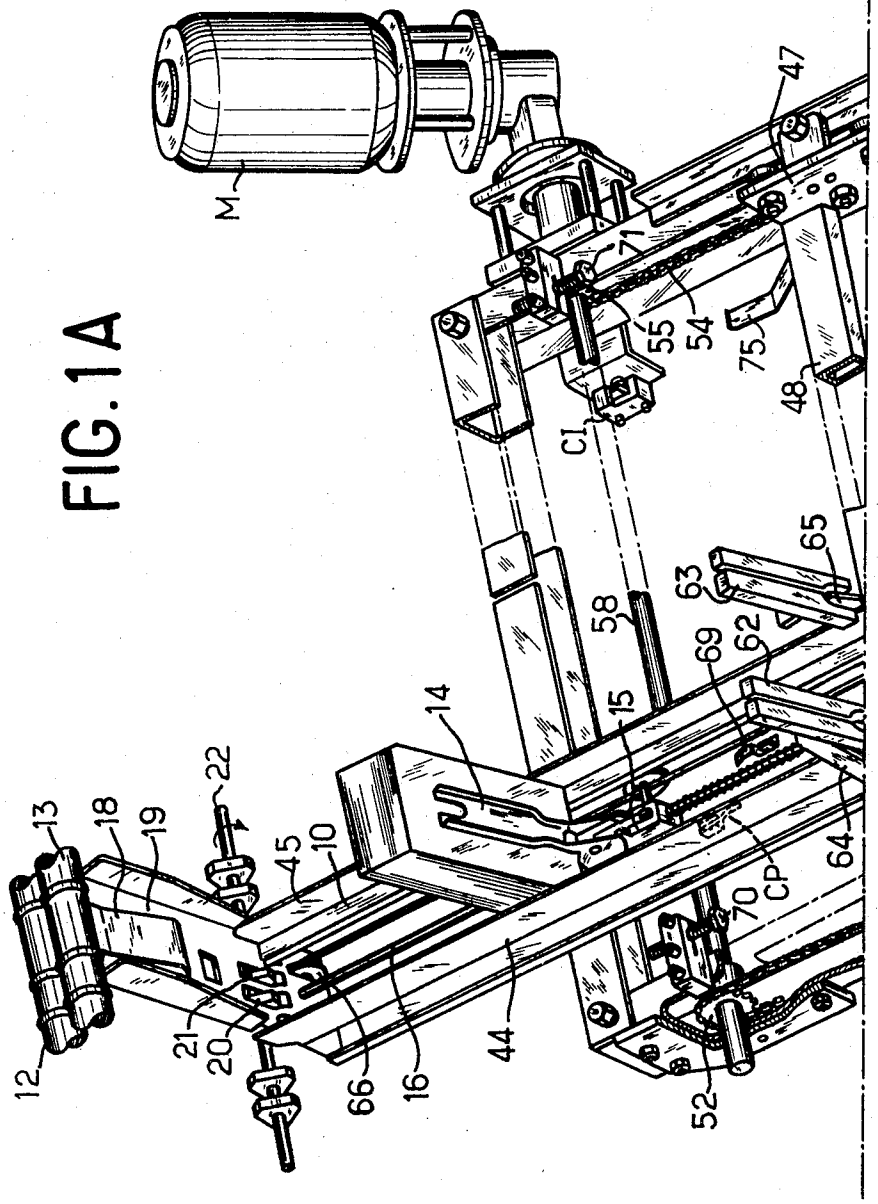
May 23, 1972 GERBEN JAN KEULEN ET AL 3,664,658

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 1

FIG. 1A



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COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 2

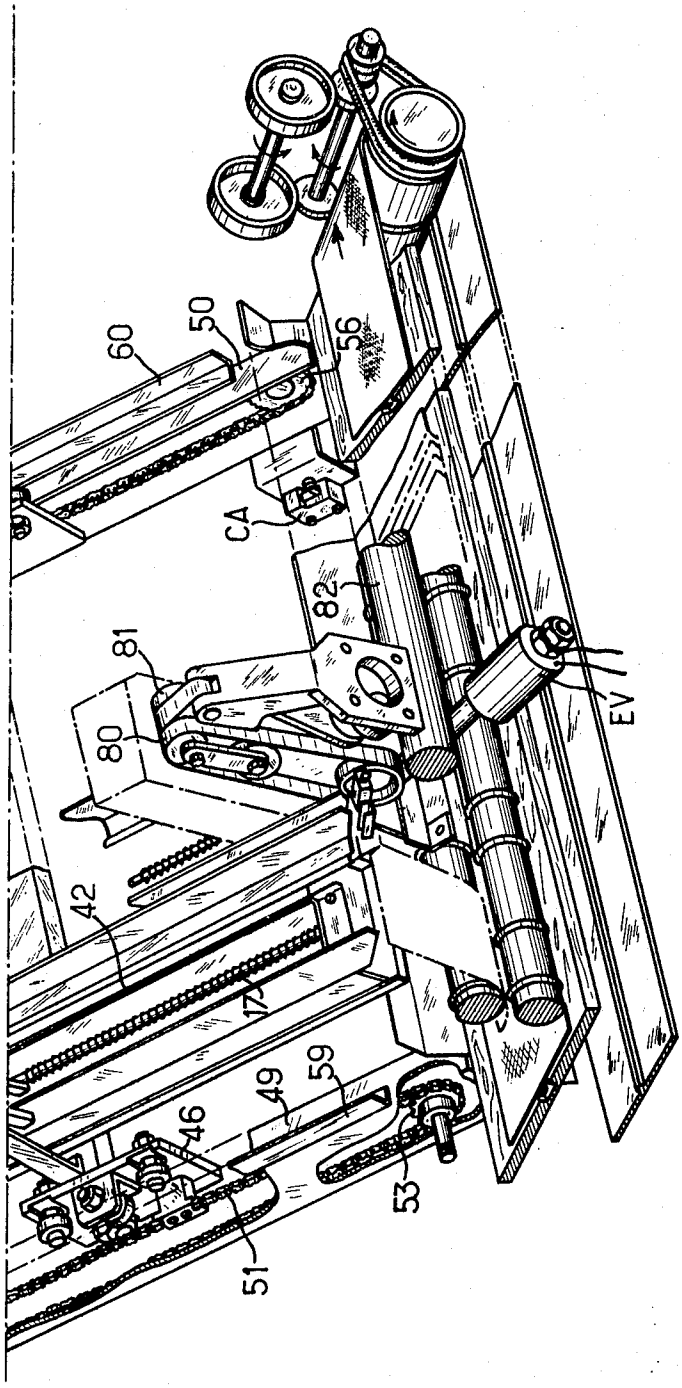


FIG.1B

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 3

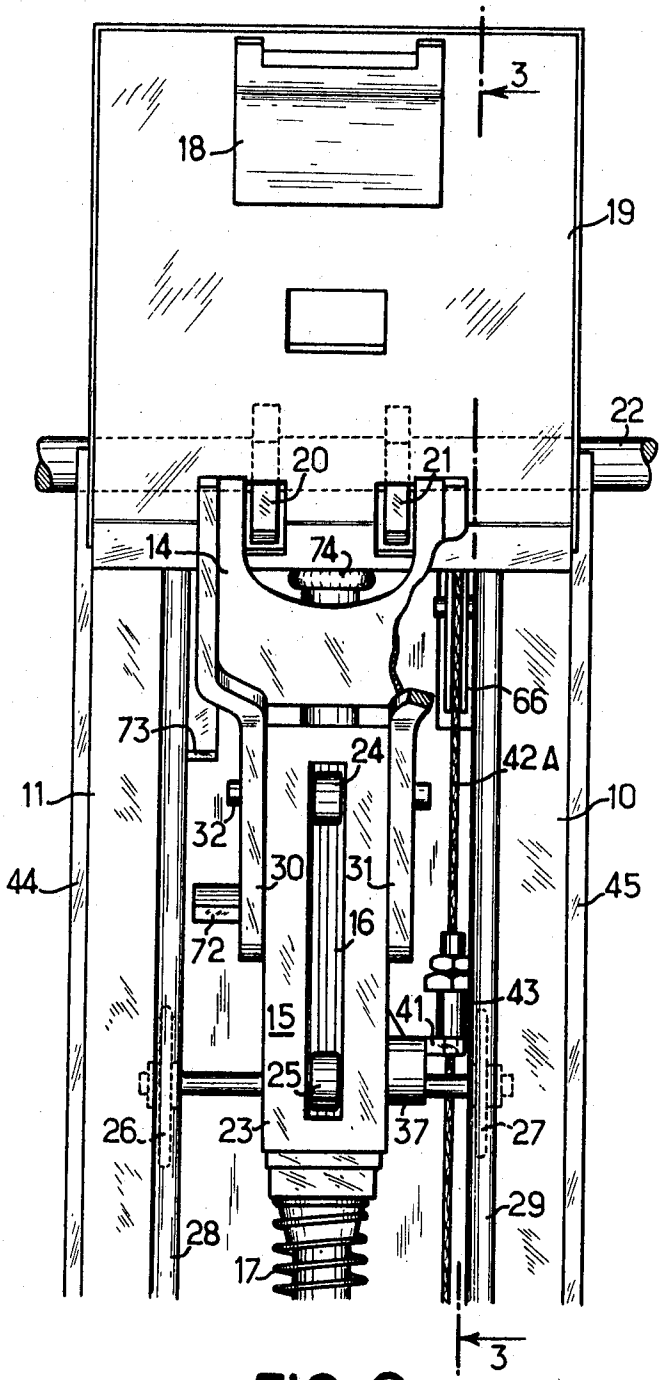


FIG. 2

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 4

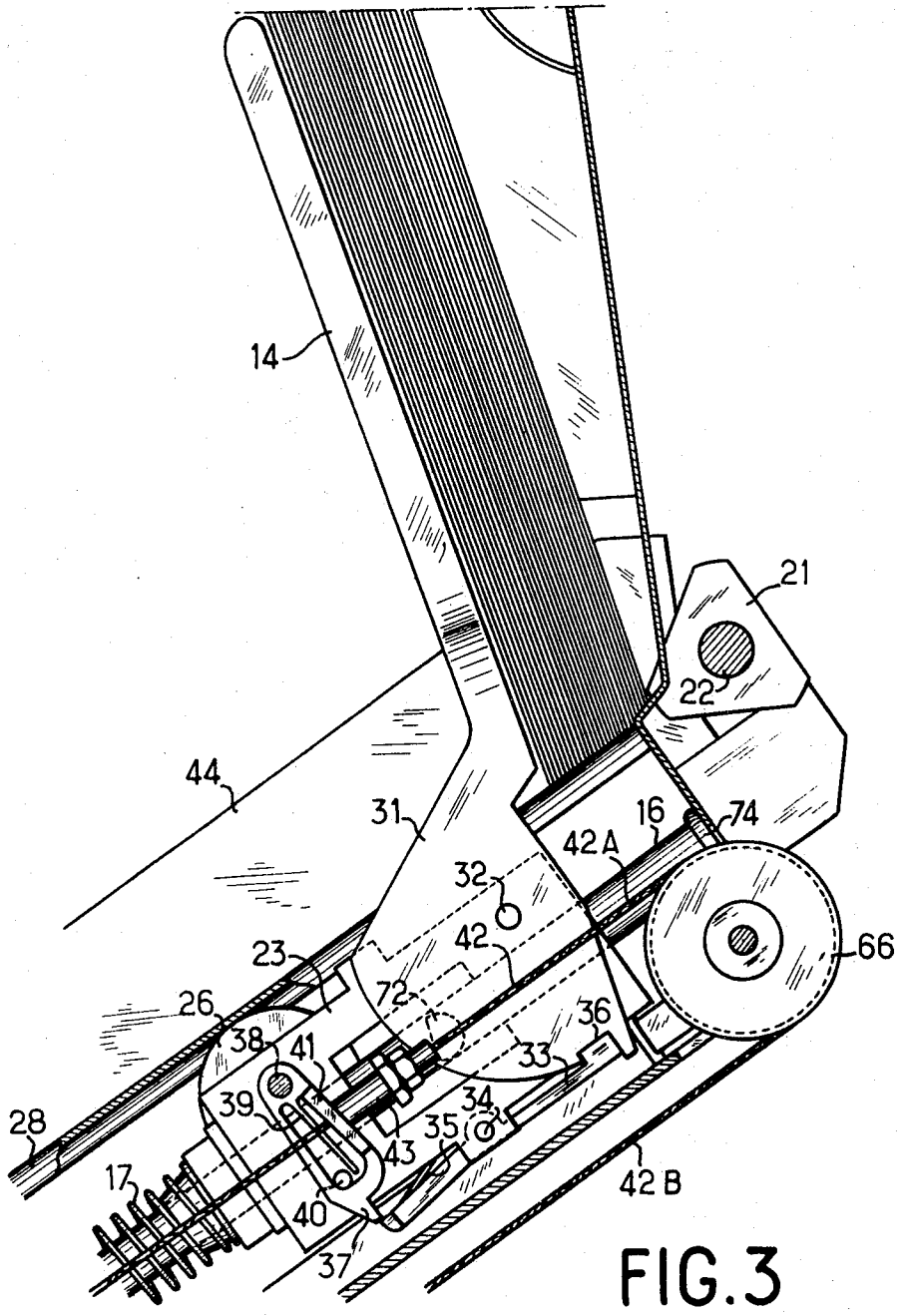
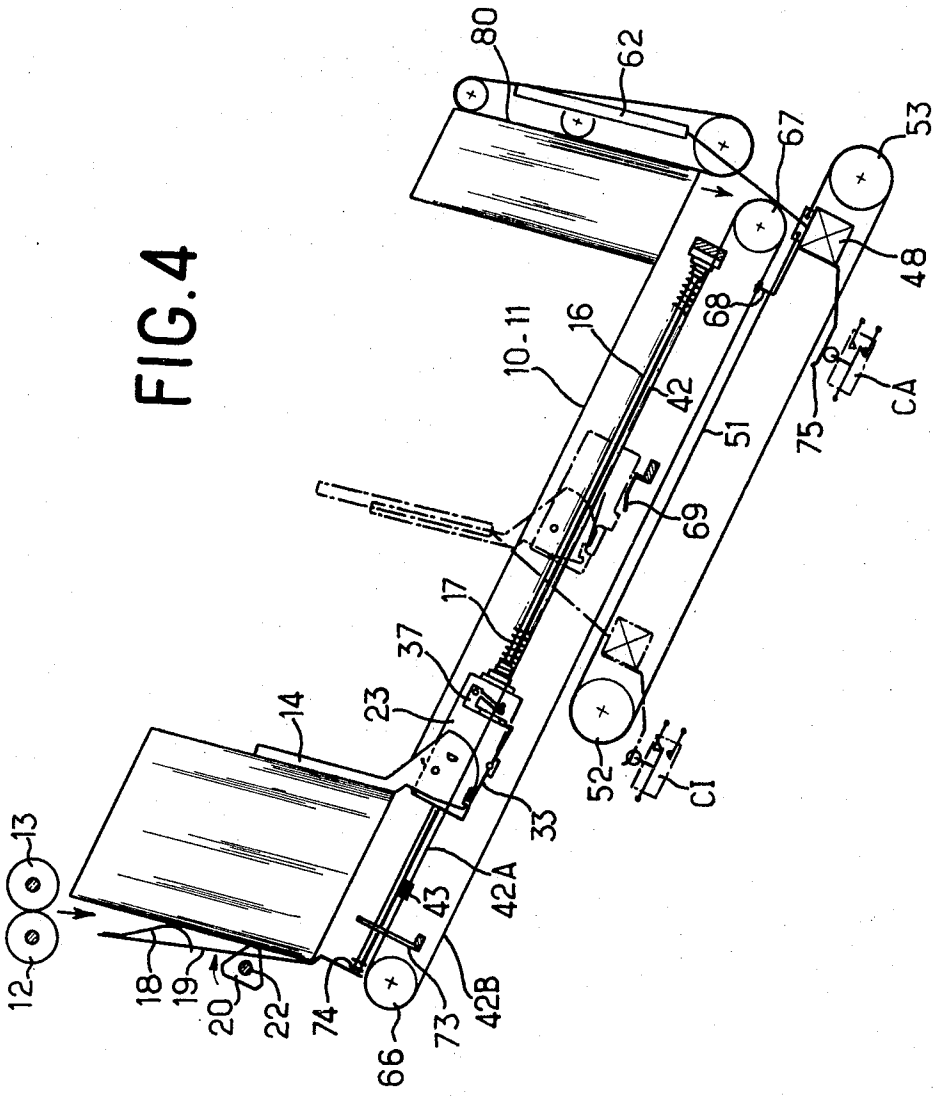


FIG.3

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 5

FIG.4



COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 6

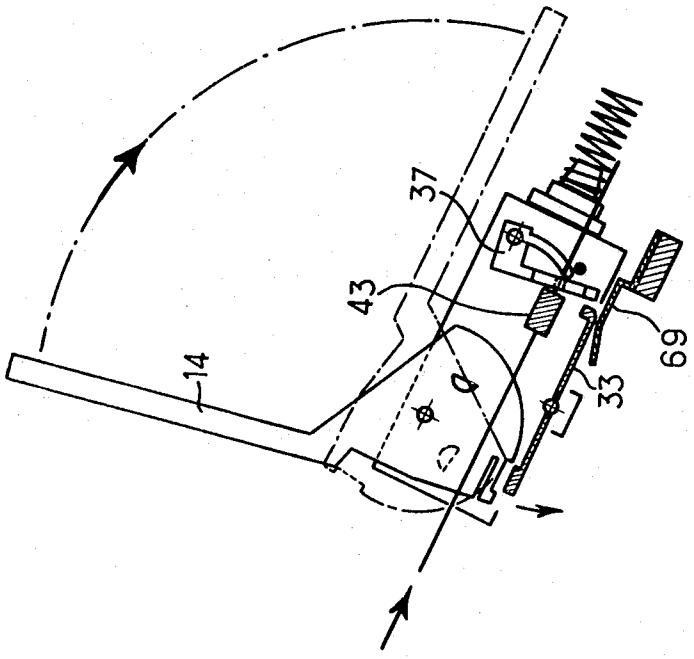


FIG. 6

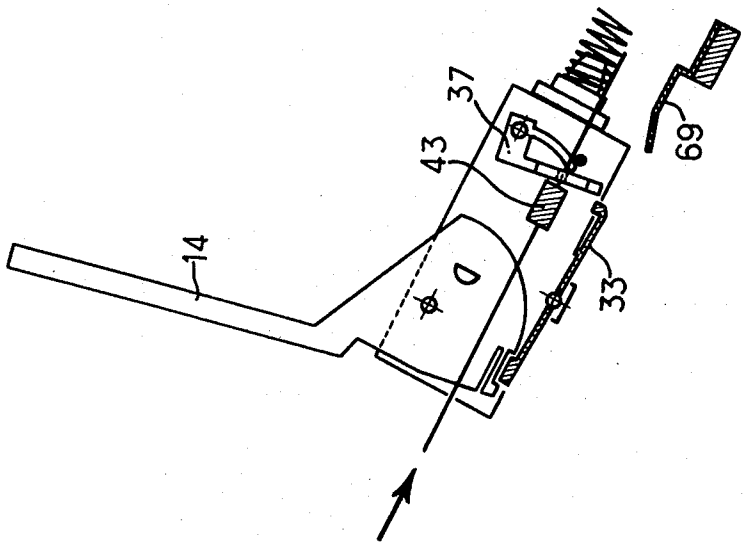


FIG. 5

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 7

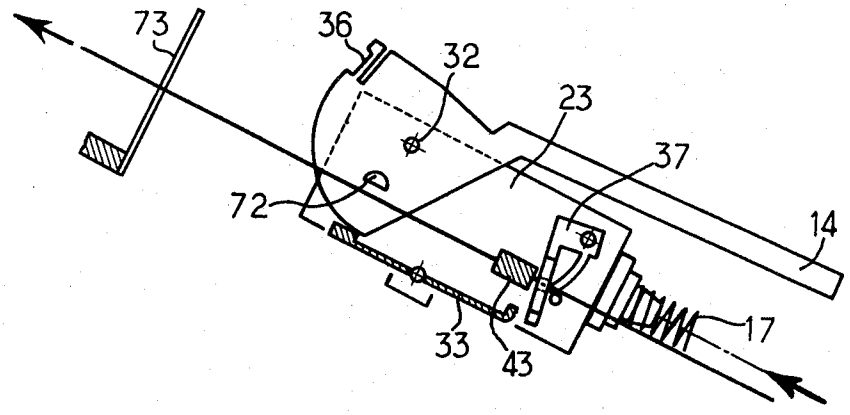


FIG. 7

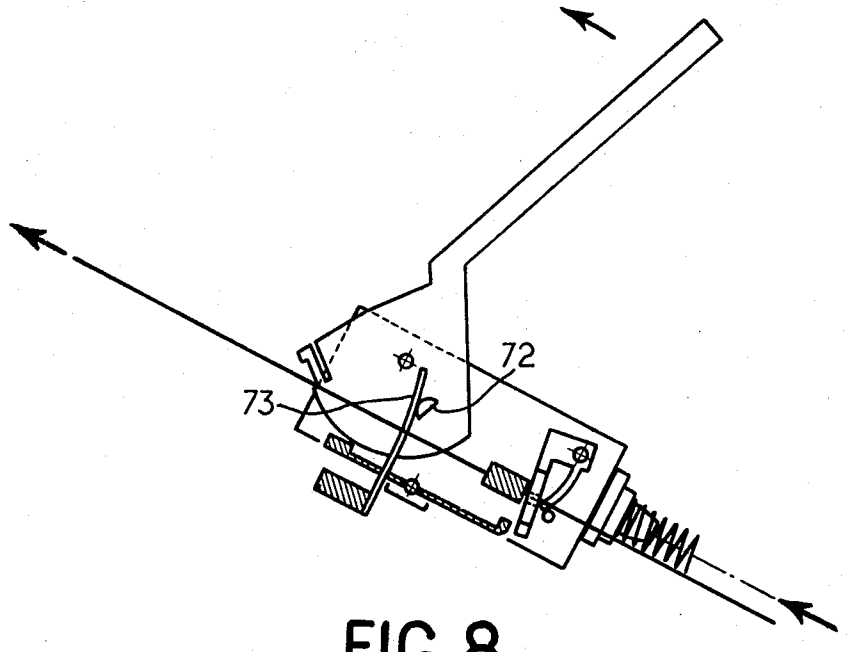
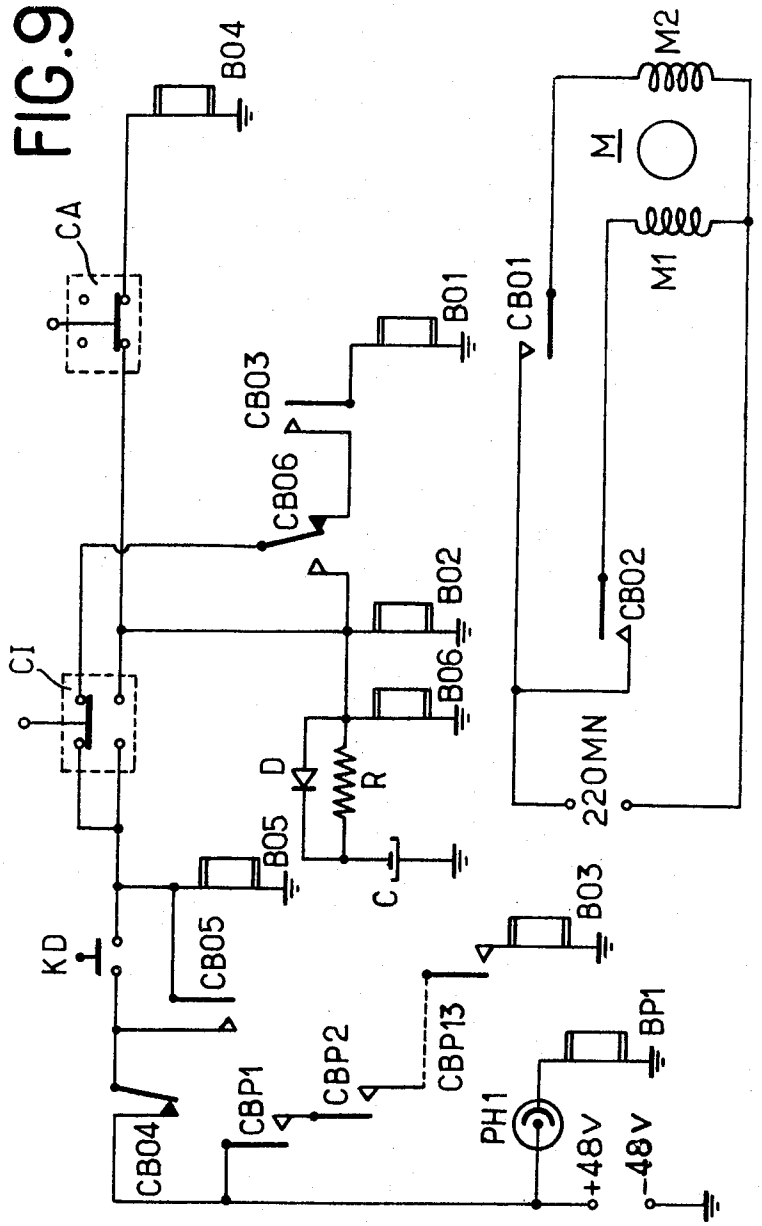


FIG. 8

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

Filed Jan. 19, 1971 8 Sheets-Sheet 8

FIG.9



United States Patent Office 3,664,658 Patented May 23, 1972

3,664,658

COMBINED SYSTEM FOR RECEIVING AND FEEDING CARDS

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Continuation of abandoned application Ser. No. 830,301, June 4, 1969. This application Jan. 19, 1971, Ser. No. 107,693

Claims priority, application Netherlands, June 7, 1968, 6808091

Int. Cl. B65h 1/30

U.S. Cl. 271—9 20 Claims

ABSTRACT OF THE DISCLOSURE

Sorting machine for record cards, comprising a plurality of receiving compartments disposed parallel alongside one another. Each compartment comprises an inclined bottom forming a descent track for the cards, a carriage arranged so that it can slide parallel to the said bottom and an upper card retaining device pivoted on this carriage and normally occupying a holding position for retaining collected cards in the upper portion of the compartment, these cards resting on edge on the inclined bottom. A common carriage extends beneath and transversely of all the descent tracks and comprises as many lower card retaining devices as there are compartments. This carriage can be displaced along the lower portion of the compartments, the lower card retaining devices normally being disposed at the lower end of the compartments. Mechanical coupling means permit the displacement of the individual carriages of the compartments in a direction opposite to the movement of the common carriage. Control means are provided which, when operated, initiate the upward movement of the common carriage and of the lower card retaining devices and simultaneously the downward movement of the cards and of the upper card retaining devices. When the bearing faces of the lower card retaining devices are disposed in the same plane as the bearing faces of the upper card retaining devices, these latter are retracted. Immediately after the retraction of the upper card retaining devices, the movement of the common carriage is reversed so as to permit the descent of the cards and of the lower card retaining devices to the bottom end of the compartments.

This is a continuation of application Ser. No. 830,301, June 4, 1969, now abandoned.

The present invention relates to a combined system for receiving and feeding cards.

It is more particularly concerned with a combined system for receiving and feeding cards, in a sorting machine having automatic recirculation of cards, such as that which has been described and illustrated in the U.S. Pat. No. 3,378,251.

The improvements which have been applied to machines for record cards or similar documents have permitted high processing speeds of the order of 1500 to 2000 cards per minute and even more to be reached. The introduction of these machines has led designers to provide these machines with large-capacity card supply magazines in order to reduce the frequency of the operations nececssary for loading such magazines. Consequently, having regard to the high processing speeds of these machines, it has been found neccessary to provide large-capacity receiving compartments capable of collecting the cards processed in the course of a single passage through the machine. However, in these machines, the manual withdrawal by an operator of the cards deposited in the receiving compartments for returning them to the feed magazine cannot be

envisaged, because not only the result thereof would be that the physical fatigue suffered by the operator is greatly increased, but the manual emptying of the receiving compartments would be longer allow the operator the time necessary to permit him to recharge the feeding magazine. This is the reason why, in machines of this type, the documents or cards which have accumulated in the receiving compartments as a consequence of a first passage are extracted from the said compartments by an appropriate device which, starting from the moment when it is set in operation by the operator, ensures the automatic extraction of the cards, the extracted cards being then taken up by a feed device in order to be returned towards the supply magazine for the purpose of a fresh processing operation.

In certain of these machines, and particularly in the case of the machine described in the aforementioned patent, each receiving compartment has been established so as to receive through its upper part the cards originating from the supply magazine, whereas the extraction of the collected cards is effected through the bottom of the compartment. In one improved embodiment which has been described, particularly in the U.S. Pat. No. 3,381,830, each receiving compartment is provided with an endless belt which is vertically disposed and which carries several supports, these being arranged at regular intervals along the said belt and being driven by the latter, so that the cards which fall into the compartment are collected on a support, descend progressively into the interior of the compartment, supported by the said support, and are stopped at the bottom of the compartment by retaining means, while the said support continues its movement until another has reached the top of the compartment for receiving the following cards. This constructional form provides the possibility of being able automatically to extract the cards retained at the bottom of the compartment, while other cards are being accumulated on one of the supports. Nevertheless, it does have the disadvantage of making manual access to the accumulated cards particularly difficult, especially when the number of cards in the stack as thus formed becomes large and exceeds several hundreds. In particular, when the number of cards of the said stack is very large and exceeds, for example, 1000 cards, it is practically impossible to extract the cards which are at the bottom of the stack, because the upper cards of the stack exert an excessive pressure on the lower cards, this pressure preventing any card of the bottom of the stack from sliding in relation to those which are in contact therewith. Under these conditions, not only the manual extraction of the lower cards presents the danger of causing the cards disposed above those which it is desired to extract from being carried along and caused to fall, but it is practically impossible to insert other cards into the lower part of the stack. This impossibility becames increasingly more of a nuisance since, in the high-speed machines, despite the use of a preestablished processing programme, it is sometimes necessary to interfere with the course of a processing operation, either for inserting cards into the series of cards undergoing processing, or for withdrawing cards, without it being necessary for this purpose to stop the machine.

The present invention has for its object to overcome these disadvantages and proposes a combined system for receiving and conveying cards, in which the manual extraction of accumulated cards can be effected easily and which also permits the manual insertion of other cards into the stack of accumulated cards.

In a machine for the handling of record cards and provided towards its upper part with a card-driving track, associated with a plurality of card receptacles which are disposed parallel at a lower level and in a direction perpendicular to the said track, one object of the present

invention is concerned with a combined system for receiving and conveying cards, which is characterised in that each of the card receptacles comprises an inclined bottom forming a card-descent track with means for guiding cards which can be stacked while resting substantially vertical on a small side, by providing for each receptacle an upper card retaining device for receiving the cards being stacked in an upper part of the receptacle, this card retaining device having a bearing face extending above the said descent track and being capable of sliding on guide means parallel to the said track, a common carriage extending beneath and transversely of all the said descent tracks, and adapted to slide on guide means, this carriage carrying as many lower card retaining devices as there are receptacles, so that normally each lower card retaining device is situated at the bottom of the lower or storage portion of the corresponding receptacle, driving means driven by a motor being adapted to be made operative for displacing the common carriage in order to bring the lower card retaining device to the bottom of the said upper portion of the receptacles and then automatically to bring these latter to their normal position, and mechanical coupling means arranged in such a way as to cause the upper card retaining devices to be displaced in a direction opposite to the common carriage, both during the upward movement of the latter and during its subsequent downward movement, the upper card retaining devices being each arranged so as to be pivotable on a support, so that when the bearing faces of the lower card retaining devices reach the same plane as the bearing faces of the upper card retaining devices, these latter are retracted beneath the descent tracks, in order that the lower card retaining devices ensure the descent of the stack of cards towards the bottom storage portions of the card receptacles.

For a better understanding of the invention, and to show how it may be carried into effect, the same will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGS. 1A and 1B are two perspective views, with parts broken away, of a part of a record card machine equipped with a combined card-receiving and conveying system, constructed in accordance with one arrangement of the invention,

FIG. 2 is a plan view of the mechanism formed by an upper card stop and its carriage, this mechanism being represented in the upper part of a card magazine forming part of the machine which has been partially shown in FIGS. 1A and 1B,

FIG. 3 is a section on the line 3—3 of FIG. 2,

FIG. 4 is a diagrammatic view intended to show the main arrangements of the combined card-receiving and conveying system designed in accordance with the invention,

FIGS. 5 to 8 are diagrammatic views of a mechanism formed by an upper card retaining device and its carriage, showing different positions occupied by this mechanism while it is operating,

FIG. 9 is a diagram showing electric cricuits for controlling and checking the combined card-receiving and conveying system, which has been shown in FIGS. 1A, 1B and 4.

In FIGS. 1A and 1B, which are assembled along the chain-dotted line, there is shown a part of a record card-sorting machine equipped with a combined system for receiving and transporting cards in accordance with the invention. This machine comprises a plurality of identical reception compartments, in which cards selected in the machine are adapted to accumulate. In known manner, these cards originate from a card-feeding magazine (not shown) and, after having been analysed by analysis devices of known type, they are advanced along a feeding track equipped with deflectors. These latter, actuated as a result of the card analysis, then divert the cards towards the reception compartments for which they are intended.

One of these compartments is shown in FIGS. 1A and 1B. FIGS. 1A, 1B, 2 and 4 show that this compartment comprises an inclined ramp formed by two guide tracks **10** and **11** and on which the cards received are stacked edgewise. The introduction of the cards into the compartment is effected at the upper end of the ramp, by means of two driving rollers **12** and **13** (FIGS. 1A and 4). The stack formed by the accumulated cards is held by a support **14**, known as the upper card stop or retaining device, which is disposed substantially perpendicularly of the ramp and which is fast with a carriage **15** which is capable of sliding along the ramp between the slideways or tracks **10** and **11**. The carriage **15** is guided in its movement by a guide rod **16** disposed beneath the ramp, parallel to the latter and between the two tracks. A spring **17**, guided by the rod **16**, urges the carriage towards the top of the compartment, so that the upper card stop **14** holds the stack of cards so that they bear against a deflecting plate **18** which is fast with a vertical plate **19** fixed to the upper end of the ramp. When a card which is driven by the rollers **12** and **13** enters the compartment, the stack formed by the cards previously received is pushed back by a cam assembly comprising two cams **20** and **21** mounted on a common shaft **22** which is driven in rotation in the direction indicated by the arrow. The stack, pushed back by the cams **20** and **21**, thus provides space for the card which is arriving, so that the latter can be engaged between the deflecting plate **18** and the stack and advanced substantially as far as the level of the shaft **22**. This card is then taken up by the cams **20** and **21** in order to be correctly positioned on the ramp.

As the cards reach the compartment and are stacked on the ramp, the upper card stop **14** is pushed back by the card stack and compels the carriage **15** to descend, thus compressing the spring **17**. However, it has to be noted that the effective travel of the carriage **15** on the rod **16** is limited in such a way that the upper card stop **14** can only be effectively displaced between an upper limiting position and an intermediate position disposed substantially at an equal distance from the two ends of the ramp.

Under these conditions, it will be considered that the upper half of the compartment is used for the accumulation of the cards which enter the compartment, the accumulated cards then being carried into the lower half of the compartment by a feed mechanism which will hereinafter be more fully described.

FIGS. 2 and 3 are adapted to show the constructional details of the carriage **15**. This carriage comprises essentially a carriage body **23** which, as shown in FIG. 3, can be moved on the ramp parallel to the latter, sliding on the rod **16** by means of two rollers **24** and **25**. The carriage body **23** is equipped with two positioning rollers **26** and **27** which are disposed on either side of the said body and which roll inside channel members **28** and **29** for preventing the carriage from rocking about its guide rod. In one preferred embodiment, the channels **28** and **29** are formed by the lateral edges being suitably deformed facing the two guide tracks **10** and **11**, so that these latter then have on their upper faces two perfectly polished projecting ribs which reduce the friction of the cards on the ramp and thus facilitates their sliding movement. The card stop **14** is extended at its bottom end by two parallel lateral side plates **30** and **31**, and it is capable of pivoting about a horizontal pivot shaft **32**, which extends through the said side plates and which is fast with the carriage body **23**.

FIG. 3 shows that the card stop **14** is held in an upper position for retaining the cards collected in the top of the compartment by a lower latch **33**, which can pivot about the pivot shaft **34** fast with the carriage body and which is engaged, at one of its ends and under the action of a spring **35**, in a notch **36** formed for this purpose in one of the side plates. A locking member **37**, disposed so as to pivot about a shaft **38** fast with the carriage body, acts on the other end of the lower latch **33** and it is held in a position referred to as the locking position of the lower

latch under the action of a resilient plate **39** which bears on a fixed pin **40** fast with the carriage body. FIGS. 2 and 3 also show that the lock **37** is equipped with a small plate **41**, which has a notch for the passage of a steel twisted cable **42**, on which is mounted a block **43**, which will hereinafter be referred to.

Referring now to FIGS. 1A and 1B, it is seen that the collected cards which descend by sliding on the projecting ribs of the ramp are guided on each side of the compartment by two lateral guide bars **44** and **45**.

It will be considered that the sorting machine which has been illustrated partly on the assembled FIGS. 1A and 1B comprises thirteen receiving compartments similar to that which has just been briefly described. It is expedient to remember here that, with the first passage of the cards into the machine, those cards which are extracted from the card supply magazine are carried along and analysed in order to be selectively directed towards the receiving compartments. In accordance with a well-known sorting principle, when this first passage is completed, the cards are extracted from the receiving compartments, at the lower ends thereof, and replaced in the supply magazine in order once again to be distributed, during a second passage, in the receiving compartments. This operation is repeated until the number of successive passages required by the sorting operation is completed.

In th embodiment described, when one card passage is completed, the cards which are distributed in the different receiving compartments and which are collected in the upper half of each compartment have to be lowered into the lower part of each of the compartments, in order then to be capable of being extracted from the said compartments by an appropriate automatic extraction device. The descent of the cards into the lower part of each compartment is effected by means of a card-feeding mechanism, which will now be described by reference to FIGS. 1A and 1B.

As shown in these figures, the card-feeding mechanism consists essentially of a movable common carriage formed by two supporting plates **46** and **47**, which are interconnected by a bar **48** extending transversely beneath the receiving compartments. The supporting plates **46** and **47** are capable of sliding, by means of rollers, on the upper edges of the two U-shaped elements **49** and **50**, these elements being fast with the frame of the machine and disposed on either side of the receiving compartment assembly, parallel to and slightly below the latter. The supporting plate **46** is fast with a metal chain **51** which is stretched over two pinions **52** and **53** inside the element **49**. Similarly, the supporting plate **47** is fast with a metal chain **54** which extends around two pinions **55** and **56** inside the element **50**. The said carriage, which is hereinafter referred to as the lower carriage, can be driven by an electric motor M through a driving shaft **58** on which the pinions **52** and **55** are fixed. By means of this arrangement, the said lower carriage can be displaced in such a way that its bar **48** remains constantly perpendicular to the direction of its displacement. In addition, this carriage is guided laterally by the rollers which slide on two angle irons **59** and **60** which are respectively fixed to the upper edges of the elements **49** and **50**.

Associated with each receiving compartment is a second card support which will hereinafter be referred to as the lower card retaining device or stop, this being formed by two short bars **62** and **63** arranged along the path followed by the cards which descend by sliding on the ramp, these bars being fixed to the bar **48** of the lower carriage by means of two arms **64** and **65** respectively. When the lower carriage is driven by the motor M, the short bars **62** and **63** which are fast with said carriage are displaced above the guide tracks **10** and **11** and close to the latter, the said bars being however sufficiently spaced from one another to permit the carriage **15** and the upper card stop **14** to pass between them. It is then understood that if, in the conditions which will hereinafter be explained, the carriage **15** which will hereinafter be referred to as the upper carriage, is driven in its descending movement and passes between the small bars **62** and **63** of the lower card stop, the stack of cards which until then had slid on the ramp while being retained by the upper card stop is stopped in its movement by the lower card stop and then bears against the latter. Nevertheless, it has to be indicated here that the travel of the lower carriage is limited, so that the lower card stop can only be effectively displaced between an extreme lower position close to the lower end of the ramp and an intermediate position disposed substantially equidistant from the two ends of the ramp. Since, as already indicated above, the upper card stop can only be displaced between a limiting upper position and the said intermediate position, the descending movement, as far as the lower end of the ramp, of the cards collected in the upper part of the compartment is effected by driving the lower carriage upwardly and by driving the upper carriage downwardly, so that the upper card stop and the lower card stop arrive simultaneously at the intermediate position, the upper card stop then being rocked downwardly in order to permit the stack of cards thus freed to bear against the lower card stop. The movement of the lower carriage is then reversed in order to permit the cards held by the lower card stop to be moved downwardly as far as the lower end of the ramp.

The downward driving of the upper carriage as far as the intermediate position is controlled by the displacement of the lower carriage, by means of a transmission system which is now to be described. This system comprises essentially the steel twisted cable **42** which has already been referred to in the specification and which is mounted on two pulleys **66** and **67** (FIG. 4) disposed beneath the ramp and in the vicinity of the two ends of the latter. As shown in FIGS. 3 and 4, the cable **42** has an upper run **42A** extending parallel to the guide rod **16** and close to the latter, and a lower run **42B**. The upper run **42A**, on which the block **43** is mounted, passes through a notch formed in the small plate **41** (FIGS. 2 and 3) of the locking member **37**. FIG. 4 shows that the bar **48** of the lower carriage is fitted with an attachment **68** by which the lower run **42B** is made fast, so that when this carriage is driven by the electric motor, through the driving shaft **58** and the chains **51** and **54**, the cable **42** is also driven and the block **43** is then displaced at the same time as the lower carriage, but in a direction opposite to the movement of this latter. It is expedient to point out here that when the lower carriage is in its extreme lower position, the block **43** is at a limiting upper position situated in the vicinity of the pulley **66**. Under these conditions, with the lower carriage initially in the extreme lower position, and if the motor M is energised, the said lower carriage is driven upwardly and the block which initially was in the limiting upper position is displaced downwardly. During this displacement, the block **43** encounters the small plate **41** and then pushes it, thus causing the locking member **37** to pivot about its pivot shaft **38** for releasing the lower latch **33**, as shown in FIG. 5. However, because of the action of the spring **35**, the lower latch **33** remains engaged in the notch **36** of the upper card stop, so that the latter is held in the upper position. The block **43**, continuing to be displaced downwardly because of the ascent of the lower carriage, then pushes the upper carriage and drives it downwardly until the upper card stop reaches the intermediate position. As it is descending, the upper carriage compresses the spring **17**. However, just before the upper card stop has reached this intermediate position, the lower latch **33** meets a fixed stop **69** provided with a ramp which, as shown in FIG. 6, causes the said latch to rock and to become disengaged from the notch **36** of the upper card stop. This latter, no longer being held, then rocks under the action of its own weight and of the thrust of the collected cards and is folded back on the body **23** of the upper carriage, below the ramp and substantially parallel to the latter. The cards which had been held by the upper card stop are then freed and bear against

the lower card stop, which has been brought into the intermediate position at the same time as the upper card stop. FIG. 4 shows in chain-dotted lines the positions which are occupied by the upper and lower card stops which have reached an intermediate position, just before the rocking of the upper card stop. In order that this rocking movement is effected quickly, even when the stack held by the upper card stop only comprises a very small number of cards, it is necessary for the ramp to have a sufficient slope. In the example described, this slope is of the order of 35° and this in addition facilitates the sliding of the cards on the ramp. On the other hand, it is expedient to point out that the upward displacement of the lower carriage is limited by two stops **70** and **71**, which are shown in FIG. 1A and which are adjusted in such a way as to stop the movement of the lower carriage at the moment when the lower card stop reaches an intermediate position. However, in order to avoid any parts breaking as a consquence of the sudden stoppage of the lower carriage by the stops **70** and **71**, the driving of the shaft **58** by the motor M is effected by means of a torque-limiting friction clutch system of known type.

Immediately after the two cards stops have been brought to an intermediate position, the direction of rotation of the motor M is reversed, in order to cause the descending movement of the lower carriage. Under these conditions, the lower card stop descends, while holding the stack of cards sliding on the ramp, while simultaneously the block **43** moves once again to its limiting upper position, thus permitting upward movement of the upper carriage under the action of the spring **17**. During the return upward movement of the upper carriage, the upper card stop **14** remains folded, as shown in FIG. 7, on the body **23** of the upper carriage and beneath the ramp, this permitting it to pass beneath the descending stack of cards. At the same time, the lower latch **33** leaves the ramp of the stop **69** and, under the action of its spring **35** (not shown in FIG. 7), is caused to bear against the plate formed with the notche **36**. However, since the upper card stop is folded, the lower latch **33** cannot be engaged in this notch and consequently it remains spaced from its locking position, thus preventing the locking member **37** from re-assuming its locking position for the lower latch. FIG. 2 shows that the side plate **30** is provided with a stud **72**, the purpose of which is to permit the upper card stop **14** to re-assume its upper position. FIG. 7 shows that, when the upper card stop is folded, the stud is disposed substantially beneath the pivot shaft **32** of the upper card stop. Under these conditions, when the upper carriage moves upwardly, this pin or stud encounters a fixed flexible stop **73** disposed along its path. The stud **72**, held during the passage by the stop **73**, while the upper carriage continues to move upwardly under the action of the spring **17**, causes the upper card stop to rock, as shown in FIG. 8. The position of the stop **73** is chosen so that the upper card stop is brought back to the upper position at the moment when the upper carriage encounters a stop **74**, referred to as a limit stop, which is disposed on the guide rod **16**, as shown in FIGS. 2, 3 and 4, in order to limit the travel of the upper carriage towards the top of the compartment. The upper card stop is once again locked in the top position by the lower latch **33** which, because of the rocking of the said card stop, has been brought into engagement with the notch **36** under the action of the spring **35**. On the other hand, the previously described card-transport mechanism and the transmission system are so designed that the stack of cards which has moved downwardly with the lower card stop reaches the lower end of the ramp at the exact moment when the upper carriage **15** again encounters the limit stop **74**. The cards, which have thus descended to the bottom of the ramp, can then be extracted from the compartment by an extraction device of known type, such as that which is shown in FIG. 1B, at the bottom of the ramp of the receiving compartment close to that which has been shown in FIGS. 1A and 1B. In the example described, it will be considered that this device is of a well known type. Said device comprises at least one conveyor belt tensioned by two guide pulleys rotating on shafts fast with a support, which is formed with openings communicating with an air vacuum source for applying the cards to the conveyor belt and ensuring that the cards are driven through a gauge when the said belt is driven by a driving mechanism, this latter being formed by a constantly rotating shaft, into contact with which the belt can be brought for being driven by the said shaft.

FIGS. 1B and 4 show that the cards which are moved to the bottom of the ramp are applied to the conveyor belts **80** and **81** of the extraction arrangement. However, the lower carriage can be moved downwardly to a slightly greater extent, as shown in FIG. 4, so as to permit the lower card stop to be disengaged from the stack of cards, in order thus to avoid interfering with the subsequent extraction of the said cards from the compartment. As a result, the block **43** continues to ascend, in order finally to reach its upper end position. However, with this last movement, the upper carriage **15**, held by the limit stop **74**, can no longer be displaced towards the top of the compartment. Under these conditions, the block **43** is spaced from the small plate **41** and thus permits the locking member **37** once again to assume its position for locking the lower latch, under the action of the spring plate **39**. From this moment, the cards which are bearing against the conveyor belts **80** and **81** can be extracted from the compartment, this extraction being controlled, in the example described, by an electromagnet EV which is shown in FIG. 1B and which, when it is energised, slightly displaces the conveyor belt assembly **80** and **81** to bring them into contact with a constantly rotating shaft **82**. The belts **80** and **81**, thus set in motion by the shaft **82**, then successively drive by fraction each of the cards of the stack for discharging them from the compartment, the extracted cards being collected by a card-conveying system comprising conveyor belts, of known type, which finally returns them to the supply magazine.

It has to be remembered that, in the embodiment described, all the lower card stops are fast with the lower carriage. Consequently, when a passage of cards is completed and the cards are distributed in the different receiving compartments, in the upper half of each of said compartments, the motor M is controlled so as to cause the upward movement of the lower carriage as far as its upper limiting position, the cards held by the upper card stops being then moved downwardly at the same time as far as the intermediate position in order to be simultaneously taken up by the lower card stops associated with their respective compartments. After this, the motor M is controlled so as to cause the lower carriage to be driven downwardly, the cards then held by the lower card stops being thus lowered altogether to the bottom of their respective compartments. The downwardly moved cards are then extracted from the compartments, this emptying operation being effected compartment-by-compartment, until they are all empty. During the emptying operation, each compartment can receive cards through its upper part, these cards originating from the supply magazine, which can itself receive the cards extracted from the receiving compartments.

In order that the descent to the bottom of the compartments of the cards collected in the upper part of the receiving compartments can be effected, it is necessary for all the cards which had previously descended to the bottom of the compartments to be all extracted from these latter. In actual fact, if this were not the case, the cards which are at the bottom of the compartments would be raised again by the lower card stops at the moment of the upward movement of the lower carriage. Not only would these cards prevent the folding of the upper card stops, but coincidentally, in each case, between an upper card stop and a lower card stop, they would be

damaged by the said card stops or would cause the machine to become inoperative. In order to obviate these disadvantages, each compartment is provided at its bottom end with means for detecting the presence of cards, said means being for example formed by photoelectric cell systems, which act on the energising controls of the motor M in order to prevent the upward movement of the lower carriage while all the cards which have been lowered to the bottom of the compartments have not been extracted from these latter. The energisation of the motor M is in addition controlled by the movement of the lower carriage which, at the moment of arrival at its upper limiting position, is adapted to actuate by means of a plate **75** (FIG. 1A), an electric contact CI controlling the reversal of the rotational direction of the motor **57**. A second electric contact CA, shown in FIG. 1B, is operated by the plate **75** of the lower carriage in order to stop the energisation of the motor **57** at the moment when the said carriage, in redescending, reaches its lower limiting position.

The electric circuits which control the energisation of the motor M will now be described by reference to the diagram given in FIG. 9. The electric diagram in FIG. 9 is a diagram for illustrating the principle of operation, and comprises manual control contacts and relays provided so that they can be used under conditions which are about to be described. The relay contacts are given the same reference as the winding which controls them, but preceded by the letter C. A contact which is normally closed when the relay coil which controls it is not energised is represented in this diagram by a black triangle. The relays shown in FIG. 9 are normally supplied with direct current taken between two terminals +48 v. and −48 v.

The electric motor M which drives the lower carriage is a motor in which the reversal of its direction of rotation is obtained in known manner, depending on the type of motor used. It will be considered that, in the example described, this motor is of the alternating current type and comprises two inductor windings M1 and M2 wound in opposition, so that when one of the windings is excited, the motor turns in one direction, while when the other winding is excited, the motor turns in the opposite direction. The two windings M1 and M2 can be fed with 220 volt single-phase alternating current supplied by two terminals **220** MN, by means of two switch contacts CBO1 and CBO2 which are respectively controlled by two relay coils BO1 and BO2.

Each of the thirteen receiving compartments of the machine is provided in its lower part with a photoelectric cell designed to detect the presence of the cards in the bottom of the compartment. In FIG. 9, only the photoelectric cell PH1 associated with the first compartment has been shown, but it will be understood that the machine comprises twelve other cells PH2 to PH13, each being respectively associated with each of the twelve other receiving compartments. If there is no card at the bottom of the first receiving compartment, the cell PH1 receives a light beam emitted from a light source, which permits the relay BP1 to be energised with direct current. The energised relay BP1 holds its contact CBP1 in the working position. On the contrary, when cards have moved to the bottom of this compartment and intercept the light beam of the cell PH1, the relay BP1 ceases to be energised and then opens its contact CBP1. Under these conditions, if there are no cards in the lower part of the thirteen receiving compartments, the cells PH1 to PH13 are illuminated and consequently, the thirteen contacts CBP1 to CBP13 of the relays BP1 to BP13 which they respectively energise are closed. A direct current then circulates, starting from +48 volts, through the closed contacts CBP1 to CBP13, and causes energisation of the relay BO3. With the relay BO3 energised, this then closes its contact CBO3. A switch KD permits the control of the general descent of the cards towards the bottom of the compartments, which cards, when a card passage is completed, are accumulated in the upper part of the receiving compartments. In the example described, this switch is operated manually, but it could however be operated by any other known operating method. Furthermore, it will be considered that known means have been provided for only permitting the switch KD to be operated when the feed device charged with extracting the cards from the supply magazine has been stopped. These means do not form part of the invention and they have neither been described nor illustrated.

If, when the feeding of cards is stopped and when no card is in the lower part of the receiving compartments, the switch KD is operated in order to hold it closed for only a few moments, a direct current circulates, starting from +48 volts, through a normally closed contact CBO4 and the switch KD, and causes a relay BO5 to be energized. When the relay BO5 is energised, it closes its contact CBO5 and establishes a holding circuit for itself. The relay BO5 thus remains energised by its contact CBO5 even if at this moment the switch KD is no longer actuated. Furthermore, because the electric contact CI is not depressed, a continuous current circulates from the +48 volts through the closed contacts CBO4 and CBO5, the contact CI, a normal reversing contact CBO6 and the closed contact CBO3, and energises the relay BO1. When the relay BO1 is energised, it closes its contact CBO1 and then permits the winding M2 to be fed with single-phase alternating current which is supplied by the terminals **220** MN. The motor M is then driven, driving the lower carriage in an upward direction. With this movement, the plate **75**, displaced at the same time as the lower carriage, frees the electric contact CA, which moves upwardly and thus prevents any energisation of the relay BO4. The upward movement of the lower carriage is accompanied by the downward movement of the driving blocks of the upper carriages. Each upper carriage starts to descend from the moment when the corresponding one of the driving blocks comes into contact with it. At the moment when the upper and lower card stops reach an intermediate position, the lower carriage, through its plate **75**, causes the depression of the electric contact CI. A direct current then circulates from the +48 volts through the closed contacts CBO4 and CBO5 and the depressed contact CI, and energises two relays BO2 and BO6. This same direct current charges a capacitor C through a diode D. The energised relay BO6 moves its contact CBO6 into the operating position, thus interrupting the energisation of the relay BO1. The relay BO1, no longer being energised, opens its contact CBO1. Under these conditions, the winding M2 of the motor ceases to be fed with alternating current. However, the relay BO2, being energised, closes its contact CBO2 and then permits the winding M1 to be supplied with alternating current supplied by the terminals **220** MN. Under these conditions, the motor M is caused to turn in the reverse direction for causing the downward driving movement of the lower carriage. It is necessary to remember here that, on reaching an intermediate position, the upper card stops have been folded and that the cards are now held by the lower card stops. These cards have then moved downwardly to the bottom of the compartments with the descending movement of the lower carriage. It must be noted, however, that during this movement, the plate **75**, displaced at the same time as the lower carriage, once again frees the contact CI, which moves upwardly. A direct current is then circulating from the +48 volts through the closed contacts CBO4 and CBO5, the raised contact CI and the reversing switch CBO6 in the operating position, and continues to energise the relays BO2 and BO6. It must further be noted that, at the moment when the contact CI moves upwardly, the electric circuit which, starting from the +48 volts, permits the relays BO2 and BO6 to be energised, is broken during a very short time interval, which corresponds to the movement of the contact CI from the depressed

position to the position in which it is not depressed. Nevertheless, during this time interval, the energisation of the relays BO2 and BO6 is maintained by the discharge of the condenser C, which is connected in parallel to the relays BO2 and BO6 through a resistance R. In this manner, the reversing switch CBO6 is unable to move to the rest position when the contact CI moves to its undepressed position. With the downward movement of the lower carriage, the energisation of the relays BO2 and BO6 is assured by a direct current which, starting from the +48 volts terminal, circulates through the closed contacts CBO4 and CBO5, the undepressed contact CI and the reversing switch CBO6 in the operating position. The cards which have been moved downwardly by the lower card stops are finally applied to the conveyor belts of the extraction device. However, the lower carriage is driven to a slightly lower level, as already indicated, and its plate 75 once again causes the depression of the contact CA. Under these conditions, as shown in FIG. 9, a direct current circulates, from the +48 volts terminal, through the closed contacts CBO4 and CBO5, the undepressed contact CI, the reversing switch CBO6 in the operating position and the depressed contact CA, and energises the relay BO4. When the relay BO4 is energised, it opens its contact CBO4 and then interrupts the energisation of the relays BO5, BO2, BO6 and BO4. The de-energised relay BO5 opens its contact CBO5. The de-energised relay BO2 opens its contact CBO2, thus stopping the energisation with alternating current of the winding M1 of the motor M. Under these conditions, the motor M is stopped. The de-energised relay BO6 moves its contact CBO6 into the rest position. Finally, the de-energised relay BO4 closes its contact CBO4. However, as the contact CBO5 remains open, and none of the relays BO1, BO2, BO4, BO5 and BO6 can be energised. It is moreover, expedient to point out that, because of the presence of cards in the lower part of the receiving compartments, the relay BO3 is no longer energised and that consequently the contact CBO3 is open. As already stated above, it follows that it will only be possible for the relay BO1 to be energised, by acting on the switch KD for once again causing the upward movement of the lower carriage, when all the cards which have descended to the bottom of the receiving cases have been extracted from these latter. In addition, to obtain the energisation of the relay BO1, it will be necessary for the supply of cards to the machine to be stopped.

It is in addition necessary to point out that, as cards enter a compartment, the upper card stop of this compartment, under the pressure of the stack of cards, causes its upper carriage to descend. This upper carriage will thus be able to be moved downwards because of the accumulation of cards until the upper card stop reaches an intermediate position. However, because the locking member 37 would not have been displaced by the driving block, the lower latch 33 would not have been able to be rocked by the stop 69 and thus prevent the folding of the upper card stop. However, in order to stop the arrival of cards in this compartment when, because of the accumulation of cards in the upper part of the compartment, the upper carriage comes in proximity to the stop 69, each compartment has been provided with a full compartment contact, which is arranged so that it can be actuated by the upper carriage when the compartment is full, that is to say, just before the upper card stop reaches the intermediate position. However, because the locking member the reference CP in FIG. 1A, can cause either the stopping of the card-feeding device of the machine or the switching towards another predetermined compartment of the cards destined for the full compartment.

Although an embodiment comprising essential features of the invention has been described with reference to the accompanying drawings, it will be understood by those skilled in the art that modifications as regards design and detail may be incorporated, without departing from the scope of the invention, as defined in the appended claims.

We claim:

1. In a machine for sorting record cards, a system for receiving and feeding cards, comprising in combination, a plurality of card-receiving compartments disposed parallel one beside the other, each compartment comprising an inclined bottom forming a card-descent track, means for guiding cards, introduction means disposed at the upper end of the compartment for inserting and stacking the received cards on edge on the inclined bottom, a carriage designed so as to be capable of sliding parallel to the said inclined bottom, an upper card retaining device fast with the carriage, the said card retaining device normally occupying a retaining position substantially perpendicular to the inclined bottom for retaining the collected cards, but capable of being brought into a retracted position beneath the said bottom, and balancing means coupled with the carriage for normally maintaining the stack of cards in the upper portion of the compartment;

a common carriage extending beneath and transversely of all the said descent tracks, the said carriage being provided with guiding means so that it can be displaced along the lower portion of the compartments, and comprising a plurality of lower card retaining devices in a number equal to that of the said compartments, these card retaining devices normally being positioned at the lower end of the compartments,

mechanical coupling means arranged to displace the said individual carriages of the compartments in a direction opposite to the movement of the common carriage,

a plurality of fixed stops, each mounted on a respective compartment for causing the retraction of the corresponding upper card retaining device when the bearing face of this latter is in the same place as the bearing faces of the lower card retaining devices,

and controlled driving means which are arranged so that, when they are operated, they are able to displace the said common carriage and the lower card retaining devices in an upward direction to cause the downward movement of the cards and the upper card retaining devices and then for reversing the movement of the common carriage immediately after the retraction of the said upper card retaining devices, in order to permit the descent of the cards and of the lower card retaining devices to the lower end of the compartments.

2. A system for receiving and feeding cards according to claim 1, in which each of the said individual carriages is provided with a latch for maintaining in the holding position the upper card retaining device which is pivoted on the carriage, the said latch being arranged so as to be displaced by the fixed stop of the compartment with which it is associated when the bearing face of the said upper card retaining device is disposed in the same plane as the bearing faces of the lower card retaining devices, and to permit the retraction of the said upper card retaining device.

3. A system for receiving and feeding cards according to claim 2, in which each of the said upper card retaining devices is provided with a stud, and each of the said reception compartments is provided with a return stop, this stop being disposed so as to hold the stud of the corresponding upper card retaining device and to bring this latter into a holding position when the carriage on which this card retaining device is pivoted is brought to the top of the upper portion of the compartment.

4. A system for receiving and feeding cards, according to claim 1, in which the said driving means of the common carriage consist of two endless roller chains made fast at one point with the said common carriage, each of these chains being on the one hand in mesh with a driving toothed wheel and on the other hand in mesh with

a tensioning pinion, the said toothed wheels being mounted on a common shaft which is disposed beneath and transversely of all the descent tracks and is coupled to an electric motor which can drive in two directions.

5. A system for receiving and feeding cards, according to claim 4, comprising in addition control circuits having a first switch arranged to be operated by the common carriage at the moment when the bearing faces of the lower card retaining devices are in the same plane as the bearing faces of the upper card retaining devices, and a second switch arranged to be operated by the common carriage at the moment when the lower card retaining devices are returned to the normal position at the bottom end of the compartments, the said circuits being so designed that when the first switch is operated they cause the reversal of the direction of rotation of the said motor and consequently the redescent of the said common carriage and, when the second switch is operated, to interrupt the energisation of the motor to stop the movement of the common carriage.

6. In a sorting machine for record cards, which is provided towards its upper part with a feeding and sorting track for the cards, which track is associated with a plurality of card receptacles, which are disposed parallel at a lower level and in a direction perpendicular to the said track, a combined receiving and feeding system for the cards, characterised in that each of the said receptacles comprises an inclined bottom forming a track for the descent of cards, with guide means by which the cards can be stacked, while remaining substantially vertical on a small side, and in that there is provided:

for each of the said receptacles, an upper card retaining device which is able to slide on guide means parallel to the corresponding descent track and which comprises a bearing element extending above the said track in order to receive the sorted cards in an upper portion of the said receptacle,

a common carriage which extends beneath and transversely of all the said descent tracks and is capable of sliding on the guide means, this carriage comprising as many lower card retaining devices as there are receptacles, so that normally each of the said lower card retaining devices is situated at the bottom of the lower portion of the corresponding receptacle,

a motor-operated drive means, which can be made operative for displacing the said carriage in order to bring the said lower card retaining devices to the bottom of the said upper portion of the receptacles and then to bring them automatically to their normal position, and

mechanical coupling means arranged so as to cause the said upper card retaining devices to be displaced in a direction opposite to said carriage, both during the upward movement of the latter and during its redescent movement, the said upper card retaining devices each being pivotable in such a manner that when the bearing faces of the said lower card retaining devices arrive in the same plane as the bearing faces of the said upper card retaining devices, these latter are retracted beneath the said descent tracks, so that the said lower card retaining devices ensure the descent of the stacks of cards towards the bottom of the lower portions of the said card receptacles.

7. A system for receiving and feeding cards, according to claim 6, in which each of the said descent tracks is provided with stop means, and in which each of the said lower card retaining devices comprises two bearing parts, the spacing of which is greater than the width of the bearing element of each of the said upper card retaining devices, each of these latter being pivotally mounted on a sliding support provided with a latch which normally holds the said upper card retaining device in a card-holding position and which engages the said stop means for causing the rocking of the corresponding upper card retaining device.

8. A system for receiving and feeding cards, according to claim 7, in which the said mechanical coupling means comprise, for each card receptacle, an endless cable stretched over two idle pulleys fixed to the frame of the machine, this cable having one run which is fast with the said common carriage, while the other run carries a block, in a position such that during the ascending movement of the said carriage, it engages the said support of the upper card retaining device which it drives downwardly.

9. In a machine for sorting record cards and the like, an apparatus for receiving and feeding cards, said apparatus comprising an elongated card receiving compartment having an inclined bottom forming a card-descent track, an upper card retaining device positioned within the upper portion of said compartment for supporting cards positioned within said compartment upper portion, means mounting said upper card retaining device for gradual descent as cards are fed into said compartment upper portion, a lower card retaining device positioned within the lower portion of said compartment for receiving cards from said upper card retaining device, means mounting said lower card retaining device for ascent from said compartment bottom portion, and transfer means operable to simultaneously move said upper and lower card retaining devices towards one another to a median position and transfer a stack of cards from said upper card retaining device to said lower card retaining device.

10. The machine of claim 9 wherein said transfer means are operable to transfer a stack of cards in a single operation.

11. The machine of claim 9 wherein said transfer means includes means for rendering said upper card retaining device temporarily inoperative to retain cards against downward movement in said compartment.

12. The machine of claim 9 wherein said means mounting said upper card retaining device includes a pivotal mounting allowing pivoting of said upper card retaining device to a position out of the path of card movement within said compartment and latch means normally operative to retain said upper card retaining device in a card supporting position, and said transfer means includes means for rendering said latch means inoperative.

13. The machine of claim 12 together with means for automatically returning said upper card retaining device to an operative and latched position during the return movement of said upper card retaining member towards the upper end of said compartment.

14. The machine of claim 9 wherein said means mounting said upper card retaining device constantly urges said upper card retaining device to an uppermost position, and said upper card retaining device is free to descend selectively due to the weight of cards thereon and the urging of said transfer means.

15. The machine of claim 14 wherein the means effecting the constant urging of said upper card retaining device to an uppermost position is in the form of counterbalance spring means.

16. The machine of claim 9 wherein said machine includes means at the upper end of said compartment for positioning cards in said compartment, and means at the lower end of said compartment for feeding out cards from the bottom of said compartment after being lowered by said lower card retaining device.

17. The machine of claim 9 wherein there are a plurality of said apparatus for receiving and feeding cards including a plurality of said compartments arranged generally in side-by-side adjacent relation, each of said upper card retaining devices being independently operable to descend as cards are fed into the respective compartment, and means interconnecting said lower card retaining devices for simultaneous movement to simultaneously transfer cards from the upper portions of all of said compartments to the lower portions thereof.

18. In a machine for sorting record cards and the like, an apparatus for receiving and feeling cards, said apparatus comprising an elongated card receiving compart-

ment having an inclined bottom forming a card-descent track, a card retaining device positioned within the upper portion of said compartment for supporting cards positioned within said compartment upper portion, means mounting said card retaining device for gradual descent as cards are fed into said compartment upper portion, said mounting means including means mounting said card retaining device for movement to an out-of-the-way position to permit transfer of a supported stack of cards into the lower portion of said compartment, and latch means normally operable to retain said card retaining device in an operative position.

19. The machine of claim **18** together with means for selectively releasing said latch means.

20. The machine of claim **18** together with fixed means for releasing said latch means when said card retaining member reaches a predetermined position within said

compartment, lock means normally preventing release of said latch means, and transfer means operable to move said card retaining device to a position adjacent said fixed means independently of movement of said card retaining device by cards stacked thereon, and said transfer means being operable to release said lock means whereby accidental and premature release of a stack of cards is prevented.

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