edges through and past the air blast jet and for converting the same into electrical impulses, said device being itself connected with a counting device.

Further and more specific objects will be apparent from the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a diagrammatic side elevational view illustrating a portion of a sheet conveyor arrangement embodying a counting arrangement according to the invention

FIG. 2 is a fragmentary side elevational view illustrating a form of the invention embodying a photoelectric cell means as an impulse sender for a counter,

FIG. 3 is a similar view illustrating another form of the invention embodying electrical contacts as impulse senders for a counter,

FIGS. 4 and 5 are fragmentary perspective views illustrating the mode of operation of the arrangement shown in FIGS. 1 and 2, and

FIG. 6 is a view similar to FIG. 2 and illustrating a further inventive embodiment.

As shown particularly in FIG. 1, overlapped sheets 1 after having been ejected or fed from a cutter or other sheet-processing machine, not shown in the drawings, are conveyed on conveyor belts or tape arrangements 2, 3, 4, 5 and 6 to a deposit stack such as a magazine or layboy 7. A sheet counting device is arranged between upper conveyor belts 2 and 5 which comprises essentially, as can be seen from FIGS. 2, 4 and 5, a pressure guide or hood 8, an air blast or jet nozzle device 9, a swingable lever 10, a photoelectric cell means 11 and an electronic counting device 12 of a known type. The lever 10 is rotatably mounted around an axis of rotation provided by a shaft 13. In order to delimit the zone of movement of the swingable lever 10, the apparatus includes upper and lower stops 14 and 15, omitted from FIGS. 1, 4 and 5 and which stops are secured or mounted on pressure guide or hood 8. The upper lever arm of swingable lever 10 that cooperates with the photoelectric cell means 11 is equipped with a reflector or mirror 16.

The mode of operation of the apparatus is as follows: As can be seen particularly well in FIG. 4, each successive frontal or leading edge L of an overlapped sheet is lifted up by the air blast jet or stream issuing from nozzle 9 in the area between the sides 8' of pressure guide or hood 8 so that the air can escape between this sheet and the sheet thereunder. During this state, the swinging lever 10 is not acted upon by the air blast jet so that the reflector 16 remains outside of the focus of photoelectric cell means 11. As the sheets continue to advance, and as clearly seen in FIG. 5, the frontal or leading edge L leaves the effective area of the air blast jet so that the air can not escape between two overlapped sheets and is directed to glow against the lower arm of swingable lever 10. The result is that reflector 16 carried by the upper arm of lever 10 is raised and enters into the focus of photoelectric cell means 11 to activate the same so as to in turn send an impulse to the electronic counting device 12, thereby adding one unit count to the latter. This mode of operation adequately assures accurate counting of the overlapped sheets since the swingable lever 10 is only acted upon by the air blast jet after one leading or frontal sheet edge L has passed beneath the air blast jet. Moreover, this counting arrangement enables accurate counting of sheet packages in which the frontal or leading sheet edges do not stack exactly evenly since the effectiveness of the air blast jet directed against the swingable lever 10 remains interrupted, thus preventing the reflector 16 from entering into the focus of photoelectric cell means 11, as long as the frontal or leading sheet edges remain in the effective area of the air blast jet.

In the embodiment of FIG. 3, the stops 14 and 15 are made up as electrical contact devices 17 and 18 which are connected with the electronic counting device 12. In this embodiment, the electrical contact devices 17 and 18 embodying set and release circuiting, take over the function of photoelectric cell means 11. Here the arrangement is such that an impulse is sent to the electronic counting device 12 only when both electrical contacts 17 and 18 have been touched successively by the upper arm of swingable lever 10. This measure prevents the electronic counting device 12 from being acted upon if the lever 10 goes through undulating motions, so that defective counts are avoided.

Further modifying the inventive idea, FIG. 6 depicts an embodiment in which the air jet or blast nozzle 9 is connected with a device 19 which measures the pressure differences arising during the passage of frontal or leading sheet edges through the path of the air blast jet. In this embodiment, the blast nozzle 9, which is connected to an air compressor not shown in the drawing, is combined with a back pressure pipe 19. This back pressure pipe 19 surrounds or encloses blast nozzle 9 in its forward part and transmits the back pressure caused by the pressure differences to a transmitter 20. This transmitter 20 in a known manner converts the pneumatic signal into an electrical impulse with the aid of an elastic diaphragm 21 and a contact 21. This electrical impulse is then transmitted to the electronic counting device 12 as described in the previous typical embodiments.

What I claim is:

1. A method of counting sheet material such as of paper, cardboard or the like material comprising feeding successive sheets along a line of movement in overlapped condition, at a position along such line of movement and solely in accordance with the continued inline movement of the fed sheets detecting successive overlaps by directing a jet of air against the oncoming overlapped sheets to lift the successive leading edges thereof and initiating a counting impulse responsive to each detected overlap.

2. The method as claimed in claim 1 in which said air jet is directed against the oncoming sheets from above and said counting impulse is initiated in response to the leading edge of an overlapped sheet passing said air jet.

3. The method as claimed in claim 2 in which said overlapped sheets pass beneath a movable control member for a counter in advance of said air jet, and moving said movable control member by the pressure of the air from said jet when responsive to the leading edge of an overlapped sheet passing said air jet.

4. Apparatus for counting sheet material of paper, cardboard or the like material comprising a counting means, means for feeding successive sheets along a line of movement in overlapped condition, means positioned along the line of movement of the sheets for detecting successive overlaps including an air jet nozzle means for directing a jet of air against the oncoming sheets to lift the successively advancing leading edges of overlapped sheets, and means operable when a leading edge of a moving overlapped sheet passes said air jet to actuate said counting means for each detected overlap.

5. Apparatus as claimed in claim 4 in which the means operable when a leading edge of a moving overlapped sheet moves past the air jet includes a lever means mounted to swing about an axis extending transversely of and above the line of movement of the sheets.

6. Apparatus as claimed in claim 5 in which said lever means is a double arm lever, one of said arms being shaped to project into and be moved by the air flowing from the air jet and impinging upon the upper surface of an overlapped sheet after the leading edge thereof has moved past the air jet, and the movement of the other arm actuates the counting means.

7. Apparatus as claimed in claim 6 and photoelectric cell means operably related with said counting means, and reflecting means on said other arm of said double arm lever means that enters into the focus of said photoelectric cell means when said one arm of said lever means is moved by the air from said air jet to cause said photoelectric cell means to transmit a counting impulse to said counting means.

8. Apparatus as claimed in claim 6 and two electrical contact devices operably connected with said counting means for providing counting impulses thereto, and the other arm of said lever means being disposed for swinging movement between said contact devices and alternately touching the same in accordance with the movement of said lever means.

9. Apparatus as claimed in claim 8 in which a counting impulse is transmitted to said counting means only in response to successive touching of both contact devices by said other arm of said lever means.

10. Apparatus as claimed in claim 1 and means operably connected with said counting means and operably related with said air jet nozzle means for measuring the pressure differences arising during passage of the successive leading edges of overlapped sheets past the air jet issuing from said nozzle means and for converting said measured pressure differences into electrical impulses for actuating said counting means.