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Delcano et al.

[11] **3,785,640**

[45] **Jan. 15, 1974**

[54] **APPARATUS FOR SEPARATING AND FEEDING DOCUMENTS**

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[21] Appl. No.: **277,012**

[52] **U.S. Cl.** **271/90,** 271/129, 271/136, 271/140, 271/141

[51] **Int. Cl.** **B65h 3/08,** B65h 3/52

[58] **Field of Search** ..... 271/44 SS, 44 A, 271/44 DR, 32, 26, 90, 99, 129, 136, 140

[56] **References Cited**

UNITED STATES PATENTS

3,645,378	2/1972	Jakubowski	271/79 X
3,531,103	9/1970	Walton	271/32 X
2,632,644	3/1953	Wockenfuss et al.	271/44 SS
1,174,984	3/1916	Huneke	271/44 A
2,680,614	6/1954	Gibson	271/44 S

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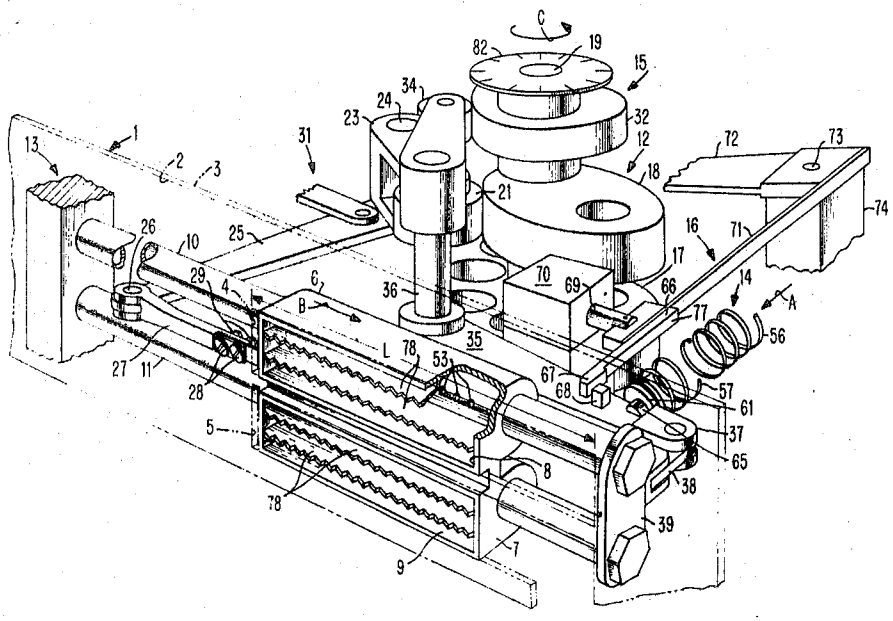
Assistant Examiner—James W. Miller
Attorney—Norman R. Bardales et al.

[57] **ABSTRACT**

A document separating and feeding apparatus utilizes a retractable and reciprocating separator head of the suction type and is provided with selectively actuable latch means. When actuated, the latch means causes the separator head to be maintained in a retracted position without interrupting the reciprocating motion of the head. Also, mounted on the head is a member with outwardly extending serrated edges. The coaction of the serrated edges and the suction of the head is used to separate and feed the documents.

9 Claims, 6 Drawing Figures



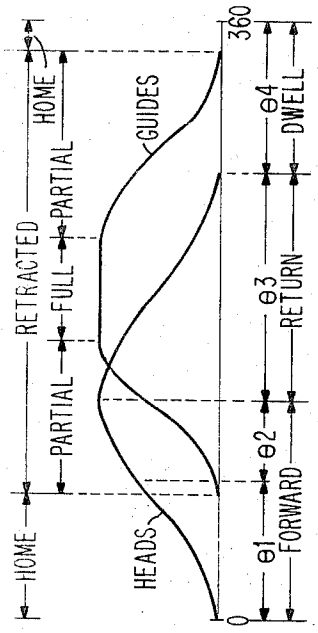

360
HOME
RETRACTED
PARTIAL
FULL
PARTIAL
HOME
GUIDES
HEADS
θ1
θ2
θ3
θ4
FORWARD
RETURN
DWELL

FIG. 6

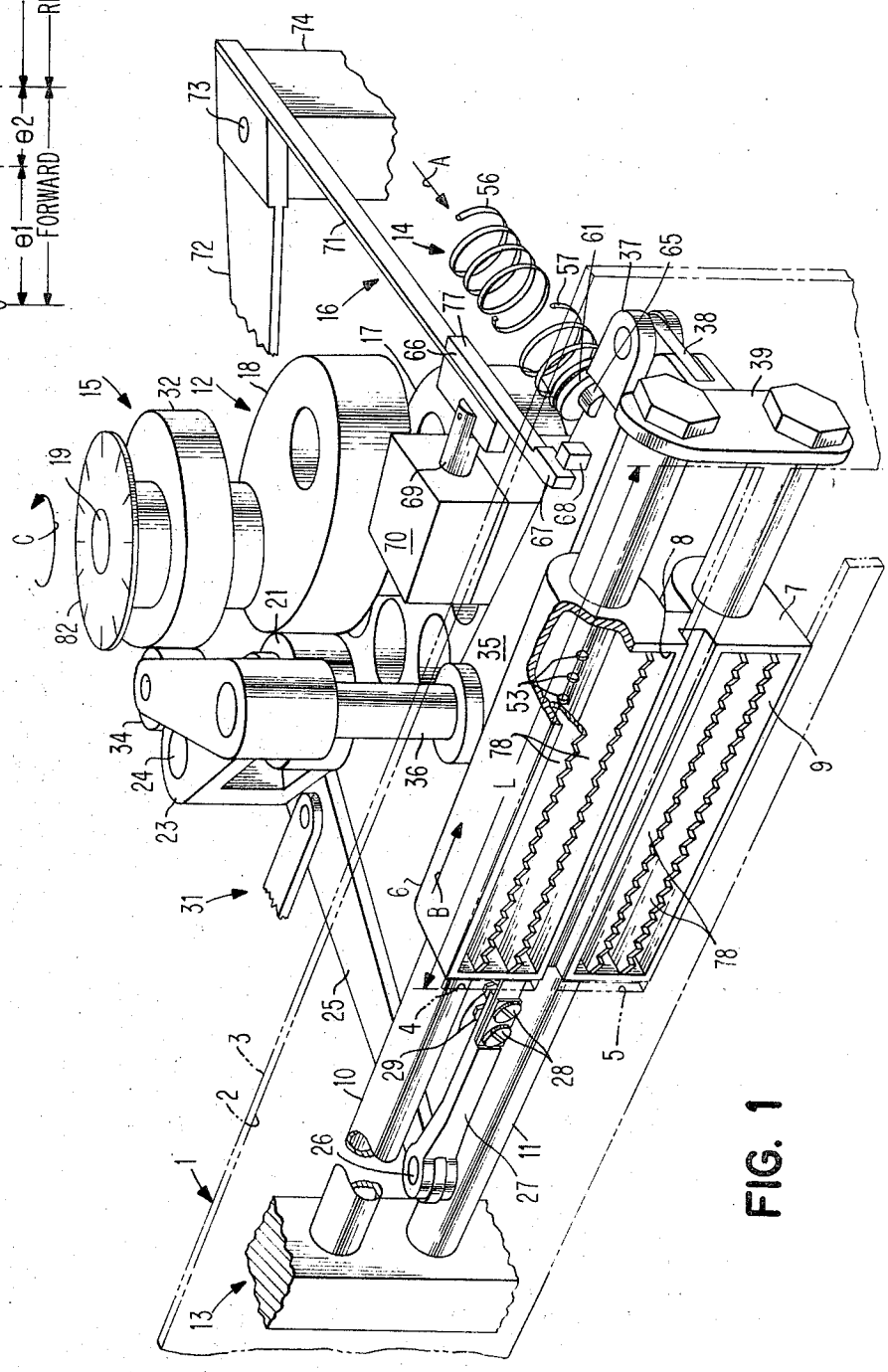
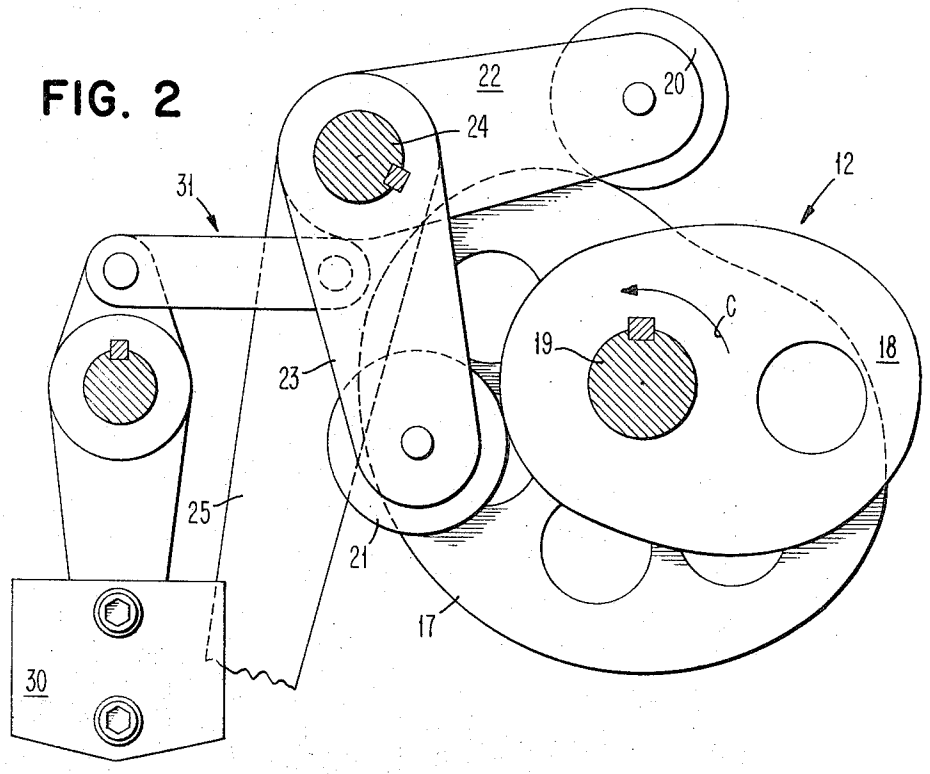


FIG. 1

FIG. 2



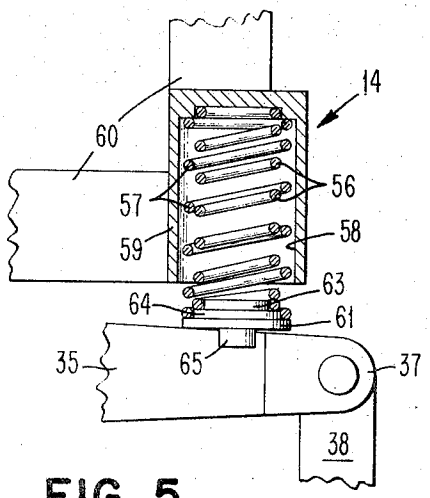


FIG. 5

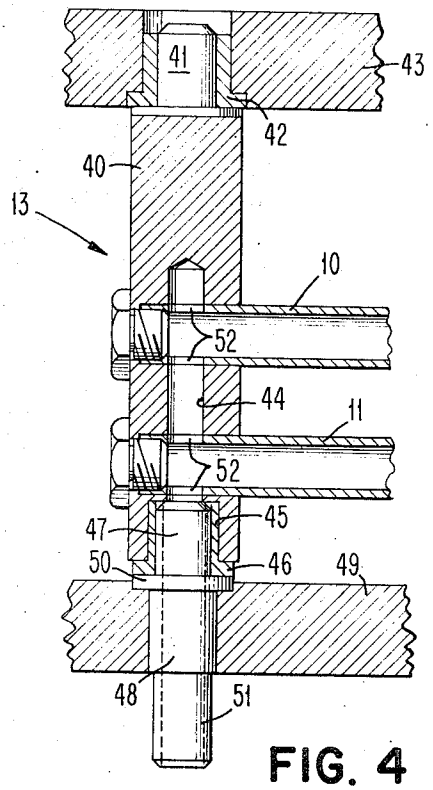


FIG. 4

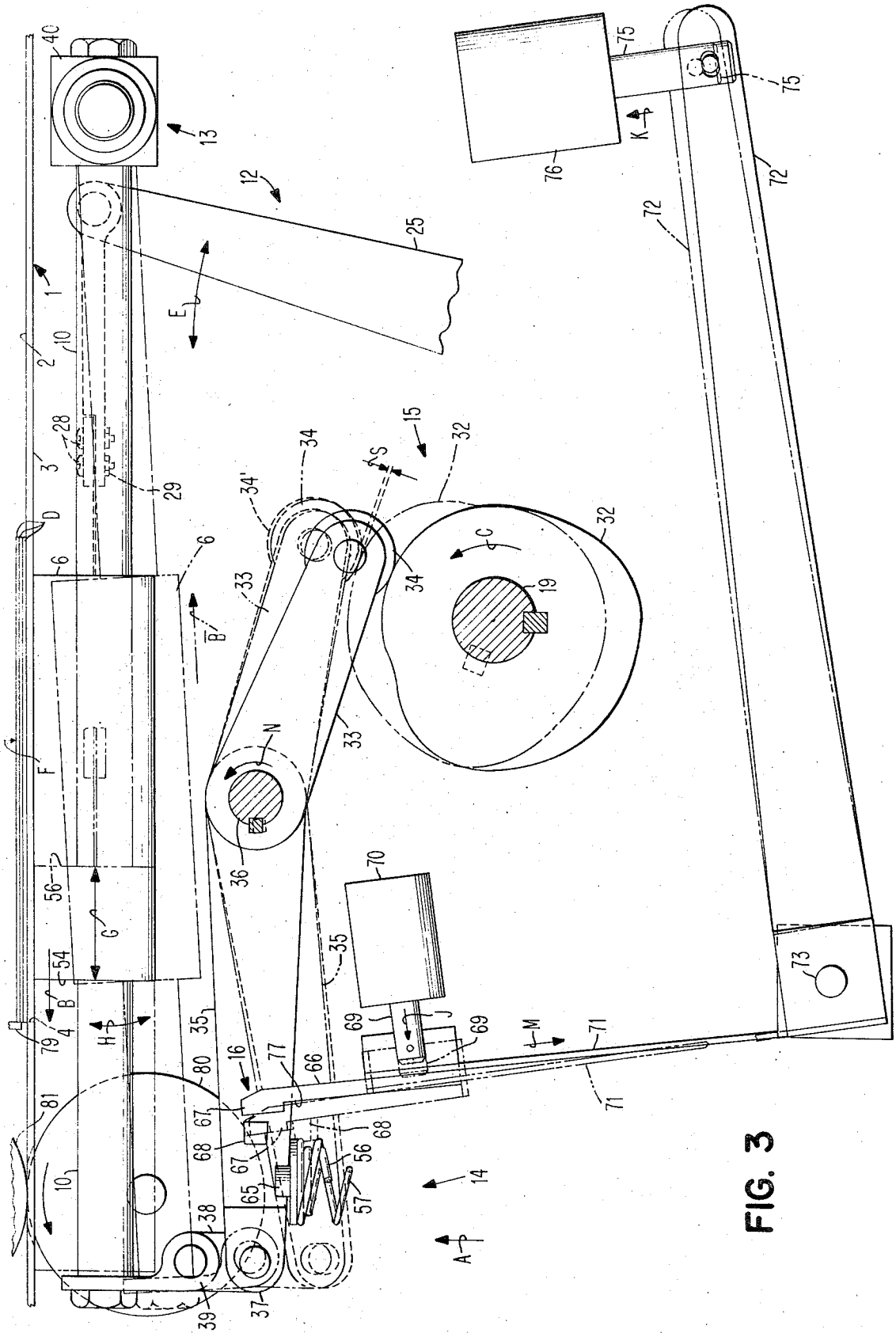


FIG. 3

APPARATUS FOR SEPARATING AND FEEDING DOCUMENTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention is related to apparatus for separating and feeding documents.

2. Description of the Prior Art

The invention is particularly useful for edge feed transport systems of the type described in U.S. Pat. No. 3,645,378, issued Feb. 29, 1972 for the patent application Ser. No. 29,599, filed Apr. 17, 1970 by Marek Jakubowski, coinventor herein, and assigned to the present assignee hereof.

In the aforementioned patent, there is described an edge feed transport system which utilizes apparatus for separating and feeding documents to a transport means, which apparatus is referred to therein simply as a separator. More specifically, the separator transports the documents located in a hopper to the transport means. The rate at which the documents are fed from the separator is synchronized with the speed of the transport so that as the leading edge of the particular document being fed emerges from the separator, it faces an unobstructed loading gap of a transport carrier. This is accomplished by the use of a pair of sliding gripper pads which are synchronized to the movement of the transport means. The pads are driven in a reciprocating motion by a cam mechanism of the complementary cam system type. Synchronization of the cam mechanism is accomplished by coupling the cam shaft through suitable drive means to the document transport drive. The pads are coupled by linkage means to one of the complementary cams which in turn are connected to the cam shaft. Superimposed on the reciprocating motion is an oscillating motion of the gripper pads' sliding guides which brings the gripper pads into contact with the face of the document through the windows of a separator face plate when the gripper pad heads are moving in the feed direction. The oscillation motion is imparted to the sliding guides by coupling the guides to an oscillator cam by a suitable linkage. The oscillator cam is coupled to the cam shaft used by the complementary cam system and synchronizes the oscillation motion of the sliding guides to the motion of the transport means. As the document is moved by the gripper pads, it is contacted by feed rollers which move the document into a carrier of the transport means. By using the oscillating separator means, proper alignment between a carrier of the transport system and a document is assured. At the end of the feed stroke of the gripper pad heads, the heads are returned along the slidable guides by the reciprocating motion imparted by the complementary cam system and simultaneously the sliding guides are retracted by the oscillating motion imparted by the oscillator cam so that the pads are in a non-operative, i.e. disengaged, relationship with the documents during the return stroke associated with the reciprocating cycle.

While the aforementioned separator was satisfactory for most applications, it had certain disadvantages. More particularly, if it was desired to interrupt the feeding of a batch of documents through the separator, it was necessary to turn off the driver means associated with the feed mechanism and/or transport mechanism. As a consequence, there was an increase in the amount of time and/or cost to restart the system due to the effects of momentum and/or power consumption required to start the system.

Moreover, the use of friction type gripper pads while also generally satisfactory, were subject to wear and hence would cause the separator to be susceptible to malfunction whenever the gripper pads failed to completely or partially adhere to the document to be moved thereby.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an improved apparatus for separating and feeding documents.

It is another object of this invention to provide the aforementioned apparatus which allows interruption of the separating and feeding of a batch of documents on a selectively actuated basis without interrupting the reciprocating motion of the separator head(s) and/or associated document feed driver means and/or transport means associated therewith.

Another object of this invention is to provide a reciprocating separator head which is less susceptible to wear or to malfunction in gripping the documents.

Accordingly, a feature of this invention is to provide apparatus for separating and feeding a batch of documents which comprises stationary plate member means having first and second sides and at least one elongated first opening extended between the sides. The documents are biased against the first side in a superimposed relationship with respect to each other and the first opening. At least one reciprocable separator head of the suction type is juxtaposed on the opposite side of the member. The separator head has a hollow configuration and a second opening facing the particular document which is exposed through the first opening. The separator head is reciprocatingly mounted to guide member means. A complementary cam system is coupled to the head for reciprocating the head along the guide member means. Spring means biases the guide member means in a first position towards the first opening to place the head in operative relationship with the particular document exposed through the first opening. When the guide member means is in the first position, the head in response to the complementary cam system is moved along the guide member means in a first direction, which is parallel to the elongated dimension of the first opening. The head when in operative relationship separates the last mentioned particular document from the remaining documents of the batch and feeds the separated document along the aforementioned first direction. A simple cam system is coupled to the guide member means and moves the guide member means to a retracted second position away from the first opening so as to place the head in a non-operative relationship with the next particular document of the batch which is exposed through the first opening. The head in response to the complementary cam system is moved along the guide member means in a reverse second direction when the guide member means is in the second position. A selectively actuable latch means is provided which latches the guide member means in the retracted second position without interruption of the reciprocating motion of the head. That is to say, the head in response to the complementary cam system continues to reciprocate along the guide member means when the

latch means latches the guide member means in the second position.

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

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a preferred embodiment of apparatus for separating and feeding documents of the present invention;

FIG. 2 is a partial plan view of the complementary cam system of the apparatus of FIG. 1;

FIG. 3 is a partial plan view of the simple cam system and latching mechanism of FIG. 1;

FIG. 4 is a more detailed cross-sectional view of the pneumatic coupler and pivot mechanism combination member shown in FIG. 1;

FIG. 5 is a partial plan view of the bias spring mechanism associated with the simple cam system shown in FIG. 1; and

FIG. 6 is a waveform diagram of the respective motions of the separator head and the separator guides in a typical operating cycle.

In the figures, like elements are designated with similar reference numerals.

DESCRIPTION OF A PREFERRED EMBODIMENT

In FIG. 1, there is shown the preferred embodiment of the apparatus for separating and feeding documents of the present invention.

The apparatus includes a stationary plate member 1, sometimes hereinafter referred to as a separator face plate. For sake of clarity, plate 1 is shown in outline and partial broken away form in FIG. 1. Plate 1 has front and rear sides or faces indicated by the reference numerals 2 and 3, respectively. One or more openings or windows, e.g. the two parallel upper and lower openings 4, 5 partially shown in FIG. 1, extend through sides 2, 3 of plate 1. The openings have an elongated dimension L. As shown in FIG. 3, the documents D to be separated and fed are biased by a force F, which is provided by suitable biasing means not shown for sake of clarity, against side 2 in a superimposed relationship with respect to each other and the openings 4, 5.

A corresponding number of suction type separator heads equivalent to the number of the openings or windows provided for member 1 are juxtaposed on the opposite side 3 of member 1. Thus, as shown in the embodiment of FIG. 1, a pair of twin connected suction type upper and lower parallel separator heads 6 and 7, respectively, are juxtaposed on side 3 of the separator plate 1. Each of the heads 6, 7 has a hollow configuration and an opening, i.e. respective openings 8 and 9 of heads 6 and 7. Openings 8 and 9 face windows 4 and 5, respectively. Each of the separator heads 6, 7 are reciprocatingly mounted to guide member means which in the preferred embodiment are the parallel hollow cylindrical guide bars 10, 11, respectively.

A complementary cam system, indicated generally by the reference numeral 12, as explained in greater detail hereinafter, is coupled to the heads 6, 7 and reciprocates the heads 6, 7 along the respective bars 10, 11.

The guide member means 10–11 are made movable with respect to the separator plate 1 and hence its respective openings 4, 5. This is accomplished in the preferred embodiment by affixedly mounting one end of member means 10–11 to the combined pneumatic coupler and pivot member mechanism 13 shown in greater detail in FIG. 4 and hereinafter described. The other end of the guide member means 10–11 is coupled to a bias spring assembly indicated generally by the reference number 14 which biases the guide member means 10–11 in a direction towards plate 1 as indicated by the arrow A. As a result, the spring assembly 14 biases the guide member means 10–11 in a first position, which is illustrated in FIG. 3 by the solid line form of the guide bar 10, that places the heads 6, 7 in operative relationship with the particular document D of the batch which is exposed through the openings 4, 5 of the separator plate 1. When the guide member means 10–11 is in the aforesaid first position, hereinafter sometimes referred to as the forward or home position, the heads 6–7 in response to the complementary cam system 12 are moving in the feed direction, c.f. Arrow B, which is parallel to the elongated dimension L of the openings 3, 4. The spring assembly 14 is described in greater detail hereinafter with reference to FIGS. 3 and 5.

The end of the guide means 10–11 which is coupled to the spring assembly 14 is also coupled to a simple cam system indicated generally by the reference numeral 15 and hereinafter described. System 15 moves the guide member means to a retracted position, which is illustrated in FIG. 3 by the dash line form of the guide bar 10. In this retracted position, heads 6, 7 are in non-operative relationship with the next particular document D of the batch which is exposed through the openings 4, 5 of plate 1. Simultaneously, the heads 6, 7 in response to the complementary cam system 12 reverses its direction of motion along the guide bars 10, 11, i.e. are in the return stroke portion of the reciprocating cycle imparted by the complementary cam system 12 as described hereinafter.

In order to interrupt the separator and feeding action of the apparatus being described and in accordance with the principles of the present invention, a selectively actuable latching mechanism, generally indicated by the reference numeral 16, is provided which when actuated latches the guide member means 10–11 in the retracted position without stopping the reciprocation of the heads 6, 7 and/or the drives associated with the cam systems 12 and 15 in the manner hereinafter described.

In complementary cam 12, c.f. FIG. 2, a pair of complementary cams 17 and 18 are affixed to cam shaft 19. The cam faces of cams 17 and 18 are suitably contoured to provide the feed and reverse strokes, respectively, of the reciprocating cycle imposed on heads 6, 7. The respective cam followers, i.e. the follower rollers 20 and 21 and their respective follower arms 22 and 23, coact with cams 17 and 18, respectively. The follower arms 22 and 23, in turn, are affixed to a shaft or pin 24. Also affixed to pin 24 is one end of a linkage member 25. The other end of member 25 is pivotably connected to a link pin 26, c.f. FIG. 1, to which is also pivotably connected the bifurcated end of the link member 27. The other end of member 27 is adjustably connected to the heads 6, 7 by any suitable means, such as the bolts 28 and nuts 29. Alternatively, member 27 may be formed as an integral part of the heads 6, 7 per se. A counterweight 30, c.f. FIG. 2, is provided for balancing the load about pin 26 if desired. Counterweight 30 is coupled to the link member 25 by a suitable linkage

system indicated generally by the reference numeral **31** in FIG. **2.**

Driver means, not shown for sake of clarity, drive cam shaft **19** in the direction indicated by arrow C. As a result, the complementary cam system **12** via its respective aforedescribed cams, cam followers and linkage members cause the heads **6, 7** to reciprocate along the guide members **10, 11** in a manner apparent to those skilled in the art. Because of the perspective chosen and/or for sake of clarity, there has been omitted in FIG. **1** the follower, i.e. roller **20** and arm **22,** associated with cam **17,** and the counterweight **30.**

Superimposed on the reciprocating motion of heads **6, 7** is the intermittent motion, c.f. arrow H of FIG. **3,** of the guide member means **10–11** between its associated aforedescribed home and retracted positions. This intermittent motion which is oscillatory in nature is imparted by the coaction of the bias spring assembly **14** and simple cam system **15** when latching means **16** is not actuated. The reciprocating motion and intermittent motion are appropriately synchronized.

More particularly, the oscillator cam **32** of system **15** is also affixed to the common cam shaft **19.** Cam **32** coacts with a cam follower which includes follower arm **33** and follower roller **34** mounted thereto. In turn, arm **33** and one end of a rocker lever **35** are affixed to a shaft **36.** The bifurcated end **37** of lever **35** is coupled by the link **38** to the end member **39** which is affixed to the guide bars **10** and **11.**

The other end of guide bar means **10–11** is pivotable. As shown in FIG. **4,** this end of means **10–11** is affixed to the pneumatic coupler and pivot mechanism combination member **13.** Member **13** has an elongated body portion **40.** Projecting from the upper end of portion **40** is a pivot shaft **41** which is inserted in the bushing **42** that is housed in and affixed to the frame **43.** A bore having concentric elongated and countersunk cylindrical sections **44** and **45,** respectively, is provided inwardly from the end surface of the other end of the member **40.** Bushing **46** is fitted to and inserted in countersunk section **45.** In turn, bushing **46** is affixed to the extension **47** inserted therein of the hollow pneumatic coupler **48** which is housed in and affixed to the lower frame **49.** Preferably, the coupler **48** is additionally provided with a predetermined polysided seat flange **50** which is seated in a corresponding polysided and contoured countersunk both provided in the upper surface of the frame **49.** Coupler **48** is provided with a nipple section **51** for the attachment thereto of a suitable pneumatic hose, not shown, to which hose is also connected a vacuum or low pressure system, not shown, which provides the suction for the heads **6, 7.** The portion of the guide bars **10** and **11** which pass through the section **44** of the body **40** are provided with appropriate openings **52** so that the aforementioned vacuum or low pressure system can communicate with the interiors of the bars **10** and **11.**

Likewise, the interiors of the suction heads **6, 7** are placed in communication with the interiors of the guide bars **10, 11,** and consequently with the aforementioned low pressure or vacuum system, by a series of holes judiciously placed on the guide bars **10, 11.** For sake of clarity, only the holes **53** provided on the guide bar **10** for this purpose are shown in FIG. **1,** it being understood that similar holes are provided on the guide bar **11.** The holes **53** are aligned along a longitudinal axis of the bar **10** and preferably face the opening **8** of the head **6.** The so provided holes are confined, i.e. disposed, within an area of the particular guide bar so as to insure their encompassment by the particular suction head no matter what position the head may be at in the feed or reverse stroke associated with the reciprocating cycle. By way of explanation, the holes **53** are confined within the area of the bar **10** designated in FIG. **3** by the reference character G and which area lies between the position of the leading edge **54** of the head **6** at the commencement of the feed stroke and the position of the trailing edge **55** of the head **6** at the termination of the feed stroke.

Bias spring assembly **14,** as shown in FIG. **5,** includes a pair of concentric compression springs **56, 57.** The springs are inserted in a compatibly contoured bore **58** located in housing member **59,** which is shown in cross-section in FIG. **5** for sake of clarity. Housing **59** is affixed to frame **60.** A circular flat plate member **61** has a pair of concentric elevated shoulders **63, 64** around which are seated the inner and outer springs **56, 57,** respectively. The other face of member **61** has a pair of symmetrically aligned and identical separated projecting tabs which straddle the rocker lever **35.** Only the upper tab **65** of the aforementioned pair is visible in the views of FIGS. **1** and **5,** it being understood that the other tab lies beneath lever **35** and is in alignment with upper tab **65.** For sake of clarity, springs **56, 57** are shown as an exploded view in FIG. **1.**

As is readily appreciated by those skilled in the art, under the combined action of spring assembly **14** and the simple cam system **15,** the guide bars **10, 11** and consequently the heads **6, 7** carried thereby are periodically moved towards and away from plate **1** when latching means **16** is not actuated, i.e. means **16** is not in a locked position. Moreover, the actions of the cam systems **12** and **15,** which are synchronized by virtue of their respective cams being commonly mounted to cam shaft **19,** are judiciously selected so that at the commencement of and during the feed or forward stroke associated with the reciprocating cycle of heads **6, 7,** the feed cam **17** is active, that is to say cam **17** drives the heads **6** and **7** along bars **10, 11** in the direction B. It should be noted that lever **25** is rotating in a counter-clockwise direction as viewed in FIG. **3,** c.f. bidirectional arrow E. During this same period, reverse or return cam **18** and for part of the time as hereinafter explained retract cam **32** are inactive. While cam **32** is inactive spring assembly **14** biases the guide bars **10, 11** against an appropriate stop, not shown, towards plate **1.** As a result, during a portion of the feed stroke, the guide bars **10, 11** are stationary and in a position parallel to plate **1** which is indicated by the respective solid line form of bar **10** in FIG. **3.** For sake of clarity, the relative positions of lever **35,** cam **32** and head **6,** when bar **10** is in this position, which is sometimes hereinafter referred to as the home position, are also indicated by their respective solid line forms in FIG. **3.**

When heads **6, 7** reach the end of the feed stroke, cam **17** becomes inactive. Shortly before or coincident therewith cam **32** becomes active causing rocker lever **35** to pivot counter-clockwise as viewed in FIG. **3** about shaft **36** and begin to move to the position indicated by its dash outline in FIG. **3.** As a result, spring assembly **14** is compressed and guide bars **10, 11** with their heads **6, 7** are pivoted in the counter-clockwise direction of bidirectional arrow H, about member **13** away from plate **1** towards the retracted position which

is indicated by the respective dash outline of bar **10** in FIG. **3**. Also shown in FIG. **3**, is the relative positions of members **6, 32** and **35** indicated by their respective dash outlines when bar **10** is in the retracted position. Shortly before or coincident with the bars **10, 11** being placed in the retracted position, the return stroke of the reciprocating cycle commences as cam **18** becomes active. This causes link member **25** to rotate in the clockwise direction of arrow E, thereby driving the heads **6, 7** in the reverse direction, c.f. arrow G, along bars **10, 11**. It should be understood that during the return stroke feed cam **17** remains inactive and cam **18** is active and cam **32** is partially active as will be apparent from FIG. **6** and the description hereinafter.

Upon completion of the return stroke, reverse cam **18** becomes inactive. Shortly before or coincident therewith cam **32** also becomes inactive. As a result, spring assembly **14** begins to pivot rocker lever **35** clockwise as viewed in FIG. **3** causing bars **10, 11** to pivot in the clockwise direction of arrow H about member **13** to place the bars **10, 11** in the aforementioned home position. Heads **6, 7** are now in position to commence the next feed stroke whereupon the aforedescribed operating cycle is repeated during the next revolution of the shaft **19**. In this manner, the intermittent oscillating motion of the bars **10, 11** is superimposed on the reciprocating motion of the heads **6, 7**.

Latching mechanism **16** will now be described with reference to FIG. **3**. Latching mechanism **16** is shown in solid and phantom form which are its relative unlocked and locked positions, respectively. Latching means **16** includes a movable latch bar **66** that has an elevated head portion **67**. The head portion **67** faces the catch block **68** which is affixed to the lever **35**. Bar **66** and the armature **69** of solenoid **70** are affixed to a flat spring member **71**. Member **71**, in turn, is affixed to another lever **72** which is pivotably mounted to the pivot shaft **73** that is journaled in the frame **74**, c.f. FIG. **1**. The armature **75** of another solenoid **76** is connected to the other end of the lever **72**. The solid outlines of armatures **69** and **75** shown in FIG. **3** represent the retracted and unretracted positions of armatures **69** and **75**, respectively. Under these conditions, solenoids **70** and **76** are energized and unenergized, respectively, and latching means **16** is unlocked.

If it is desired to interrupt the feed of a batch of documents, latching means **16** is actuated. To do this, lever **35** must be in the position associated with the retracted position of the guide bars **10, 11**, c.f. phantom outline **35**, FIG. **3**. With the lever **35** in this position, solenoid **70** is de-energized and releases its armature **69** in the direction indicated by arrow J to the position indicated by its phantom outline in FIG. **3**. As a result the upper right corner of the catch block **68** will be engaged by the corner formed between the elevated portion of head **67** and face **77** of the member **66** when the latter is driven by the co-action of released armature **69** and spring member **71**. The latching means **16** is thereby locked. Shortly thereafter, solenoid **76** is energized causing armature **75** to retract in the direction indicated by the arrow K to the position indicated by its outline form **75** in FIG. **3**. As a result, lever **72** pivots counter-clockwise about shaft **73** causing member **71** to move in a likewise counter-clockwise direction. As viewed in FIG. **3**, this causes head **67** to move in a direction having a downward component indicated by the arrow M. This exerts a corresponding downward force on the block **68**. As a result, the lever **35** rotates counter-clockwise c.f. arrow N, about shaft **36**, lifting the follower arm **33** and its roller **34** to a position, indicated by the phantom outline **34'** of roller **34**, to provide sufficient clearance S between roller **35** and the high dwell portions of cam **32**. This prevents any knocking between the roller **34** and cam **32** as shaft **19** continues to rotate. It should be noted that the heads **7, 8** continue to reciprocate along the bars **10, 11** when latch means **16** is locked.

When it is desired to restart the document feed, latching mechanism **16** is unlocked. First, solenoid **76** is de-energized, thereby releasing its armature **75**. The resultant linkage action causes roller **34** to be positioned from the outline position **35'** to the other outline position **35** shown in FIG. **3**. Next, at an appropriate time, i.e. when the cam shaft **19** is in an angular position corresponding to the fully retracted position of the guide bars **10, 11**, solenoid **70** is energized causing its armature **69** to retract. Latch bar **66** and consequently its head **67** is thereby released from catch block **68** and latching means **16** is unlocked. With latching means **16** now unlocked, cam system **15** and spring bias assembly **14** coact to move periodically the guide bars **10, 11** towards and away from separator plate **1** in the manner previously explained.

According to another aspect of the invention, there is provided on heads **6** and **7** one or more serrated edge members **78**. The serrated edges or teeth of members **78** are pointed in the direction of feed and protrude sufficiently through windows **4, 5** of Plate **1** to contact the exposed portions of the particular document D facing the windows when the bars **10, 11** are in the home position. The teeth of members **78** coact with the suction of the head to separate and feed the documents. The concentration or density of the teeth is judiciously selected so as not to penetrate the documents being fed. For example, a density of **10** teeth per inch may be used.

In operation, a batch of documents D are fed in the aforementioned superimposed relationship to the separator plate **1** by a suitable document feed hopper, not shown. Preferably, the document feed hopper is of the type described in the aforementioned U.S. Pat. No. 3,645,378. The document feed hopper described therein was of the continuous loading type. However, in the apparatus described therein, it was impossible to interrupt the feeding of a batch of documents through the separator without turning off the driver means associated with the feed mechanism and/or transport mechanism described therein and as was mentioned herein previously.

Continuing with the operative description of the present invention, it will be assumed that the latching means **16** is not actuated and that the drive means, not shown, driving the cam shaft **19** in the direction indicated by arrow C. Under these circumstances, it will be further assumed that the bars **10, 11** are in their aforementioned home position and the heads **6, 7** are at the beginning of the forward stroke. Under these circumstances, the angular position of the shaft **19** is arbitrarily selected as the **0°** position, c. f. FIG. **6**.

As the cam shaft **19** rotates from its 0° position the heads **6, 7** move in a direction B. Due to the coaction of the heads' suction and the serrated edge members **78**, the particular document D which is facing the windows **4, 5** begins to move in the same direction B. A

stop 79 or or other restraining means is provided to prevent the movement of the other documents D of the batch which are stacked behind the particular document D being fed. The face of cam 17 is designed so that during the time period when the shaft 19 is being rotated through the sector $\theta 1$, c. f. FIG. 6, the heads 6, 7 are moving under an accelerated motion. As the shaft 19 continues to rotate through the next angular sector $\theta 2$, the heads 6, 7 continue to move in the forward direction B but the face of cam 17 is designed so that the motion of the heads 6, 7 is deaccelerated.

Shortly after the heads 6, 7 begin to deaccelerate, cam 32 causes the spring assembly 14 to begin to compress. As a result, the guide bars 10, 11 begin to move away from the separator plate 1. By the time the heads 6, 7 have reached the end of the forward stroke, the guide bars 10, 11 will be at a position sufficient to disengage the document being fed from the coaction of the suction heads 6, 7 and members 78. Moreover, when this occurs, the leading edge of the document being fed will have been engaged between the pair of feed rollers 80, 81 which are shown in phantom outline in FIG. 3 for sake of clarity. The feed rollers 80, 81 move the document into a carrier, not shown, of the transport means, not shown, which is similar to the carrier and transport means described in the aforementioned patent.

As the heads 6, 7 begin the return stroke, in response to cam 18, the bars 10, 11 continue to be moved by the cam 32 towards their retracted position. Sometime after the commencement of the return stroke, the bars 10, 11 are fully retracted as indicated by the legend FULL in FIG. 6, cam 32 being designed with an appropriate dwell for this purpose. The return stroke as indicated in FIG. 6 is associated with the rotation of the shaft 19 through the angular sector $\theta 3$. The guide bars 10, 11 remain in the fully retracted position until sometime just prior to the end of the return stroke whereupon the cam 32 in coaction with the spring assembly 14 begins to move bars 10, 11 gradually back towards the home position.

Complementary cam system 12 is designed so that the heads 6, 7 at the end of the return stroke, c.f. end of angle $\theta 3$ in FIG. 6, will be in position to commence the forward stroke after a suitable dwell angle $\theta 4$ provided in the cams 17, 18. Just prior to the end of this dwell, the guide bars 10, 11 will be placed in their home position. Thereafter, the cycle repeats itself for each revolution of the cam shaft 19. If desired, a suitable calibrated dial 82 may be provided for measuring and/or adjusting the phasing of the cam shaft 19 relative to the transport, not shown.

By providing appropriate synchronized control signals to the solenoids 70 and 76, the latching and unlatching of mechanism 16 can be selected to occur during the fully retracted position of the guide bars 10, 11 which is indicated by the legend FULL in FIG. 6.

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

We claim:

1. Apparatus for separating and feeding documents, said apparatus comprising:

stationary plate member means having first and second sides and at least one elongated first opening extended between said sides, said documents being biased against said first side in a superimposed relationship with respect to each other and said first opening;

at least one reciprocable separator head of the continuous suction type juxtaposed on said second side, said separator head having a hollow configuration and a second opening facing the particular document exposed through said first opening;

movable guide member means having said separator head reciprocatingly mounted thereto;

a complementary cam system coupled to said head for reciprocating said head along said guide member means;

spring means for biasing said guide member means in a first position towards said first opening to place said head in operative relationship with the particular document exposed through said first opening, said head in response to said complementary cam system being moved along said guide member means in a first direction to separate said last mentioned particular document from the remaining said documents and feed the separated document in said first direction when said guide member means is in said first position, said first direction being parallel to the elongated dimension of said first opening;

a simple cam system coupled to said guide member means for moving the guide member means to a retracted second position away from said first opening to place said head in non-operative relationship with the next particular document exposed through said first opening, said head in response to said complementary cam system being moved along said guide member means in a reverse second direction when said guide member means is in said second position; and

selectively actuable latch means for latching said guide member means in said retracted second position, said head in response to said complementary cam system being continuously reciprocated along said guide member means when said guide member means is latched by said latch means in said second position.

2. Apparatus according to claim 1 wherein the cams associated with said complementary cam system and with said simple cam system are mounted on a common drive shaft.

3. Apparatus according to claim 1 wherein said guide member means comprises:

an elongated hollow tube extending through said hollow head parallel to said second opening, said head being reciprocatingly operated on a predetermined portion of said tube by said complementary cam system, and

said tube further having an interior coupled to a low pressure system, said tube further having at least one opening on said predetermined portion for connecting said hollow head to said low pressure system to provide the operative suction of said head for separating the particular document.

4. Apparatus according to claim 1 further comprising:

a member having outwardly extending serrated edges of a predetermined concentration mounted to said

head across said second opening, said serrated edges protruding sufficiently through said first opening to contact the particular document exposed through said first opening whenever said guide member means is in said first position, said serrated edges coacting with the suction of said head to feed said documents, and said predetermined concentration being sufficient to prevent penetration thereby of the exposed document.

5. Apparatus according to claim **1** wherein said complementary cam system comprises complementary first and second cams mounted on a common cam shaft, first and second follower apparatus coacting with said first and second cams, respectively, and first linkage means for effecting the coupling of said first and second cams to said head.

6. Apparatus according to claim **5** wherein said single cam system comprises a third cam mounted to said cam shaft, third follower apparatus coacting with said third cam, and second linkage means for effecting the coupling of said third cam to said guide member means.

7. Apparatus according to claim **6** wherein said selectively actuable latch means further comprises means for disengaging said third follower apparatus from said third cam when said guide member means is latched in said second position.

8. Apparatus according to claim **3** further comprising pivot means coupled to said guide bar means, said guide bar means being pivoted about said pivot means when being moved relative to said first and second positions.

9. Apparatus according to claim **8** wherein said pivot means further comprises a pneumatic coupler connected to said guide member means in operative relationship with said interior thereof, said pneumatic coupler being connectable to a predetermined pneumatic source.

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