

[72] Inventor **Donald R. Grody**
6 Lee Road, Lenox, Mass. 01240
[21] Appl. No. **735,034**
[22] Filed **June 6, 1968**
[45] Patented **Jan. 12, 1971**

1,545,912 7/1925 Maxson 271/76
Primary Examiner—Richard E. Aegerter
Assistant Examiner—W. Scott Carson
Attorney—Chapin, Neal & Dempsey

[54] **SHEET-SHINGLING APPARATUS**
2 Claims, 2 Drawing Figs.

[52] U.S. Cl. 271/76
[51] Int. Cl. B65h 29/18;
B65h 29/66
[50] Field of Search 271/46, 76

[56] **References Cited**
UNITED STATES PATENTS
1,545,910 7/1925 Maxson 271/76
1,545,911 7/1925 Maxson 271/76

ABSTRACT: Apparatus for shingling or overlapping sheets having a high-speed upper tape system extending in overlying relationship from a lower, high-speed tape system to an overlying relationship with a low-speed, lower or overlap tape system. The upper surface of the low-speed tape system is disposed at a level substantially below the upper surface of the lower, high-speed tape system. Also the upper tape system has a substantial angle of inclination formed with the sheet-receiving surface of the low-speed tapes with a deflector located at the angle of inclination and in superposed relation to the upper surface of the low-speed tapes.

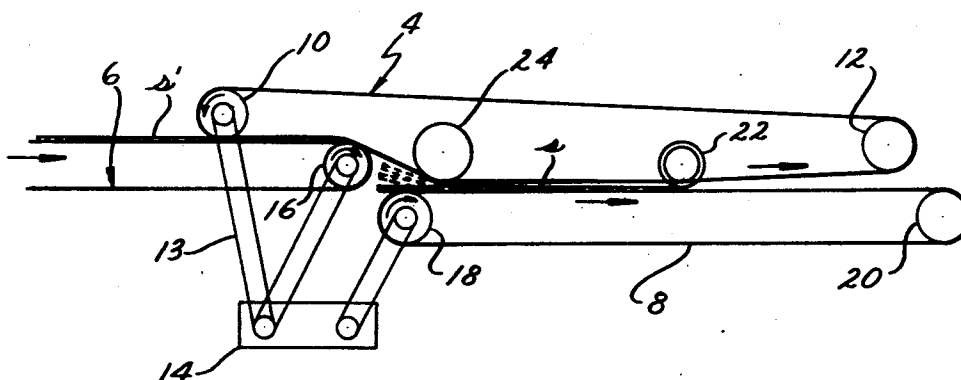


Fig. 1.

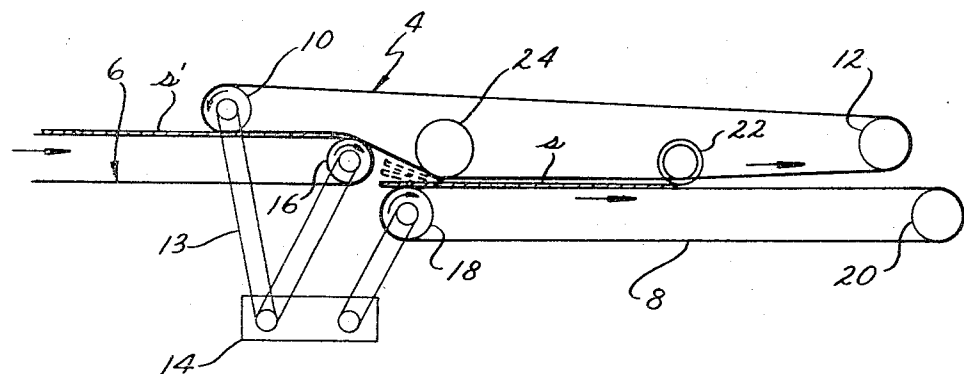
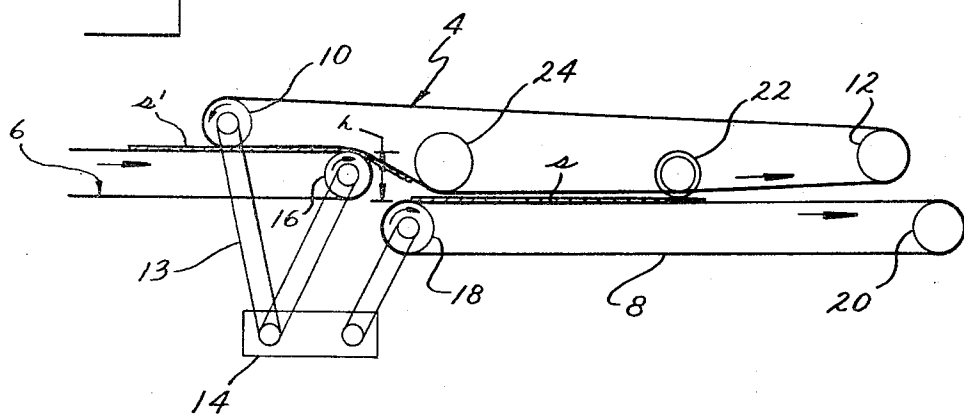


Fig. 2.



INVENTOR.
Donald R. Grady
BY *Chapin, Neale & Bompsey*
Attorneys

SHEET-SHINGLING APPARATUS

BACKGROUND

In paper-cutting machinery, in the delivery of cut size sheets for stacking, it is common for the sheets to be overlapped or shingled as they are fed to the stacking station. The overlapping or shingling operation is usually performed by high and low-speed tape systems. The speed of the leading sheets is reduced as they are fed onto the low-speed tapes. This is usually accomplished by some suitable means, such as a grooved stop roll. The leading edges of succeeding sheets are then fed into overlapping relationship with respect to the trailing edges of the preceding sheets.

In one of the early shingling devices, as the leading sheets reach a grooved low-speed roll they were stopped and the sheets fell by gravity onto the low-speed tape system, which was located approximately 3 inches below the high-speed tape system. This device was operated on what is known as the Maxon principle. While with some gauge papers this system worked satisfactorily, when lighter weight sheets are used or higher speed deliveries are attempted with heavier gauge papers, two problems are encountered. The first problem arises from the fact that the tail ends of the slowed sheets which are acted on only by gravity tend to "float" in the air for a certain period of time. At high-speed operation, the leading edges of the succeeding high-speed sheets tend to crash into the trailing edges of the slowed, preceding sheets before they have time to settle onto the surface of the low-speed tapes. This problem is encountered both with lightweight sheets and high delivery speeds.

When lightweight sheets or heavier sheets traveling at high-speed engage the low-speed stop roll, the sheets tend to buckle transversely of their length. As a result of this buckling action the sheets tend to span the gap between the upper run of the low-speed tapes and the lower run of the high-speed tapes. Contact with both the high and low-speed tapes usually causes wrinkles in the sheets which may even jam in the tape system.

Over the years a number of solutions have been proposed to solve the problems of shingling high-speed or lightweight sheets. Perhaps one of the first was the use of a vacuum chamber of suction box disposed below the lower tapes. The vacuum was used in an attempt to suck down and control the tail ends of the sheets so that the higher feed speeds could be attained without "buckling" or "crashing". An example of such a device is shown in U.S. Pat. Nos. 3,178,174, 3,218,897 and 3,315,956. Other devices include mechanical arrangements to deflect or depress the tail ends of the leading sheets. One such device is shown in British Pat. No. 938,731.

Another proposed solution involved the use of a swingable gate feed formed at the delivery end of the high-speed tape system. The purpose of this was to provide a wide gap to accommodate the tail ends of the sheets. Thus the leading edges of the succeeding sheets may at high speed be overlapped with respect to the adjacent edges of the preceding sheets. The difficulty with this arrangement is that it is relatively complex and requires critical timing in the operation of the gate at high speeds and thus does not provide an entirely suitable solution to high-speed feed nor to the shingling of lightweight sheets. U.S. Pat. No. 1,545,914 shows such a pivotable gate feed system.

While the use of mechanical devices to depress the tail ends of the slowed sheets clear of the following high-speed sheet provided suitable results, extreme care was required in handling finely coated papers, as mechanical deflectors tend to damage the coating of fine quality papers. Also machines of this type are quite expensive to produce, since it is necessary to provide suitable phasing devices to allow for correct positioning of the deflecting device over the tail ends of the sheets.

The principal object of this invention is to provide a shingling apparatus which overcomes the problems heretofore encountered in the overlapping of high-speed or lightweight sheet handling.

Another object of this invention is to provide a simple, inexpensive and yet highly effective-type delivery system, capable of handling heavyweight grades of paper at high speeds and lightweight grades of paper.

Another object of this invention is to provide a novel overlapping sheet feed system which obviates the necessity of providing means to turn the leading edges of the high-speed sheets into the air so as to insure clearance over the tail ends over the slowed preceding sheets.

The above and other objects of this invention will be more readily apparent from the following description and with reference to the accompanying drawings:

FIG. 1 is a diagrammatic elevational view of an apparatus embodying this invention; and

FIG. 2 is a view similar to FIG. 1 but with the sheet shingling operation at a later point of time.

Referring in detail to the drawings, in FIG. 1 is shown a high-speed tape system or sheet conveyor 4 which extends in overlying relationship from a position adjacent the delivery end of a high-speed lower or delivery tape system or conveyor represented at 6 to a position adjacent the delivery or downstream end of a low-speed or lower overlying tape system or conveyor 8.

Each of the tape systems shown comprises a plurality of parallel, closely spaced tapes, such as shown in U.S. Pat. No. 3,182,537. In tape system 4 the tapes are trained around rolls 10 and 12. The roll 10 may be driven by any suitable means, such as pulley 13 driven from a variable speed transmission as shown at 14. Rolls 16 and 18 of the other tape systems are also shown as being driven by pulleys from variable speed transmission 14. Roll 20 extends the lower tape system 8 in a continuous loop from adjacent roll 16 to a point somewhat beyond the roll 12. In the embodiment shown, the tapes move in the directions shown on the drawings.

A brake or stop roll 22 engages the upper surface of the lower speed tapes 8. The roll 22 is positively driven by any suitable means (not shown) at the same speed as the low-speed tapes of tape system 8. The roll 22 may be suitably grooved to allow clearance for the high-speed tapes so that they do not engage the roll. The stop roll 22 is disposed forwardly of the roll 18 at a distance less than the length of sheets to be overlapped or shingled by the apparatus embodying this invention. As each sheet, such as shown at *s*, is fed between the high and low-speed tape systems 4 and 8, respectively, when its leading edge enters the nip formed between the roll 22 and the upper surface of the tapes of system 8, the speed of the sheet is immediately reduced to the speed of tapes 8. Thereafter, the slowed sheets are fed along the upper surface of the tapes 8 to a stacking station. Prior to contact with the stop roll 22, the sheets are still moving at a high speed, approximately the same as the speed of the sheets *s'* carried by the tape system 6.

In accordance with my invention, means is provided for causing the after ends of the slowed sheets *s* to snap down into the plane of the upper surface of the tapes 8. In the embodiment shown a deflector 24 is provided which may be either in the form of a roll or bar located on the upstream end of the stop roll 22. The deflector 24 is also disposed adjacent the sheet-receiving or upstream end of the tape system 8, and its lower surface is contiguous with the upper surface of the tape system 8 and may be on the order of one-eighth to 1 inch above the tape system 8. Indeed, a spacing of about one-fourth inch between the lower surface of the tape system 4 and the upper surface of the tape system 8 has proved most suitable. As shown, the deflector 24 is located slightly downstream of the roll 18, and it has been found that a horizontal distance on the order of 2—4 inches from the roll 16 on the delivery end of tape system 6 produces suitable results.

The upper surface of tape system 8 is disposed at a substantial distance *h* below the upper surface of tape system 6 so that tapes 4 form an oblique angle of inclination with the tapes of system 8. The inclination extends from the upper surface of roll 16 to the under surface of deflector 24. A distance *h* of

about 1—3 inches with a spacing of 2—4 inches between roll 16 and deflector 24 produces suitable results. The location of the deflector 24 relative to the stop roll 22 must be less than the length of sheets being handled, and 2—4 inches less than the sheet length has proved suitable. It has been found that by so locating the deflector 24 in relation to the tail end of the sheets that as the sheets are slowed by the stop roll 22, they are subjected to a "bull whip" type of action which causes the tail ends of these sheets to snap into the plane of the upper surface of the tapes 8. This action is shown in FIG. 1, in which the tail end of the sheet *s* is snapped down and out of the way of the oncoming high-speed sheet *s'*. This operation is totally compatible with very high-speed delivery, and even high-speed delivery with lightweight sheets, which as previously pointed out tend to float above the surface of the low-speed tapes. The problem of sheet "buckling" is also overcome by this geometry in which the deflector holds the lower run of tapes 4 closely adjacent the upper run of the tapes 8. As a result, there is provided a quite restricted space or "throat" between the lower run of the upper high-speed tapes and the upper run of the tapes 8. Consequently, as the sheets *s* contact the surface of the stop roll, they are prevented from buckling as commonly occurred with the previous Maxon-type overlapping system.

OPERATION

As the sheets are fed at high speed between the upper run of tape system 6 and lower run of tape system 4, they follow the inclined portion of the tape surface between the rolls 16 and deflector 24. From this point the sheets continue to be held between the closely spaced high-speed tapes 4 and the low-speed tapes 8 until they contact the stop roll 22. The proximity of the tapes 4 and 8 prevent the sheets from buckling. Substantially simultaneously the tail ends of the sheets are snapped down into the plane of the tapes 8 by the deflector 24. At about the same time the next high-speed sheet *s'* being fed past the roll 16, thus, it will travel over the tail ends of the preceding sheets, as shown in FIG. 2. Sheets *s'* continue at high speed to overlap the slowed sheets *s* until the sheets *s'* strike the stop roll 2. This process is repeated continuously so that all the sheets fed by the system will be overlapped or shingled as they pass along the upper surface of the tapes 8 to a stacking station.

This invention also does away with the need for the so-called edge turners previously used in conventional overlapping systems. The edge turners are used to turn the front edges or corners of the overlapping sheets upwardly to insure that they will clear the tail ends of the slowed preceding sheets. Since in any sheet delivery system it is important to be able to handle sheets of different width, it was heretofore necessary to reposition the edge turners for each different width sheet being handled by the system. This adjustment is not only time consuming, but frequently very critical and if

not done correctly, proper shingling is not obtained and frequent jamming of the machine occurs. With the shingling apparatus embodying this invention, the need for uplifting the front edges of the overlapping sheets is eliminated. Moreover, no critical timing or phase relationship is encountered with respect to deflecting the tail ends of the sheets, since this is achieved by the geometric arrangement of the high-speed tape systems relative to the low-speed tape system.

While reference has been made herein to cut size sheets, it should be understood that the invention relates to all sizes of sheets and is not limited to any particular size or range of sheet sizes. For purposes of this description, the shingling operation was described in relation to single sheets cut one roll at a time, but the invention is also applicable to multiple sheets where more than one roll is cut simultaneously.

I claim:

1. Apparatus for overlapping cut size sheets comprising a high-speed tape conveyor system, a low-speed tape conveyor system, the delivery end of the high-speed tape system being adjacent the receiving end of the low-speed tape system, the sheet-carrying surface of the low-speed tapes being disposed at a level substantially lower than the sheet-carrying surface of the high-speed tapes, an upper tape system in the form of a loop with its lower run disposed in superposed relation to the upper run of the high and low-speed systems, means for driving the upper and high-speed tape systems at substantially the same speed and for driving the low-speed tape system at a substantially lower speed, a stop roll rotatably disposed to engage the leading edges of sheets carried between the lower run of the upper tape system and the upper run of the lower tape system and being located at a distance from the delivery end of the high-speed tapes which is approximately equal to the length of said cut size sheets, and a deflecting roll for the tail end portions of said cut size sheets being located intermediate said stop roll and said receiving end of the low-speed tapes at a distance from the stop roll which is a function of the length of said cut size sheets, said deflector roll being disposed within the upper tape system and positioned to retain the lower run thereof at a substantial angle of inclination from the delivery end of said high-speed tapes to the receiving end of said low-speed tapes and from the deflector roll to the stop roll in closely spaced generally parallel relationship to the upper run of the low-speed tapes whereby at approximately the same time that the leading edges of said sheets engage said stop roll the tail end portions of said sheets upstream of said deflector roll are deflected into the plane of the upper run of the low-speed tape system by the deflector roll, and whereby the portions of said sheets between said stop roll and deflector roll are restrained against buckling by the closely spaced generally parallel tapes.

2. Apparatus as set forth in claim 1 in which the distance between the stop roll and deflector roll is approximately 2—4 inches less than the length of said sheets.