DEVICE FOR FEEDING AND SORTING DOCUMENTS

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Filed: June 14, 1972

Appl. No.: 262,804

U.S. Cl. ......................... 271/4, 271/34, 271/62 R, 271/88

Int. Cl.......... B65h 1/18, B65h 3/04, B65h 31/10

Field of Search ................. 271/4, 6, 34, 35, 271/3, 7, 39, 62 R, 86-88, 12, 10

References Cited

UNITED STATES PATENTS

3,025,051 3/1962 David et al. ......................... 271/4

3,488,048 1/1970 Dykaar et al. ......................... 271/10

3,682,473 8/1972 Kuyt ................................... 271/87

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ABSTRACT

This device includes a station for separating documents from a stack, one by one, with the platform upon which the stack rests being automatically movable so that the top of the stack remains next to the separating mechanism. The device further includes two collecting platforms which are automatically movable so that the top of the collected stack remains level with the collecting mechanism. The collecting mechanism may be positioned to accommodate different length documents and the positioning controls the speed at which the documents are removed by the separating station.

6 Claims, 5 Drawing Figures
DEVICE FOR FEEDING AND SORTING DOCUMENTS

BACKGROUND AND SUMMARY OF THE INVENTION

The subject matter of this invention relates to reading and sorting devices for flexible documents such as bank checks. More particularly, this invention relates to improvements in the mechanism for removing documents from a stack and for placing these documents into two other stacks.

One of the main problems in reading machines is the automatic removing of the documents from a stack and sending them toward the reading mechanism. According to this invention, the documents, which are stacked on a platform, are brought into contact with a moving belt which strips them from the stack by means of a motor which moves the platform toward the belt. The platform continues to move toward the belt until the pressure of the documents against the belt overcomes the force exerted by a spring, at which time a switch is activated to stop the motor and the platform movement. As the documents continue to be stripped, the pressure against the belt will be relaxed until the motor is started again. By this means, the top document on the platform will always be kept next to the stripping belt, no matter how thick the stack happens to be.

According to another aspect of the invention, the documents after having been read, are stacked on platforms which are automatically controlled so that the top of the stack is always next to the stacking control mechanism; this mechanism includes a flat spring for damping the horizontal velocity of the documents and a moving belt which pulls each document against the flat spring. As the stack of documents grows thicker, the control mechanism lifts until a switch is triggered; the switch causes the platform to lower, thereby causing the control mechanism to lower and stop the lowering of the platform.

According to a third aspect of this invention, after the documents have passed the reader and before they are stacked, the documents pass barrel shaped rollers which curve them so that they will be stiffened, thereby insuring proper stacking.

Also disclosed is a device which controls the positioning of the stacking mechanism so that it can accommodate documents of various lengths. This device not only positions the stacking mechanism but also controls the speed of the motor which strips documents from the incoming pile; by this means, the distance between documents as they pass through the machine can be kept constant, without regard to the length of individual documents.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of loading, separating and accelerating devices and a partial view of the aligning device constructed according to the principles of this invention;

FIG. 2 is a front view of the reading device and a partial front view of the aligning device;

FIG. 3 is a partial front view of the sorting and receiving devices in the apparatus according to the invention;

FIG. 4 is a partial front view of the sorting and receiving devices;

FIG. 5 shows the arrangement of the first four figures.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the accompanying drawings, the apparatus according to the invention includes a vertical supporting plate 15 (FIG. 1) which carries a loading station 10 which includes a stack of documents 11, a separating device 12, an accelerating and aligning device 13 (FIGS. 1 and 2), a reading station 14 (FIG. 2) and a receiving unit 16 (FIGS. 3 and 4).

The loading station 10 (FIG. 1) includes a vertically movable loading platform 18 which supports documents 11. The platform 18 is moved in a vertical direction by means of a belt 24 which is stretched between two pulleys 26 and 27; arm 25 cooperates with groove 21 which is located in front plate 22 and in the base plate 15. Belt 24 is circulated by feed motor 23. The front plate 22 and the side plate 9 serve as vertical reference planes for the documents 11 carried by loading platform 18.

Located in recess 28 of the platform 18 is a light source 29 which co-operates with photoelectric cell 30 to provide an indication as to whether or not documents are on the loading station 10.

The movable platform 18 carries a scale 31 by means of which the operator can read the length of the documents 11.

Located on the upper portion of the loading station 10 is a feed device 12 which includes a separating roller 32 made of a pliant (or rubber-like) material and provided peripherically with a plurality of notches 33; the roller is driven by motor 34 which is housed behind the support plate 15. The roller 32 drags a stripping belt 36 which is stretched between pulleys 37 and 38; pulley 37 is integral and coaxial with the roller 32 and covers the middle portion of roller 32.

Located opposite to roller 32 is an ejection roller 51 which rotates at a lower rate and in the opposite direction to that of separating roller 32; the roller 51 is driven by the same motor 34 which drives roller 32.

Fulcrumed on the same pivot 41 which carries the pulley 38 is a lever 39 having roller 42 at one end thereof; the roller 42 holds belt 36 tight by pushing on its internal surface due to the thrust of spring 43 which is stretched between the other end 44 of the lever 39 and a fixed point 46.

There is another lever 47 located behind base plate 15 which lever is identical to lever 39; the lever 47, as it lifts, will contact microswitch 49. This operation will be discussed hereinafter.

After a document 11 is separated from the stack by the device 10, it is shifted into accelerating and aligning path 48, which path is defined by the base plate 15 and a pair of guides 52 and 53 fixed perpendicularly to said base plate (FIGS. 1 and 2).

Two accelerating rollers 60 and 70 (FIGS. 1 and 2) are located at the initial and final portion of the accelerating and aligning path 48; the rollers act through suitable slots formed in the guide 53. There are other accelerating and aligning rollers 54 which are located along the intermediate portion of path 48; these latter rollers are assembled on the base plate 15 with their axes being parallel to the accelerating path 48 but are inclined with respect to the plane of the base plate 15.

This inclination imparts a component of thrust to the documents toward the base plate 15; the plate there-
fore serves as a vertical reference plane for aligning the documents. The rollers 60 and 70 alter the velocity of the documents from the stripping rate to the desired feed rate of the reading station.

The rollers 54 are driven by driving belt 57 which passes around the pulleys 56 which are assembled coaxially with said rollers 54 on the read side of the base plate 15; the motion is imparted to the belt by a feed motor 58 through suitable intermediate idle means. This same motor 58 also imparts motion to the accelerating rollers 60 and 70.

Counter rollers 59 are located in opposition to the rollers 54 and push against the rollers 54 by means of flat spring 61 (FIG. 2).

After the documents leave accelerating and aligning device 13, they are fed toward the reading station 14 by drum 62. Drum 62, which is driven by motor 58, is coupled to belt 63 which passes along an arc of said drum; the belt 63 is held in tension by a tension roller 64 which acts by means of a lever urged by a spring 66.

Magnetic read-write heads 67 and 68 are located so as to scan the documents as they pass between drum 62 and belt 63.

Two parallel plates 69 and 71 (FIGS. 2, 3 and 4) are located perpendicular to the base plate 15 and define the path of the documents 11 from the accelerating and aligning device 13, through the reading station 14, and into the receiving unit 16.

Located at the input of the receiving unit 16 is a movable deflector 72 which can be caused to rotate about shaft 73; depending upon the position of deflector 72, documents will be deflected toward one of the receiving pockets 74 and 76.

Two collecting pockets are provided so that sorting can be carried out; for example, documents confirmed as valid by the reading station may be collected at 74 and invalid documents may pass to 76.

The receiving pocket 74 (FIG. 3) includes collecting platform 77 which is slidable vertically along shaft 78. Shaft 78 is behind the plate 15 and the position of platform 77 along shaft 78 is controlled by bi-directional motor 79. The motor controls belt 81 to which collecting platform 77 is rigidly connected.

Pocket 74 includes a collecting carriage 82 which insures the correct stacking of the documents by means of a rigid positioning arm 88 which serves as a horizontal end-of-travel stop for the documents which are deflected into the pocket 74. The carriage 82 includes a rocking arm 83 carrying two pulleys 84 and 86 on its ends; the pulleys carry continuously circulating belt 87 which draws each incoming document firmly against path limiter 88. The stop surface of the positioning arm 88 carries a flat damping spring 85 which deadens the horizontal travel of the documents when they strike the stop member 88. The arm 83 is fulcrumed on pin 89 of pulley 86 and can rock freely between two positions which are defined by the positions of the two control interswitches 93 and 94. A lug 92 of the arm 83 makes contact with one of the other of the switches depending on the position of the arm 83 so as to energize or de-energize the motor 79; this operation will be explained hereinafter in detail.

It is possible to manually adjust the longitudinal dimension of the receiving pocket 74 in accordance with the length of the documents processed by virtue of the fact that the collecting carriage 82 is displaceable along a guiding slot 91 which is provided in the base plate 15.

The documents are made more rigid before being collected by bending them along their middle portions. In order to accomplish this, two tapered or barrel shaped rollers 96 and 97 curve the documents as they pass. Since the documents are bent with their outer edges higher than their middle portion, they will not sag before they reach the end of travel stop 88. A spoon shaped plate 98, which is located immediately after the roller 97, insures that the document will remain curved for sufficient time.

A spool 101 carries a band 99 which has one end anchored to the arm 83 of the carriage 82; the band can be unwound from the spool 101 and follow the displacements of the carriage 82 along the guiding slot 91.

The receiving pocket 76 (FIG. 4) is similar to pocket 74 and includes a horizontal collecting platform 102 which slides along shaft 103; the platform is controlled by bi-directional motor 104 which acts through belt 106.

Pocket 76 includes collecting carriage 107 having positioning arm 113 which serves as an end-of-travel stop of the collected documents; the carriage 107 further includes a rocking arm 108 which carries two pulleys 109 and 111 which continuously rotate belt 112. The belt stacks the documents shifted into the receiving pocket 76 by accompanying and holding them against travel limiter 113. The construction details are the same as those of pocket 74.

The longitudinal dimension of receiving pocket 76 is hand adjustable to correspond to the documents processed by virtue of the fact that collecting carriage 107 is slidable along a guiding slot 116; by this means the position of the stop arm 113 is modified.

Located between the deflector 72 and the receiving pocket 76 are two guides 127 and 128 which are parallel each other and perpendicular to the base plate 15; these guides define the path of the documents which are sent to pocket 76. A set of rollers and counter rollers provide the feeding means for the documents along this portion of the path.

Motor 129 drives pulleys 109 and 111 by means of belt 131; the motor also drives pulleys 84 and 86 (carriage 82, FIG. 3) through a belt not shown in the drawings.

The adjustable displacements of carriages 82 and 107 along slots 91 and 116 are controlled by the rotation of knob 132 which is connected to a slide 134 by means of belt 133. The slide is integral with carriage 107 and slides on shaft 136; carriage 107 is connected to the other carriage 82 by a rigid bar which is located behind the plate 15 and not depicted in the figures. This interconnection causes carriage 82 to move when carriage 107 is moved. A graduated scale 137 is carried on the plate 15 parallel to slot 116. Pointer 138, which is integral to the carriage 107, indicates the displacement of the carriages 82 and 107.

Knob 132 also controls a potentiometer 140 (located behind plate 15) which regulates the speed of the stripping motor 34 (FIG. 1). This will be hereinafter discussed.

The operation of the device is as follows. The platforms 18 (FIG. 1), 77 (FIG. 3), and 102 (FIG. 4), are lowered to the end-of-travel position by the motors which are controlled by the photoelectric system 29, 30 (FIG. 1). The absence of documents on the loading
platform 18 signals that the platforms are to be lowered.

The presence of documents in the loading station 10 is signalled by the photoelectric system 29, 30 (FIG. 1). This system, together with lugs 92 and 117 of carriages 82 and 107 (FIGS. 3 and 4) activate the control switches 93 and 118 which, in turn, cause the lifting of platforms 77 and 102 (FIGS. 3 and 4).

The operator observes the length of the documents 11 (FIG. 1) on scale 18 and sets the pointer 138 (FIG. 4) to this length, thereby setting collecting pockets 74 and 76 to the proper length.

The separating device 12 (FIG. 1) can be adjusted so as to allow a constant interspace between documents even if operating with documents of varying lengths. When short documents are processed (for example 50 mm), the collecting carriages 82 and 107 (FIGS. 3 and 4) are displaced to the left by knob 132 (FIG. 4). It will be recalled that knob 132 also controls a potentiometer 140; this potentiometer is connected to the motor 34 (FIG. 1) in a well known manner to control the motor speed. The separating device will be set to run at a peripheral speed of 1.5 meters/sec. and if the speed of rollers 54 is equal to 3 meters/sec. the speed of each document is accelerated until double during the flow from accelerating station to reading station. The space between subsequent documents will be equal to the length of the documents themselves.

When long documents are processed (for instance 220 mm), the collecting carriages 82 and 107 are displaced by the knob 132 toward the right hand end of the slots 91 and 116 (FIGS. 3 and 4). The knob 132 sets the potentiometer 140 to increase the speed of the motor 34; for long documents the roller 32 will rotate at a peripheral rate of, for example, 2.45 meters a second. Each document will go through the constant peripheral speed of the accelerating rollers 54 (which is equal to 3 meters/sec.) to be accelerated to a speed of 3/2.45 times the separating speed.

The leading edge of each long document is separated from the subsequent document by a distance equal to 270 mm; that is, the interspace between a document and the subsequent one is approximately 50 mm, the same as was the case for shorter documents.

However, when an intermediate separating speed is chosen also bundles of mixed documents having a length difference up to 50 mm may be processed.

When the photoelectric device 29, 30 (FIG. 1) starts the motor 34, it also starts the motor 23 (FIG. 1), which, by means of belt 24 lifts loading platform 18 upwards until the document at the top of the bundle contacts the stripping belt 36. The belt 36 circulates and feeds the document 11 to roller 32.

As previously discussed, located in the initial portion of the feed path is the rejection roller 51; the coefficient of friction between the separating roller 32 and the document 11 is greater than the coefficient of friction between the document and the rejection roller 51. The coefficient of friction between two documents is less than that of document and roller 51. The roller 51 rotates the reverse direction with respect to the moving document and insures the passage of but a single document.

So, if two documents are lifted by the stripping belt 36 at the same time, since the coefficient of friction between the two documents is less than the coefficient of friction between the document and the roller 51, the roller will grip the lower surface of the second document and prevent it from being fed with the first one.

The upward displacement of the platform 31 (FIG. 1) will continue until the force exerted by the documents 11 overcomes the urge of the spring 43 and causes tension lever 39 to bring lug 48 into contact with the plunger of the switch 49 thereby activating it. This activation stops motor 23.

The loading platform 18 ceases to move but belt 36 continues to separate documents from the top of the pile. The pressure between the belt and the documents is maintained by the lever 39 which is urged by the spring 43. After a sufficient number of documents 11 is separated, the lug 48 is removed from microswitch 49 since the lever 39 has moved counterclockwise by the urge of the spring 43; consequently, the motor 23 starts rotating again and a new upward displacement of the platform 18 commences. Therefore, the loading motor 23 continuously re-establishes a constant thrust of the documents 11 against the stripping belt 36.

When all the documents of the stack are removed, the light source 29 and phototransistor 31 signal the backward rotation of motor 23, bringing platform 18 to the lowered position.

When the documents leave the separation device 12, they are shifted toward the reading station 14 by rollers 60,54,70 and the counter rollers 59; the rollers 54 are inclined with respect to the feed path, and they accelerate and align the documents. The aligning is accomplished by bringing the documents into contact with the fixed reference plane provided by the base plate 15.

The documents are aligned, accelerated and passed to drum 62 and belt 63; the documents are passed to the reading station 14, where the reading is carried out by magnetic or optical heads.

After the documents are read they are conveyed toward the collecting pockets 74 and 76 (FIGS. 3 and 4). The deflector 72, which is suitably controlled by the command of a sorting electronic control unit, causes the documents to be directed to either pocket 74 or 76.

As has been previously stated, photoelectric device 29, 30 (FIG. 1) signals not only motor 23, but also motors 79 (FIG. 3) and 104 (FIG. 4) thereby causing the lifting of platforms 77 and 102.

The upward displacement of the loading platforms 77 and 102 continues until they contact the collecting carriages 82 and 107. The upward displacement stops when the microswitches 93 and 118 are inactivated by the lugs 92 and 117 being raised under the thrust of the platforms.

The stop arms 88 and 113 fit into holes in the platforms 77 and 107 so as to not to interfere with the platforms.

When the deflector 72 routes the documents into the main pocket 74 (position shown in FIG. 3 by a broken line) the single documents leave the guides 69 and 71 and pass beneath the barrel shaped rollers 96 and 97 which are kept in rotation. As has been pointed out the shape of such rollers renders the documents curved before they are collected.

The documents fed by rollers 96 and 97 are guided by the plate 98 and by the band 99 toward the collecting carriage 82. The belt 87 circulates continuously and pushes the documents against the damping flat spring 25 of the stop member 88. Belt 97, contacting the documents before they leave the roller 97, insures a good document stacking operation.
The documents are stacked between the platform 77 and the carriage 88, the arm 83 rotates clockwise about the pin 89 thus activating the microswitch 94. This activation rotates the motor 79 in an opposite direction to lower the platform 77; the lowering continues until the microswitch 93 is activated.

The operation of the collecting pocket 76 (FIG. 4) is the same as that of pocket 74 (FIG. 3).

What we claim is:
1. In a device for separating documents from a stack, passing the documents through a reader, and restacking the documents, the combination comprising a removing station for individually separating the documents and passing them toward a reading station;
a station for re-stacking the documents after they leave the reading station;
the removing station including a vertically movable platform upon which the documents lie, a moving belt for gripping the top document by means of friction and thrusting it away from the first station, a motor for moving the platform so that the documents contact the belt, movable means for applying pressure to the inner surface of the belt to hold the belt taut, the pressure applying means being located above the documents to be stripped with the moving belt between the documents and the pressure applying means, a motor control switch fixed adjacent to the pressure applying means for stopping the motor and the upward movement of the platform when the movable pressure applying means has been moved upward by the upward moving documents carried by the upward moving platform.
2. The device according to claim 1, wherein the pressure applying means includes a lever having a roller for contacting the inner surface of the belt on one end thereof and a spring affixed between the other end thereof and a fixed point, the spring urging the roller against the inner surface of the belt.
3. The device according to claim 1, wherein the restacking station includes a second movable platform, controlled by a second motor, for accepting the documents, the restacking station including a second moving belt mounted on a frame, which frame can rotate about a fulcrum point, the frame including a stop bar which limits the horizontal travel of the documents as they enter the restacking station, at least one restacking control switch, mounted adjacent the movable frame, for controlling the second motor and thereby controlling the movement of the second platform, the documents being urged toward the stop bar by the second moving belt and being stacked on the second platform which is below the stop bar, the stack of documents between the frame and the second platform forcing the frame to move away from the second platform and contact the restacking control switch which activates the second motor to lower the second platform until the frame returns from said restacking control switch.
4. The device according to claim 3, wherein there are a plurality of barrel-shaped rollers between the reading station and the restacking station for bending the documents so as to stiffen them.
5. The device according to claim 3, wherein the speed of the moving belt in the removing station is controlled by a third motor which is in turn controlled by a potentiometer, the potentiometer being connected to a control mechanism for adjusting the horizontal position of said stop bar so that the stop bar position will accommodate the length of documents being read, the adjustment of said stop bar by said control mechanism adjusting also the potentiometer which controls the speed of the third motor which controls the speed of the moving belt in the removing station.
6. The device according to claim 3, wherein the stop bar has a spring placed between the bar and the incoming documents.