Sept. 4, 1962 F. L. FERTIG 3,052,467

STACKER FOR INTERMIXED DOCUMENTS OF VARYING SIZE

Filed July 18, 1960 3 Sheets-Sheet 1

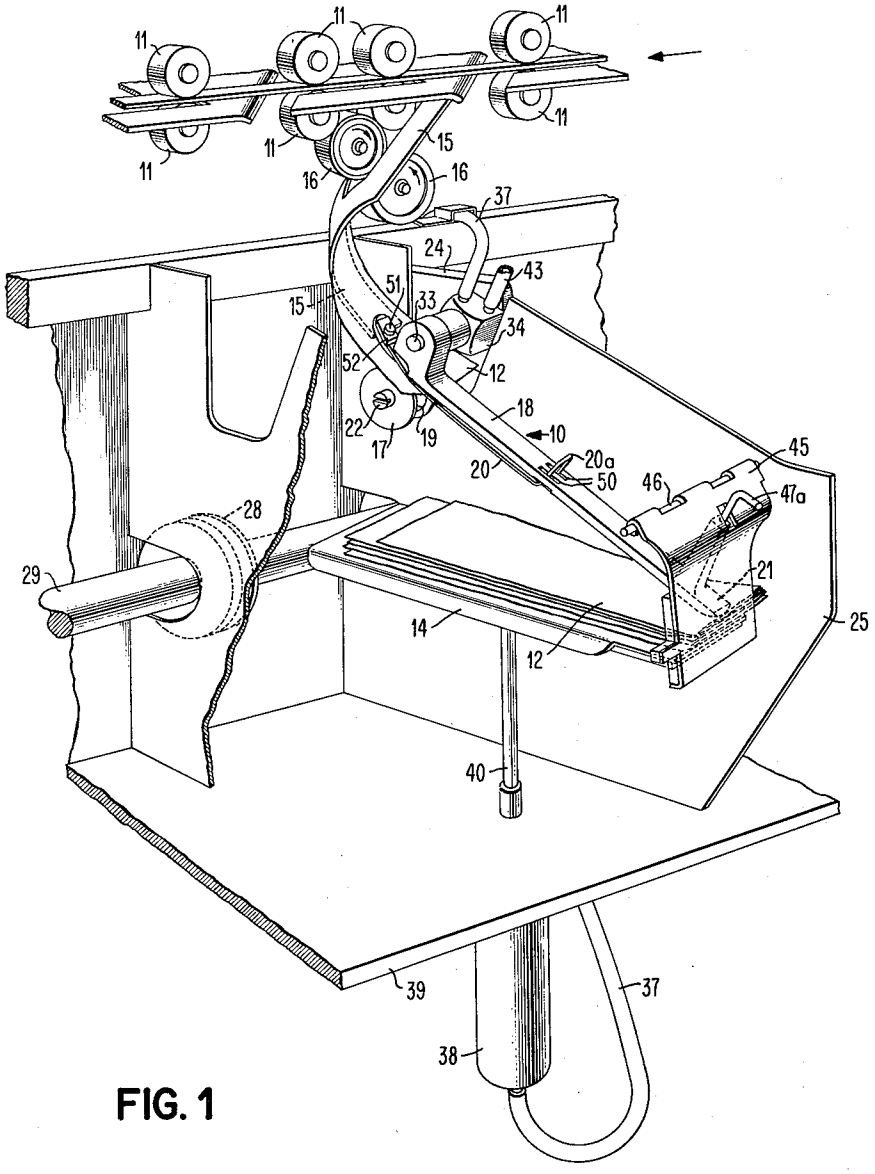

FIG. 1

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Sept. 4, 1962 F. L. FERTIG 3,052,467

STACKER FOR INTERMIXED DOCUMENTS OF VARYING SIZE

Filed July 18, 1960 3 Sheets-Sheet 2

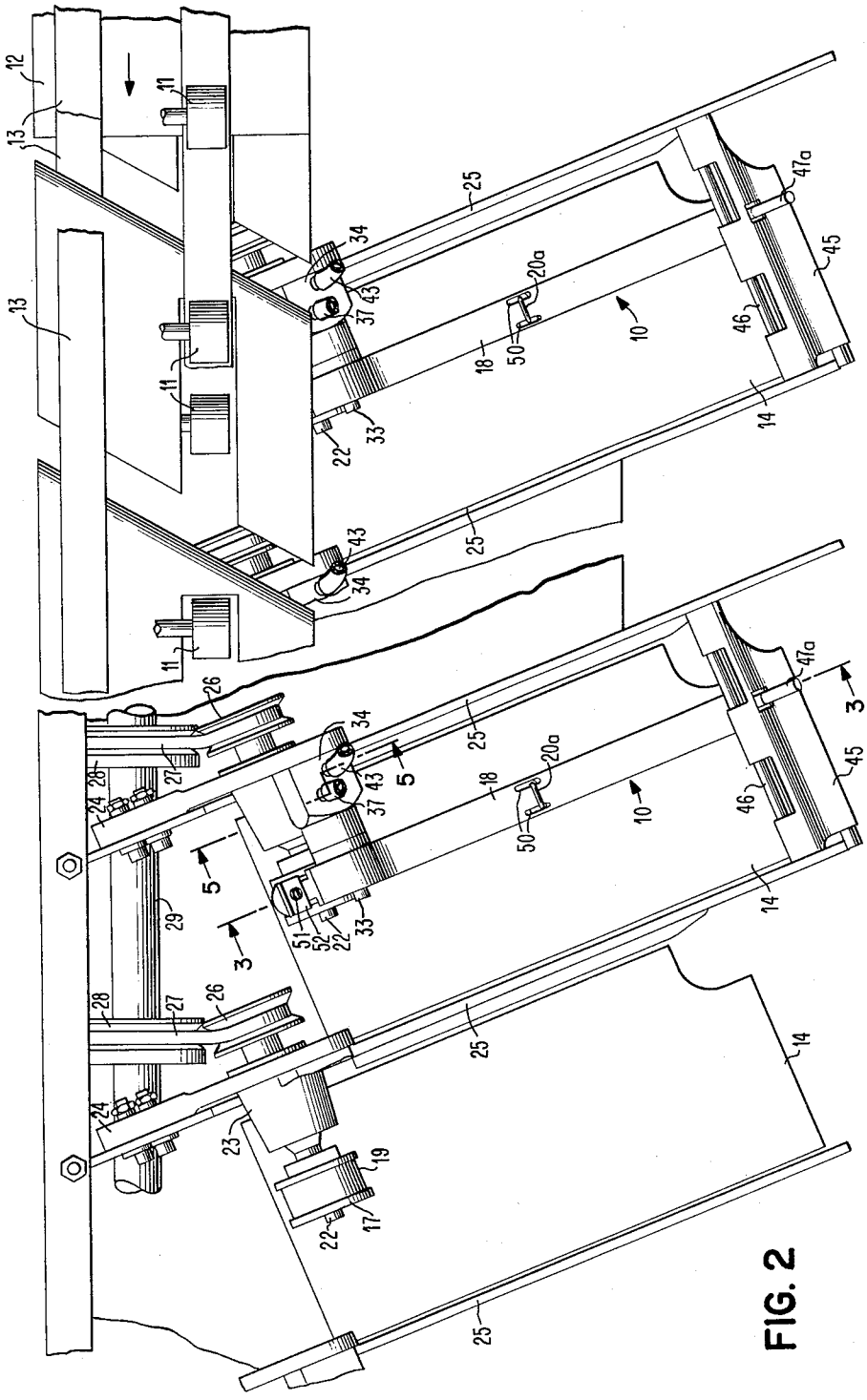

FIG. 2

Sept. 4, 1962 F. L. FERTIG 3,052,467

STACKER FOR INTERMIXED DOCUMENTS OF VARYING SIZE

Filed July 18, 1960 3 Sheets-Sheet 3

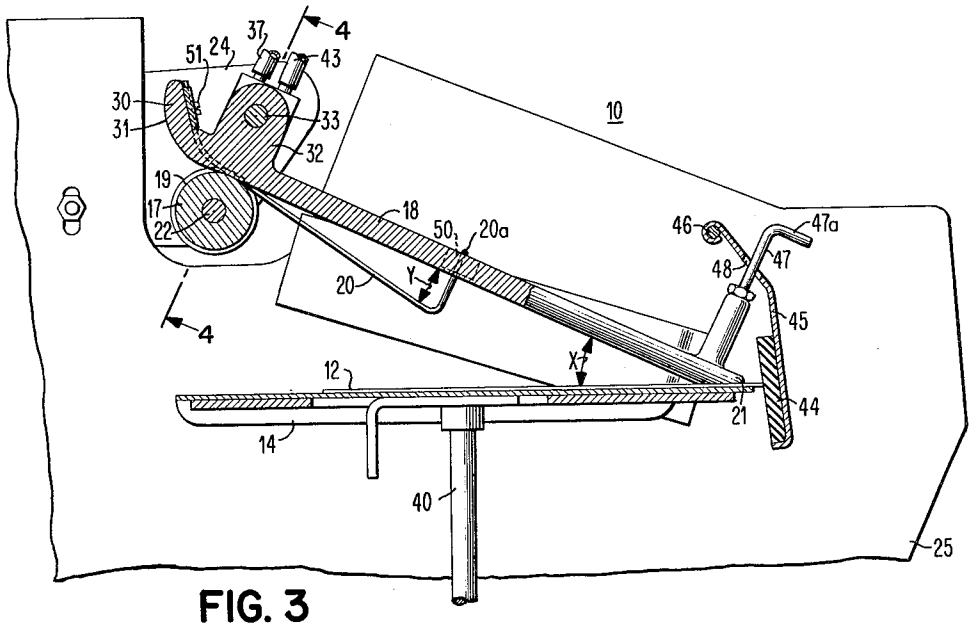

FIG. 3

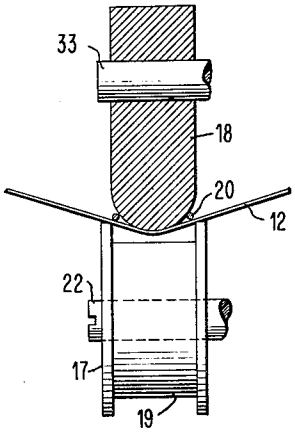

FIG. 4

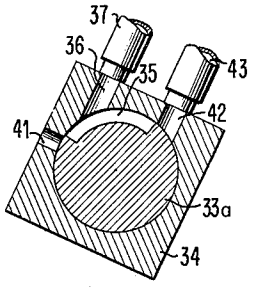

FIG. 5

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STACKER FOR INTERMIXED DOCUMENTS OF VARYING SIZE

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8 Claims. (Cl. 271—71)

This invention relates to stacking devices especially suitable for stacking documents of varying sizes, such as bank checks or letters, and more particularly relates to an improved stacking device embodying means for assuring better stacking and alignment of such documents and minimizing the possibility of jamming if documents are mutilated.

It has heretofore been proposed to provide a stacking device comprising a synchronously operated cam-driven finger to pat an incoming document downward onto the top of the stack and out of the path of the succeeding document. However, such a device is not suitable for stacking intermixed documents of varying sizes because the patting fingers operate periodically at constant time intervals without regard to the length of the documents. It has also been proposed to provide concave-convex mating feed rolls which engage the document at and between its edges and bow the card to give it some rigidity so that it will not droop or curl in uncontrolled fashion as it drops into a pocket. When these rolls are used, the documents can become jammed in the rolls or else torn if the rolls contact already torn edges, embossed matter, folds, creases or staples or the documents are abnormally thick.

The principal object of this invention is to provide an improved stacking device wherein an incoming document is stacked in such a manner that its trailing end will be positively kicked down out of the path of the succeeding document by an asynchronously operated means that is controlled by the length of the particular document being stacked.

Another object is to provide an improved stacking device wherein an incoming document is stacked with a minimum of contact with a stacking drive mechanism and with the top of the stack to minimize the possibility of jamming or tearing the document if it should be mutilated.

Still another object is to provide a stacking device which aligns a document both transversely and longitudinally as it stacks the document, thereby to eliminate the need for "joggling" or otherwise realigning the stacked documents before they can be reprocessed.

According to the invention, a stacking device embodying the invention comprises a grooved feed roll and an overlying hinged inclined guide rail which has a convex underside which can project into the groove in the feed rolls. A spring is clamped to the guide rail and passes through the grooved portion of the feed roll and then normally downward at an angle to the inclined guide rail. The feed roll is substantially narrower than the document and centered relative to the longitudinal axis thereof so that it will not contact any mutilations at or near the side edges of the document. When the leading edge of the document is fed between the feed roll and rail, the document will be bowed to increase its rigidity and the spring will be deflected upwardly by, and out of contact with, the document. The roll will positively drive the bowed document so that it will fly into contact with a stop and en route be kept transversely aligned by the rail, and its leading edge will pass between the low end or toe of the rail and the forward part of the top document on the stack. As long as any part of the document contacts the roll, the spring will be maintained in its upper

or noneffective position so that it will not interfere with the guiding action of the guide rail against the leading part of the document; but, as soon as the trailing edge of the document passes beyond the roll, the spring will be unleashed and kick the trailing portion of the document down out of the way of the succeeding document.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of a preferred embodiment of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of a stacking device embodying the invention shown associated with a transport portion of a document sorting machine;

FIG. 2 is a plan view of part of the transport system and of a plurality of underlying stacking devices with a portion of the transport system broken away to show details of some of the stacking devices;

FIG. 3 is a section view taken along the line **3—3** of FIG. 2;

FIG. 4 is a section view to enlarged scale taken along the line 4—4 of FIG. 3; and,

FIG. 5 is a section view to enlarged scale taken along the line 5—5 of FIG. 2.

Description

Referring to FIGS. 1 to 3, a plurality of stacking devices **10** embodying the invention are shown in side-by-side relation applied to a document sorting machine. The sorting machine comprises, briefly, a plurality of pairs of feed rolls **11** which drive documents **12**, such as checks, letters or cards, seriatim face upward along a main feed path in the direction of the arrow. Conventional means, such as chute blades **13**, not forming part of the present invention, are selectively deflectable by a reading means (not shown) to divert each document from the main feed path downwardly to a selectable one of the stacking devices **10**. Each stacking device **10** controls the stacking of documents on a vertically movable platform **14** in a respective receiving pocket or bin.

Each stacking device **10** comprises an outer guide member **15** along which a document is fed by a pair of feed rolls **16** after being diverted from the main feed path by the corresponding chute blade **13**. Each guide member **15** curves downwardly and laterally to cause the document to be moved in a twisting corkscrew-like path along said member so that it will be turned face downward, for reasons presently to be explained. After the leading edge of the document passes beyond the lower end of guide member **15**, it is fed between a feed roll **17** and an overlying guide rail **18**.

The feed roll **17** has an annular groove **19** intermediate its ends and is substantially less than the width of the document so that the ungrooved parts of the roll will straddle the longitudinal axis of the document and yet be spaced well within the side edges of the document so that any mutilations adjacent said edges cannot be engaged by said roll and cause jams. The guide rail **18** has a convexly curved undersurface which extends into the groove **19** so that, as the document is fed between the roll **17** and rail **18**, it will be bowed longitudinally as shown in FIG. 4. This bowing of the document will increase its rigidity and facilitate stacking of documents which are inherently "weak" or "flabby" due to lightness of weight, direction of grain, high relative humidity and/or mutilations. The guide rail **18** and a deflector spring **20** carried by said rail also serve to hold the document firmly against the feed roll **17**. The roll **17** is made of material having a high coefficient of friction to positively drive the document so that it will fly to the stacked posi-

tion in which it is shown in FIG. 3, and en route will enter between the toe 21 of the guide rail and the top surface of the platform 14 or the top surface of a preceding document already stacked.

Each grooved feed roll 17 is keyed to a shaft 22 journaled in a bearing 23 carried by a bracket 24 secured to one side 25 of the document receiving pocket. Each shaft 22 is suitably driven at a constant speed, such as by a pulley 26 driven via a belt 27 from another pulley 28 that is rotatably driven by a drive shaft 29. Shaft 29 preferably drives all the pulleys 28 for the respective stacking devices.

At its upper end, the inclined quide rail 18 has an integrally formed heel 30 providing a curved guide surface 31. Adjacent its heel 30, the rail 18 has an upwardly extending lug 32. The rail 18 is keyed to, and carried on, a rockable shaft 33 which passes through the lug 32 and is journaled in a valve casing 34 carried by the bracket 24. The rail 18 is biased by gravity clockwise, as viewed in FIG. 3, about shaft 33 such that its toe 21 will rest lightly on the platform 14 or the top document stacked on the platform. As illustrated in FIG. 5, the portion 33*a* of the shaft 33 that extends into the valve casing 34 has a lapped pressure-tight fit with the casing and has an arcuate recess 35 in its periphery.

Portion 33*a* is in the nature of a plug valve or cock which controls the air pressure in a delivery port 36 that is connected via a hose 37 to the underside of a piston (not shown) of an air cylinder 38. This cylinder is mounted on a bed plate 39 and has a piston rod 40 connected to the platform 14 to control the height of the platform. More specifically, when valve 33*a* is in a neutral or normal position in which it is shown in FIG. 5, air under pressure will be bottled up in the air cylinder below the piston. As documents are stacked on the platform 14, the toe 21 of the rail 18 will tend to rise and thus cause shaft 33 and valve 33*a* to rock counterclockwise to an exhaust position. In this position, recess 35 registers with an exhaust port 41 (FIG. 5) in the casing 34 to bleed air from the cylinder 38 and thus cause the platform 14 to lower slightly until the toe 21 drops enough to rock the valve 33*a* back to neutral position. When a stack of documents is removed from the lowered platform 14, the toe 21 will drop and cause the shaft 33 and valve 33*a* to rock clockwise to a supply position. In this position, recess 35 connects delivery port 36 to a supply port 42 for causing the air cylinder 38 to be recharged from a source (not shown) of compressed air via a hose 43 and the ports 42, 36 until the platform 14 is elevated sufficiently to engage toe 21 and rock valve 33*a* back to neutral position.

It will thus be apparent that valve 33*a* acts to raise or lower the platform 14 as necessary to maintain the top of the stacked deck of documents at a constant preselected height at which the guide rail 18 is inclined to the platform and deck at a predetermined angle X.

As shown in FIG. 3, the front edge of each guide rail toe 21 is spaced slightly from the left-hand side of a corresponding stop or aligning member 44 against which the documents 12 are driven as they are stacked. This member 44 is laterally mounted to a generally vertical portion of a bent support gate 45, that at its upper end is supported on a hinge pin 46 carried by the side walls of the pocket. A stop bar 47 is connected to the lower end of the guide rail 18 above toe 21 and projects upwardly through a slot 48 in the bent part of gate 45. At its upper end, bar 47 terminates in a hook-like end 47*a* that overlies and is adapted to rest on the upper part of the gate. If the gate 45 is rocked manually counterclockwise far enough for the gate to engage and elevate the hook-like end 47*a* of the bar 47, the toe 21 will be raised and rock the valve 33*a* to exhaust position to lower the platform 14 to facilitate removal of documents from the platform.

As shown in FIGS. 1 and 3, each deflector spring 20 comprises a piece of wire looped through parallel axially elongated slots 50 extending vertically through the guide rail 18 intermediate the lug 32 and toe 21 so as to overlie the upper side of the guide rail and provide two substantially identically spaced parallel strands. These strands project below the guide rail 18 and then normally angle back toward and through the groove 19 of the feed roll and thence upwardly through slots in the guide rail heel 30 to the upper side of the guide rail. The ends of these strands that project upwardly through these slots are suitably clamped to the upper side of the guide rail, such as by a clamping screw 51 and plate 52. Thus, the spring 20 is generally nose shaped and biased to a normal position, in which it is shown in FIG. 3. In this position, the strand-joining loop 20*a* rests on the upper surface of the guide rail 18, and the strands of the spring 20 project downwardly at an angle Y from the lower surface of the guide rail and lie within, but near, the outer transverse edges of the groove 19 in the feed roll 17. Spring 20 is provided to kick the trailing portion of a document down as soon as the trailing edge of the document passes beyond the grooved feed roll 17.

Summary of Operation

Assume that a document 12, which is being driven face upward along the main feed path by rolls 11, is diverted from said path by a chute blade 13 and into contact with the outer guide member 15 of a stacking device 10. The document will then be driven by rolls 16 along the outer guide member 15 and, due to the twisting shape of said member, be constrained to follow a downwardly and laterally curving path, whereby the document will approach the grooved feed roll 17 face downward.

Immediately after the leading edge of the document leaves the lower end of the guide member 15, it will be guided by the curved surface 31 of guide rail heel 30 and then fed between the guide rail 18 and grooved feed roll 17. Due to the generally concave surface of the roll 17 and overlying convex surface of the rail 18, the document will be "bowed" or "cupped" longitudinally, as shown in FIG. 4, to increase it rigidity.

According to one feature of the invention, the roll 17 will positively drive the bowed document so that its leading edge will fly toward and under the toe 21 and into abutting contact with the stop 44; and, during such flight, only a small portion of the document adjacent its leading edge will actually slide along the top document of the existing document deck. Also, since the roll 17 is substantially narrower than the document, it will not contact any mutilated edges of the document. Also, since the documents are longitudinally bowed and guided to the stack by the rail 18, the documents will be stacked in good alignment. This permits the documents to be removed from the bin and reloaded into the sorting machine or another machine for further processing without requiring the use of a "joggling" device to properly realign the documents beforehand.

Meanwhile, according to another important feature of the invention, as the leading edge of the document moves into the roll 17, it will deflect spring 20 upwardly to the abnormal position, in which it is shown in FIG. 1, and which the angle Y is reduced to zero and the looped part 20*a* projects above the guide rail 18. The spring 20 will be maintained flexed in its upper position so long as any part of the bowed document is passing through the roll 17; and, hence, spring 20 will not in any way deflect the leading part of the document as it flies toward the stop 44. However, as soon as the trailing edge of the document passes out of contact with roll 17, the flexing force on the spring will be removed. The energy previously stored in the spring 20 will thereupon snap the spring downward and kick the trailing part of the document downward as the spring moves to its normal position, in which it is shown in FIG. 3. Thus, the positive deflective action of spring 20 assures that a document will be shifted promptly

out of the way of a succeeding document and will not pass under or collide with a preceding document.

It is to be noted that the stacking device **10** is especially suitable for stacking intermixed documents, such as checks or letters, of varying lengths because the time at which the spring **20** moves to its normal or deflecting position is in each instance controlled by the length of the particular document it is to deflect. This device constitutes a distinct improvement over a synchronously operated deflecting mechanism which, at the end of each successive constant interval of time, pats or kicks the documents because, if the sizes of the documents vary appreciably, the patting action would tend to get out of phase with the uneven rate of presentation of the documents.

As documents are successively stacked on the platform **14**, the valve **33***a* will be operated, in the manner already fully described, to cause the air cylinder **38** to lower the platform as necessary to maintain the top of the stack of documents at a constant height. Since the documents are turned over and deposited face downward on the stack, they will be stacked in the same order as they originally had when fed into the sorting machine.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. In a document stacking device, the combination of a roll and a guide member cooperating to provide a constriction through which documents are fed serially; and a deflector spring secured to the member and forcibly displaced one way by a document while and so long as any portion thereof is within the constriction between the roll and member to render the spring ineffective to deflect such document, said spring, as soon as such document passes beyond the roll, being freed from such forcible displacing force to permit it to be deflected the opposite way by the energy stored therein for deflecting the trailing portion of such document.

2. In a document stacking device, the combination of a driving feed roll; a guide member; means for advancing documents serially between said roll and member; a stop engageable by the leading edges of successive documents under the driving action of the feed roll; and spring means carired by said member and extending generally longitudinally past the roll toward said stop, said spring means, when a document engages the roll, being forced by such document to an abnormal position in which it is ineffective to deflect such document, the power stored in said spring means thereafter being effective, as soon as sush document moves out of engagement with said roll, to snap the spring means to a normal position for deflecting the trailing portion of such document away from said guide member.

3. In a device for stacking documents, the combination of a driving feed roll having an annular groove which straddles the longitudinal center line of the feed path of the documents, said roll being narrower than the width of the documents so as not to engage the documents at or immediately adjacent their side edges; a guide member providing a surface which is adapted to project longitudinally through and beyond the groove and cooperates with said roll to bow a document longitudinally to increase its rigidity as it is fed by and past said roll; a stop into contact with which the documents are successively driven by the positive action of the feed roll, said documents as they are driven toward said stop being maintained in substantially transverse alignment by said projecting surface of said guide member; a deflector member movably connected to said guide member for striking and deflecting the trailing portion of each document out of the path of the following document; and means, including each document, for effecting operation of the deflector member only after the trailing edge of such document leaves said groove.

4. In a device for stacking documents, the combination of a driving feed roll having an annular groove which straddles the longitudinal center line of the feed path of the documents, said roll being narrower than the width of the documents so as not to engage the documents at or immediately adjacent their side edges; a guide member having a surface which is adapted to project into the groove to bow a document longitudinally to increase its rigidity as it is fed by and past said roll toward a stop; and spring means anchored to said member and extending between the roll and member so as to be forced toward said member by a document whenever any portion of the document is engaged by said roll, said spring means being freed and effective when the trailing edge of the document passes beyond the roll to positively strike and deflect the trailing portion of the document away from the member promptly to clear it out of the path of a succeeding document.

5. In a device for stacking documents, the combination of a driving feed roll having an annular groove which straddles the longitudinal center line of the feed path of the documents, said roll being narrower than the width of the documents so as not to engage the documents at or immediately adjacent their side edges; a platform on which the documents are adapted to be stacked; a stop near the end of the platform remote from the roll; and a hinged guide member having a toe which lightly rests on the top of the document stack, in proximity of the stop, said guide member being inclined to the stack and hinged on an axis spaced from the axis of the roll and lying in a plane normal to the feed path and passing through the axis of said roll, said guide member having a curved surface which faces the groove and is capable of projecting into said groove to cause a document to be bowed longitudinally to increase its rigidity as it is fed by and past said roll, said documents being successively driven positively toward said stop by said roll and concurrently being maintained in substantially transverse alignment by sliding engagement with said curved surface, said roll imparting sufficient velocity to the documents to cause them to fly clear of the top of the stack until their leading edges approach the toe and then slide under the toe into contact with the stop, thereby to minimize the possibility of tearing or jamming of documents due to imperfections in their side edges or the top faces of the preceding document.

6. The combination according to claim 7, including deflector spring means comprising two spaced strands of wire which are adapted to project generally tangentially through the groove and straddle the guide member, said spring means being anchored to said guide member and normally inclined to the guide member execept when a document engages the roll and deflects the spring means to an abnormal position in which it is substantially flush with the guide member, said spring means being effective after such document passes beyond said plane to positively strike and deflect the trailing portion of such document toward the platform to clear it from the path of a succeeding document.

7. In a device for stacking intermixed forms of random varying lengths, the combination of two members having adjacent portions separated by a small clearance space, means for advancing the forms successively through and past said space, and deflecting spring means extending generally through and past said space such that whenever any part of a form is at a certain point within said space such form will forcibly displace the spring means to an energy-storing position in which it is substantially ineffective to deflect such form, and whenever the trailing edge of such form passes beyond said point such force will be removed and free the spring means

to cause the latter to strike the form a deflecting blow to divert it out of the path of a succeeding form, whereby the instant at which the spring means is freed to strike such blow will vary asynchronously according to the length of each successive form.

8. In a device for stacking forms, the combination of two members providing closely spaced surfaces between which forms are successively feedable en route to a stack, and deflecting means extending generally between said surfaces and toward the stack and resiliently biased such that whenever any part of a form is between said surfaces such form will divert said deflecting means against such bias and to one side of the path of the form as it exits from between said surfaces, and after the trailing edge of such form passes from between said surfaces said deflecting means will be biased to a normal position in which it intercepts said path and diverts such form from said path.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,052,467 September 4, 1962

Frank L. Fertig

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 50, for the claim reference numeral "7" read -- 5 --.

Signed and sealed this 29th day of October 1963.

(SEAL)
Attest:
ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS

Acting Commissioner of Patents