

Sept. 22, 1964

H. W. FAEBER
STREAM INTERRUPTER

3,149,834

Filed April 3, 1961

2 Sheets-Sheet 1

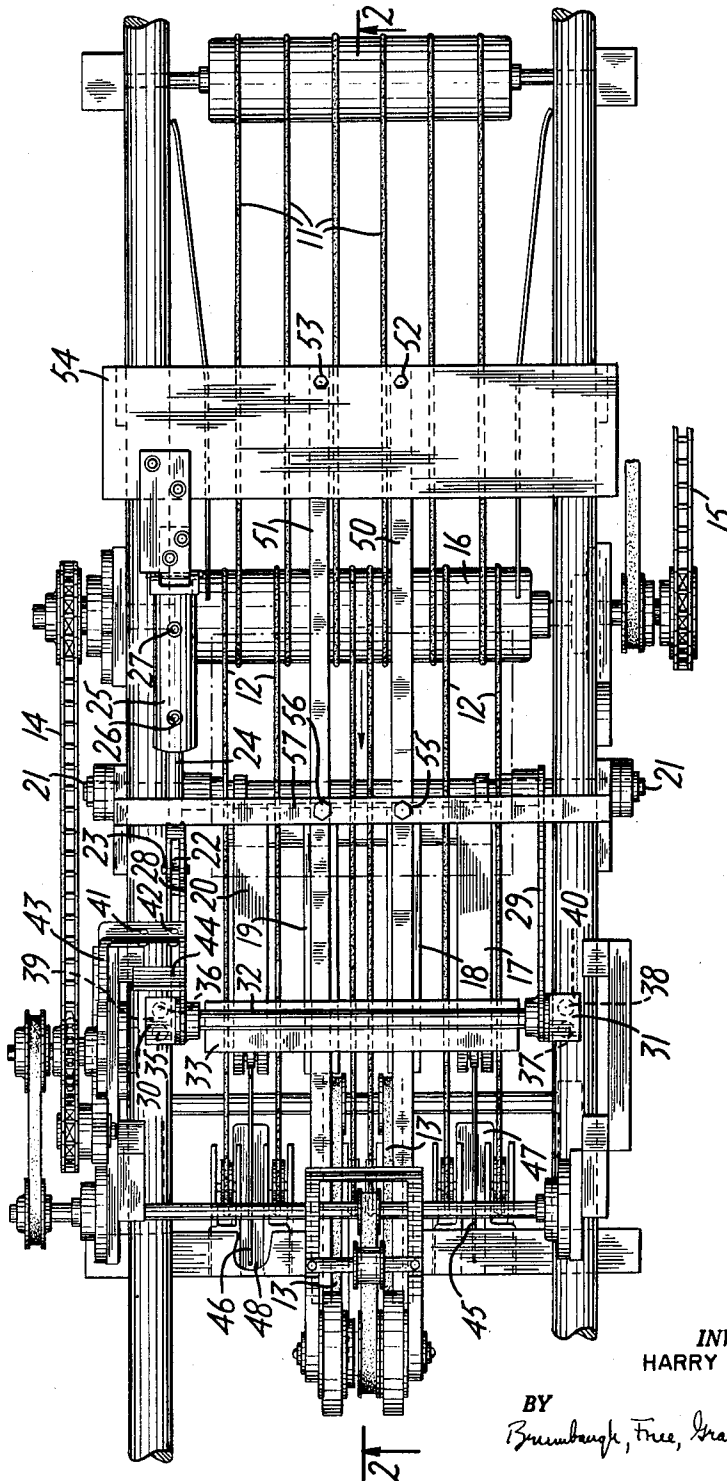


FIG. 1

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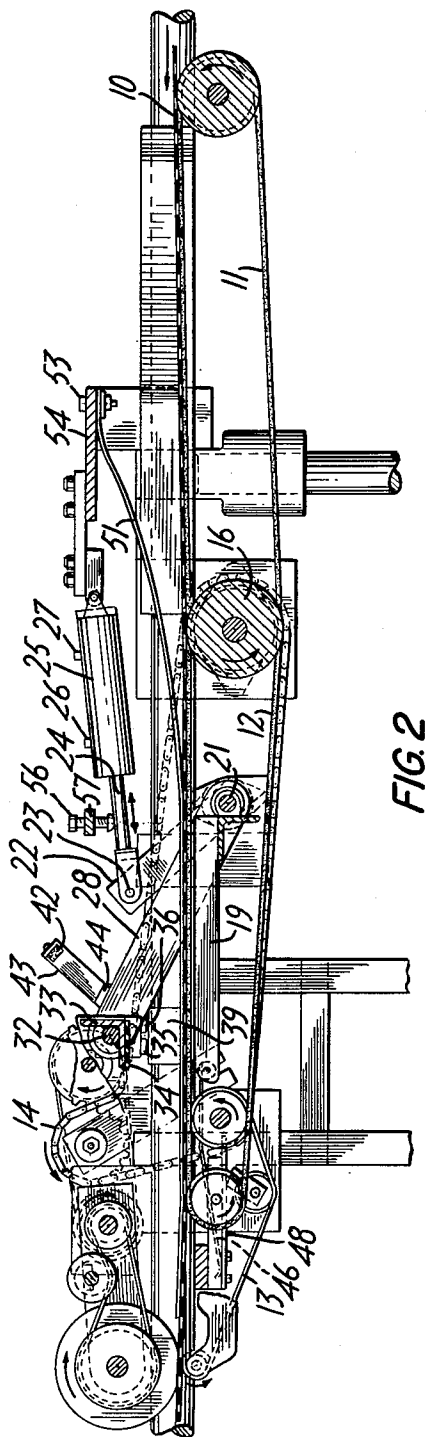


FIG. 2

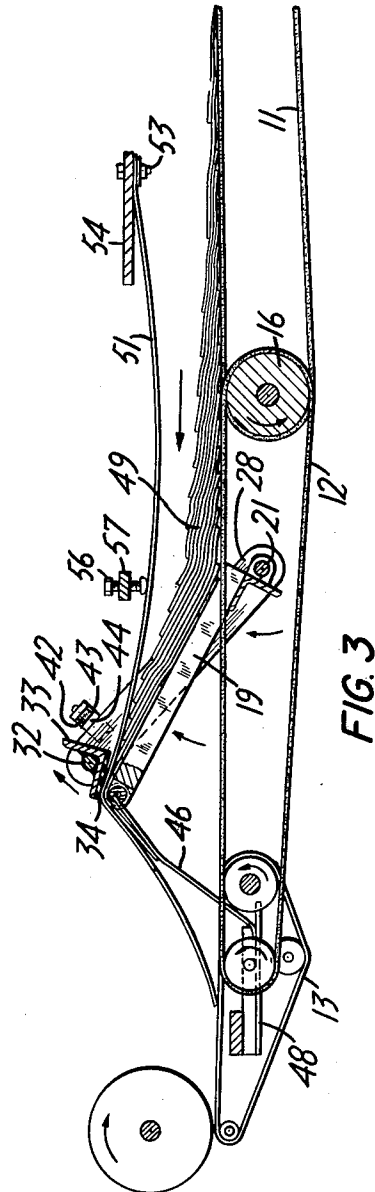


FIG. 3

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1

3,149,834

STREAM INTERRUPTER

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Filed Apr. 3, 1961, Ser. No. 100,250

14 Claims. (Cl. 271—47)

This invention relates to the handling of materials and, more particularly, to apparatus for the interruption of a stream or series of items flowing on a conveyer system from one point to another. The invention is an improved version of the stream interrupter described in the copending application of Harry W. Faerber, Serial No. 838,156, filed September 4, 1959 (now abandoned).

In the printing industry in which this invention finds particular application, printed sheets are normally conveyed from point to point where various operations are performed upon them, such as, for example, stacking, collating, storing, and the like. In conveying the sheets from one point to another, it often becomes necessary to interrupt the movement of the stream of sheets. Such an interruption may become necessary when a jam occurs in the moving stream, when it is desired to divert the stream from one series of conveyor belts to another series of belts, or for any other function requiring a gap in the otherwise continuous stream of signatures.

Generally, interruption of stream movement is accomplished by pinching the moving sheets between a pair of brake plates lying above and below the moving stream. In the present invention this simple pinching action is utilized as a basic interrupting operation to which other operations are added to accelerate the interrupting action and the forming of the gap and, further, to prevent jamming by minimizing the amount of accumulation of the printed sheets on the upstream side of the interruption and by tapering out such accumulation to prevent the formation of "wads" or bunched-up groups of such sheets or "signatures." These added operations comprise inclining the pinched sheets at an angle with respect to the plane formed by the moving sheets to force the sheets back against those flowing into the point of interruption and, in the case of sheets moving in a horizontal plane, to allow gravitational forces to aid in the interruption process; supporting specific portions of the pinched sheets; defining the contour of the pile of interrupted sheets; and providing for the upstream movement of the pinched sheets, thus opening the gap by both the upstream and downstream movement of the separated sheets, the latter movement resulting from the continued flow of the downstream section of the stream.

The added operations are conveniently embodied in a conveyer system that comprises a series of parallel spaced conveyer belts. A group of fingers are positioned below the conveyer belts, each one of the fingers being placed between a different pair of adjacent belts. In order to interrupt the movement of the stream of sheets, each finger is raised to come into contact with the moving sheets, thus to raise the contacted sheets against a movable stop member which is positioned above the sheets, directly above the fingers, and which, weighted, spring-loaded, or otherwise urged downward, is free to be raised for a limited distance. The fingers and the stop member are raised together to a position above the plane of the moving sheets, and thereby raise the pinched sheets with them. In this fashion, interruption of the sheet stream is greatly facilitated in that the moving stream heading toward the interrupting fingers and stop member has a number of sheets forced back upon it, and meets an inclined series of sheets whose movement has been halted. Further, the formation of the gap is

2

facilitated and accelerated by the pullback of the last pinched sheet. Such an incline, while facilitating the accumulation of the sheets, also takes advantage of the gravitational forces upon the raised sheets tending to slide them back down upon the flat plane of the moving sheets thus making the accumulation gradually tapered rather than abruptly bunched.

To prevent the likelihood of a jam, the pinched and raised sheets are supported by a support means attached generally in pivotal fashion to the tips of some of the finger members. When the fingers are raised to pinch the moving sheets against the stop member thereabove, the support means cradles or supports that portion of the pinched sheets which lies immediately downstream from the stop member and which normally hangs in mid air.

When the fingers are lowered to reinstate stream movement, this portion of the pinched stream is supported and is allowed to pass smoothly onto the conveyer belts.

To further prevent a subsequent jam in the sheet stream following the interruption of stream movement, the general shape or contour of the pile of interrupted sheets is held within certain defined limits. This may be advantageously accomplished through the use of a flexible belt adjustably positioned both above the stream of sheets and upstream from the stop member. In this fashion, jamming is prevented, and the extent and contour of an accumulation of interrupted sheets is accurately controlled in accordance with the needs of a particular printing establishment and with the subsequent operations to be performed upon the interrupted stream, such as diverting it onto a branch-conveyer, or separating stacks, for example.

Although the invention has been described above in general terms, a better understanding of it may be obtained by consulting the following detailed description when taken in conjunction with the appended drawings in which:

FIGURE 1 is a plan view of exemplary apparatus embodying the principles of the present invention;

FIGURE 2 is a sectional side view of the apparatus of FIGURE 1 taken along the line 2—2 of that figure, looking in the direction of the arrows; and

FIGURE 3 is a simplified sectional view of a portion of the apparatus of FIGURE 2.

Referring to FIGURES 1 and 2 together, a series of sheets of paper 10, shown only diagrammatically in FIGURE 2, are conveyed on a plurality of conveyer belts 11, 12, and 13 from right to left in the figures. The movement of the belts is controlled by a pair of chain drives 14 and 15 coupled to roller 16 that provides a support for belts 11 and 12. The movement of the chain drives is controlled in turn by a source of power (not shown) that is coupled to chain drive 15.

The interrupting apparatus comprises a plurality of parallel fingers 17 through 20 that are positioned below and in between conveyer belts 12. Each of the fingers is rigidly attached at one end thereof to a rotatable shaft 21. Also rigidly coupled to shaft 21 is one end of a plate 22, the other end of which is pivotally attached to a rod-end 23. Rod-end 23 forms a portion of piston rod 24 that is part of an air cylinder 25. Movement of the piston rod in the directions of the arrow of FIGURE 2 is brought about by the application of air pressure to a particular one of pressure lines 26 and 27 of air cylinder 25.

A pair of arms 28 and 29 are supported by shaft 21 in a freely pivotal fashion so that rotation of the shaft imparts no movement to the arms. A pair of supporting blocks 30 and 31 are attached to the upper portions of arms 28 and 29, and a rod 32 couples the two blocks. Attached to the bottom portion of rod 32, for example, by being welded thereto, and extending across the entire series of conveyor belts 12 is a stop plate 33. The plate

3

has a facing 34 of sponge rubber, for example, which will not damage or scratch the sheets of paper when coming in contact therewith.

The movement of arms 28 and 29, and thus the movement of stop plate 33, is limited in a lower of two extremes by small cushions 35 and 36, 37 and 38, which are attached to blocks 30 and 31, respectively, and which rest upon supporting structures 39 and 40. The upper limit of movement of arms 28 and 29 is similarly restrained by a pair of cushioned stops 41 and 42 which are attached to a supporting plate 43 which contacts an exposed portion 44 of arm 28. Arms 28 and 29 are biased to the lower of the two positions by the weight of the structure supported thereby, by added counterweights (not shown), or by spring loading (not shown).

In a non-interrupting position, fingers 17 through 20 lie below the conveyor belts, a position assumed when piston rod 24 is at its leftmost position, i.e., when a source of air pressure (not shown) is applied to pressure line 27 of air cylinder 25, line 26 serving as an exhaust line.

When it is desired to interrupt the movement of the sheets conveyed on the conveyor belts, air pressure is applied to pressure line 26, line 27 serving as an exhaust line, and piston rod 24 is thus forced to its rightmost position. As piston rod 24 moves to the right, pulling plate 22 with it, shaft 21 is rotated in a clockwise fashion, thus lifting the ends of fingers 17 through 20 up against the sheets thereabove on the conveyor belts. (See FIGURE 3.) The fingers are raised upward until the sheets thereabove are pinched firmly between the fingers and the facing 34 of stop plate 33. At this point the movement of the stream of sheets is interrupted by the pinching action, the degree of pinching being determined by the total weight of the stop plate structure or the amount of spring loading applied thereto.

Piston rod 24 continues to move to the right, however, and fingers 17 through 20 thus continue to be raised upward. Since stop plate 33 is supported by arms 28 and 29, which freely pivot about shaft 21, the rising fingers force the stop plate to its upper position against upper stops 41 and 42. In this fashion, the pinched sheets are raised above the plane of the flowing sheets and the interrupting action is greatly facilitated by both a gravitational action and by a backward pushing action against the flow of the sheets.

In order to support the sheets that are pinched between the fingers and the stop plate, a pair of support wires 45 and 46 are included that are pivotally mounted with respect to the ends of fingers 17 and 20, respectively. The other ends of the wires are supported on a pair of plates 47 and 48 over which they are free to slide. When fingers 17 through 20 are in non-interrupting positions, as shown in FIGURE 2, the wires rest in the positions as shown in that figure. However, when the fingers are raised to an interrupting position, as shown in FIGURE 3, the wires assume the position as shown in that figure and support the overlapping sheets that are pinched between the fingers and stop plate 33. When the interrupting fingers are lowered, the wires continue to support the sheets and prevent any jam from occurring as the sheets continue once again to flow in a stream on the conveyor belts.

In order to define the contour of the interrupted series of sheets 49 as shown in FIGURE 3, a pair of belts 50 and 51, covered with Teflon, for example, are utilized. The belts are rigidly attached by a pair of bolts 52 and 53 to a plate 54 which extends over the conveyor belts. The belts pass freely from the points of attachment on plate 54 to points downstream from stop plate 33 after passing between the stop plate and the series of sheets. Thus when the fingers are raised to an interrupting position, as shown in FIGURE 3, the belts define the contour of the interrupted sheets in order to prevent an excessive pile-up. To regulate the degree of contour, a pair of set screws 55 and 56 are included that are attached to a crossbar 57 bridging the conveyor belts. The positions of the set

4

screws regulate the positions of the belts above the sheets and thereby the contour assumed by the interrupted sheets.

After the interruption of stream movement, the flow of sheets upon the conveyor belts is reestablished by applying air pressure to line 27 of air cylinder 25. This results in a lowering of fingers 17 through 20 and a lowering of stop plate 33 to the positions shown in FIGURE 2.

Although the invention has been described above in detail, numerous additions, substitutions and modifications of the embodiments shown may be made without departing, however, from the scope of the invention which is defined in the following claims.

I claim:

1. Apparatus for the interruption of a stream of sheets comprising a pair of stop members, means for pinching a portion of said stream between said pair of stop members to halt the movement of said pinched portion of said stream, and means for pivoting said stop members about an axis to a predetermined position adjacent said stream to incline said pinched portion of said stream with respect to the plane defined by said stream to aid in the interruption of the stream.

2. Apparatus for the interruption of a stream of horizontally moving sheets comprising a pair of stop members, means for pinching a portion of said stream between said pair of stop members to halt the movement of said pinched portion of said stream, and means for raising said stop members while in pinching relationship above the horizontal plane formed by said moving sheets to a predetermined position adjacent said stream to aid in the interruption of the stream.

3. Apparatus for the interruption of a stream of sheets conveyed upon a series of moving belts spaced in parallel relation to each other comprising a plurality of finger members rigidly fixed to a common shaft, the position of said shaft being such that in a non-interrupting state each of said fingers lies both adjacent the space between adjacent ones of said belts and on one side of the plane defined by said series of belts, a stop plate lying on the other side of said plane opposite said fingers and attached to a support arm, said support arm being freely rotatable around said common shaft for a limited angular distance, means for biasing said support arm normally to assume a position at one limit of said limited angular distance, and means for rotating said common shaft to pinch said sheets between said finger members and said stop plate and to drive said stop plate to the other limit of said limited angular distance thereby to facilitate stream interruption and stream accumulation.

4. In apparatus for conveying a series of sheets from one location to another, means for interrupting the movement of said series comprising a finger member located on one side of said sheets, a stop member located on the other side of said sheets, means for bringing said finger and said stop members toward sheet contacting relationship to pinch a portion of said series of sheets therebetween and to halt the movement of said pinched portion of said series, and means for moving said finger and said stop members while in sheet contacting relationship to a second position in which the pinched portion of said series of sheets is raised out of said plane defined by said moving sheets to aid in interrupting the movement of said series of sheets.

5. In combination with apparatus as recited in claim 4, means for supporting the portion of said sheets preceding said pinched and raised portion of said sheets in the direction of travel of said series thereby to prevent jamming.

6. Apparatus as recited in claim 5 in which said supporting means comprises a supporting member one end of which is freely rotatable about a point in said finger member, the other end of said supporting member resting upon a plate that lies on the same side of said moving sheets as said finger member.

7. In combination with apparatus as recited in claim 4,

5

means for defining the contour of said series of sheets whose movement is stopped for a given distance from where said sheets are pinched and in a direction opposite to the direction of movement of said series thereby to facilitate reestablishment of said series movement.

8. Apparatus as recited in claim 7, in which said contour defining means comprises a belt of flexible material fixedly attached to a first point lying a predetermined distance away from said stop member in a direction therefrom opposite to the direction of movement of said series and on the same side of said series as said stop member, said belt extending from said first point to a second point lying beyond said stop member, said belt passing between said stop member and said series of sheets.

9. In combination with apparatus as recited in claim 8, a set-screw member positioned against the side of said belt that is not adjacent to said series of sheets, said set-screw member lying between said first point and said stop member, said set-screw member being adjustably positioned against said belt thus to provide adjustable contour defining means that is capable of establishing any desired contour for said series of sheets whose movement is terminated and who are positioned beneath said belt.

10. In apparatus for conveying a series of sheets moving in a stream from one location to another, means for interrupting the movement of said series comprising a finger member located at a first position on one side of said sheets, a stop member located at a second position on the other side of said sheets, means for bringing said finger and said stop members toward contacting relationship to pinch a portion of said series of sheets therebetween and to halt the movement of said pinched portion of said series of sheets, and means for raising said pinching finger and stop members to a position above and upstream from said first and second positions to aid in interrupting the movement of said series of sheets.

11. An apparatus for the interruption of a stream of horizontally moving sheets comprising a moving conveyor for feeding the stream of sheets, interruption means above and below the stream and normally in positions which do not interfere with the feed of the stream by the con-

6

veyor, and actuating means for moving one of said interruption means into the path of the stream and toward the other of said interruption means until the friction exerted by the cooperation of both of said interruption means stops the flow of signatures by the moving conveyor.

12. An apparatus for the interruption of a stream of moving sheets comprising a moving conveyor for feeding the stream of sheets, interruption means above and below the stream and normally in positions which do not interfere with the flow of the stream, and actuating means for moving the lower interruption means upwardly into engagement with the stream and toward the overhead interruption means, thereby stopping the flow of the stream by the moving conveyor, the lower interruption means having a surface which moves in a backward direction opposite to the direction of feed of the sheets as it moves upwardly to stop the feed of the stream and move backwardly the leading sheet interrupted.

13. An apparatus as set forth in claim 12 in which the lower interruption means is a pivotal element pivoted at its upstream end so that the downstream end moves upwardly and rearwardly as it moves into position to interrupt the stream.

14. An apparatus as set forth in claim 12 in which the upper interruption means is also a pivotally mounted element pivoted at its upstream end and including stop means for limiting the upward pivotal movement of said upper interruption means by the actuation of the lower interruption means.

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