United States Patent

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[54] **DRIVE MECHANISM FOR USE WITH INFORMATION CARDS**

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[73] Assignee: **Sony Corporation,** Tokyo, Japan

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[51] **Int. Cl.**.....**G11b 19/02**

[58] **Field of Search** .....340/174.1 C; 235/61.12 M

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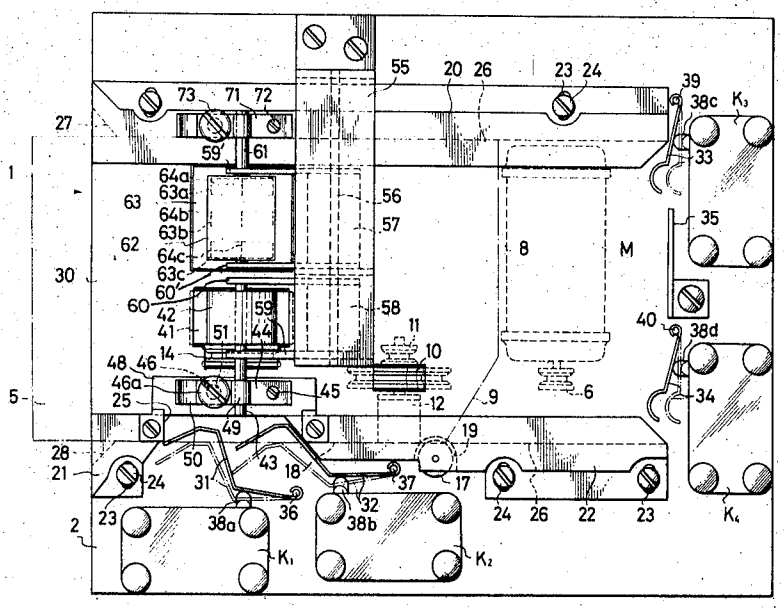
[57] **ABSTRACT**

An information card drive mechanism comprising a pinch roller and a capstan driven by a motor for selectively driving the information card in one of two predetermined directions and at least three switches and an electronic logic circuit for controlling the driving direction of the motor.

7 Claims, 8 Drawing Figures



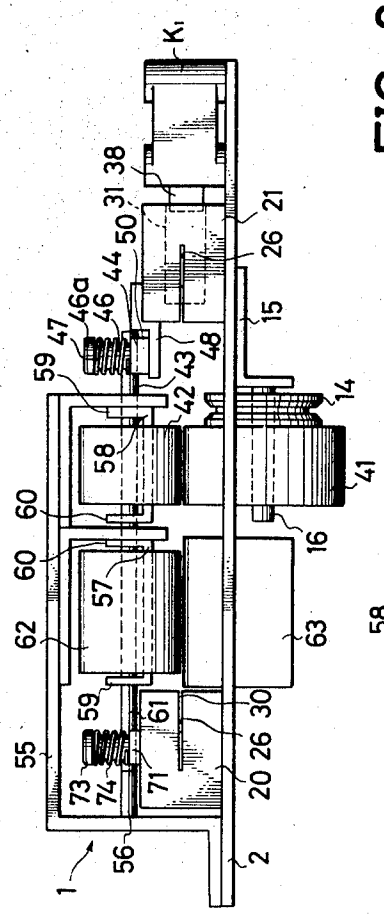


FIG. 1

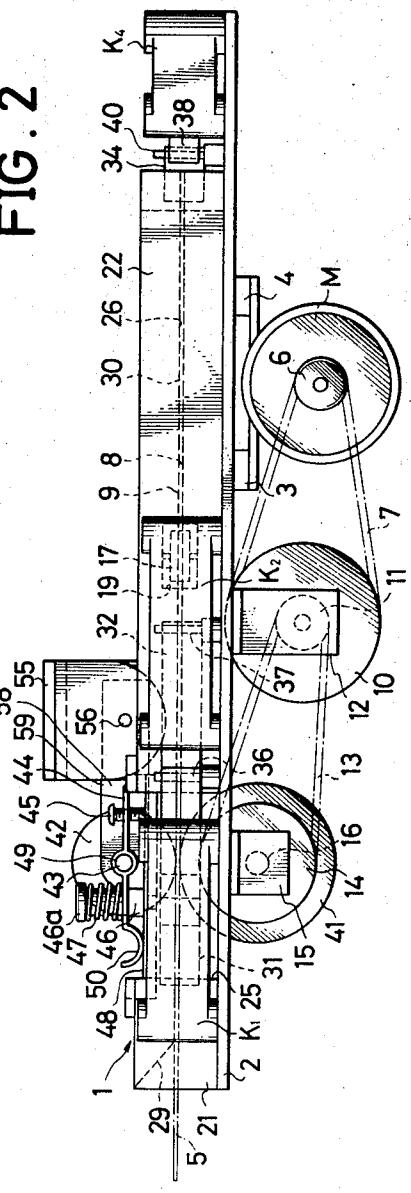


FIG. 2

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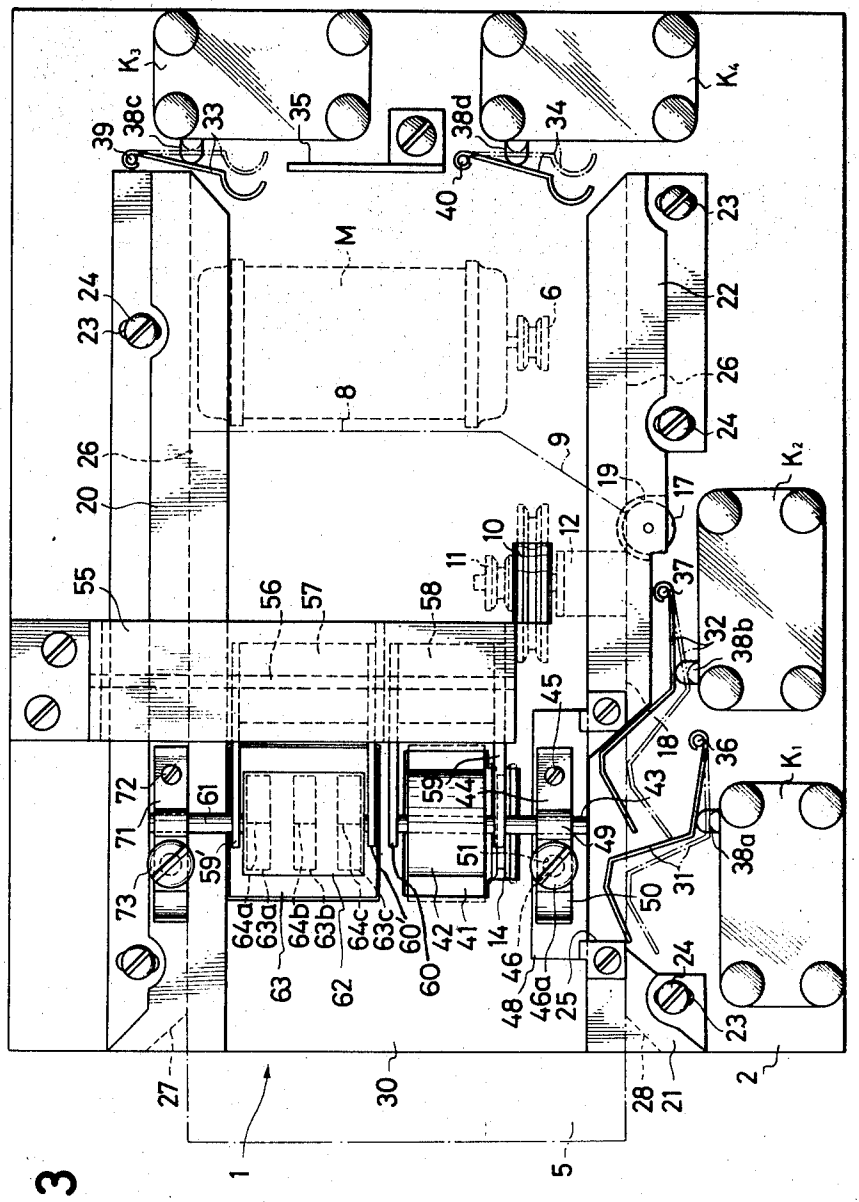

FIG. 3

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FIG. 4

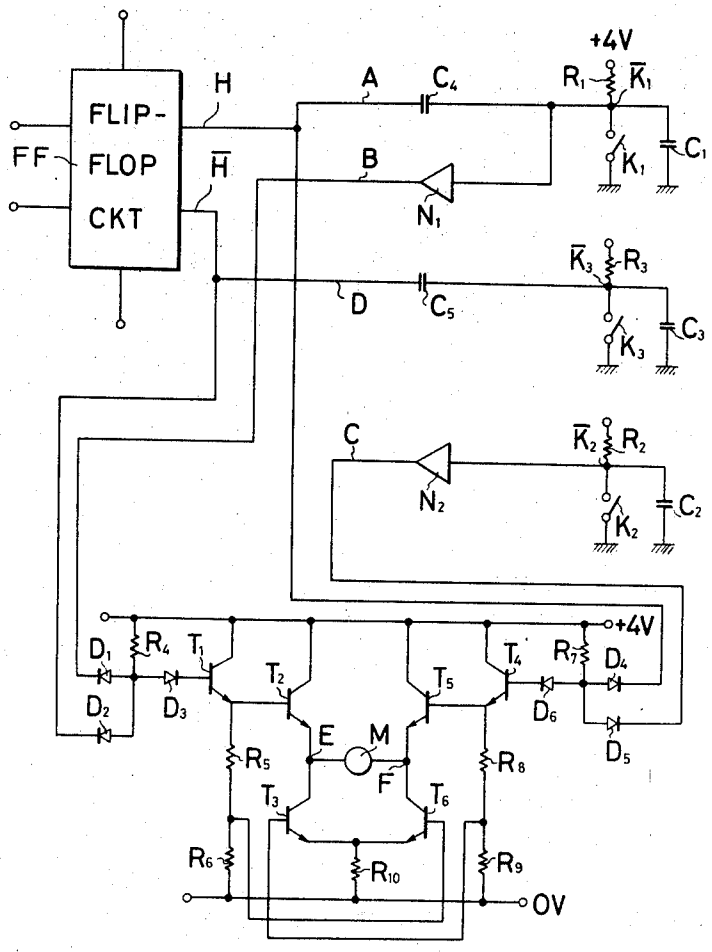

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FIG. 5

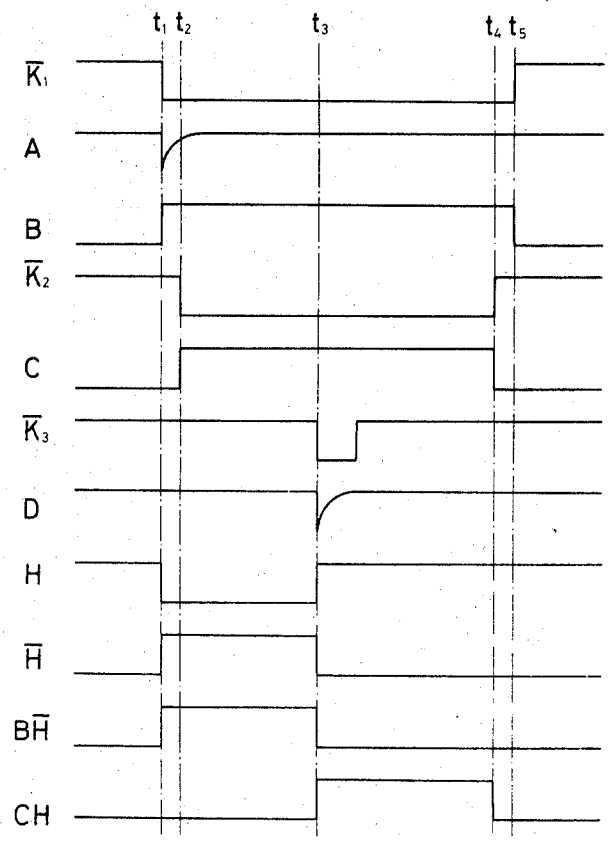

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FIG. 6

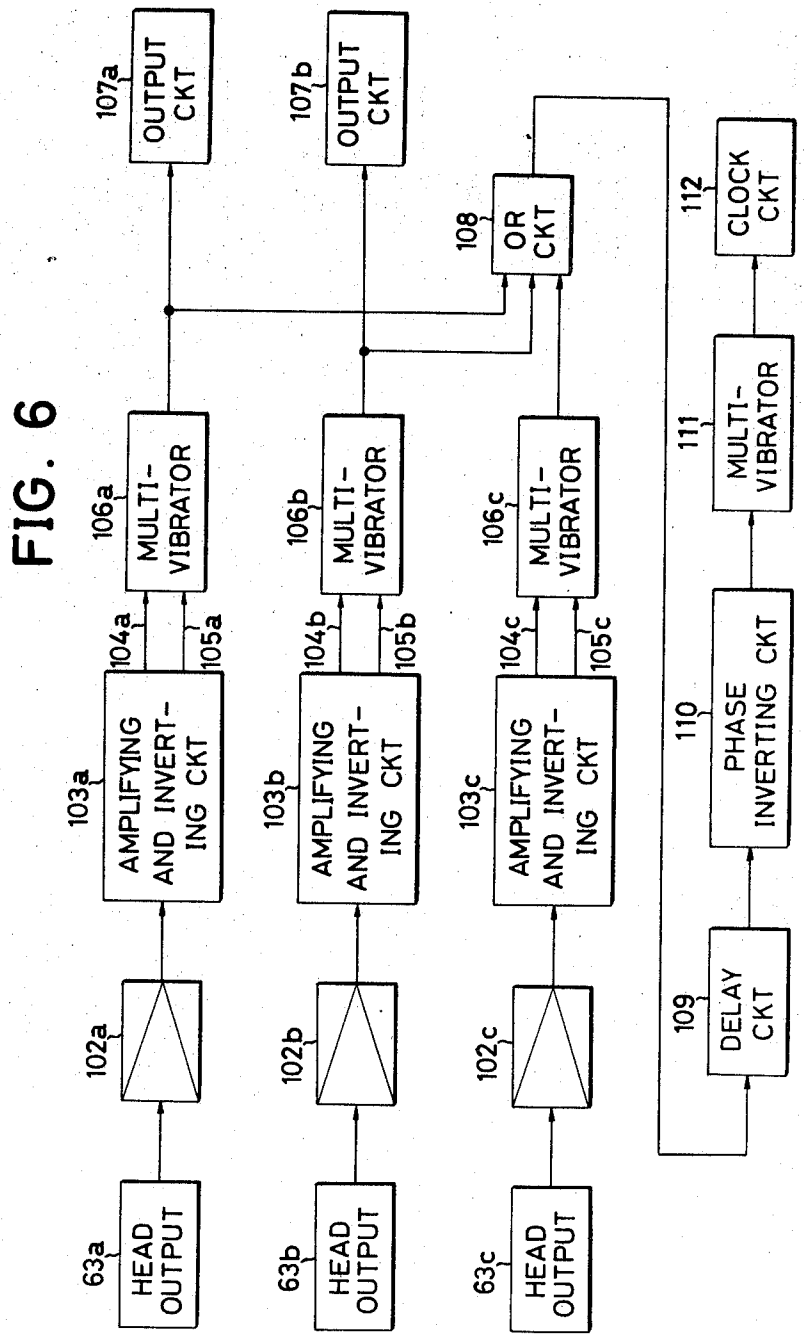

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FIG. 7

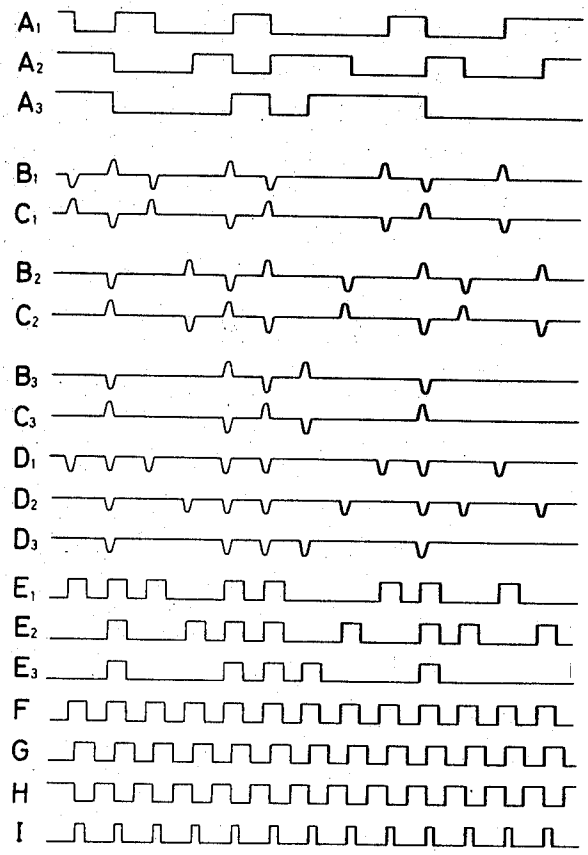
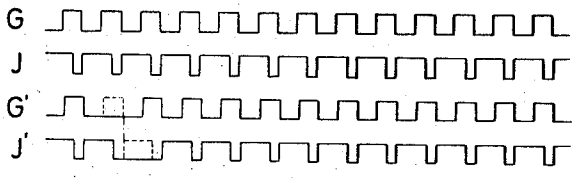


FIG. 8



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DRIVE MECHANISM FOR USE WITH INFORMATION CARDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a drive mechanism for use with information cards, and more particularly to such mechanisms which are automatically controlled by the information card.

2. Description of the Prior Art

In a prior mechanism, the entrance for the information card is generally formed at one end of a straight passage while the exit for the card is at the other end. The information card is passed straight through by the cooperation of a capstan and a pinchroller. While being passed, a magnetic head records information signals on the card or reproduces magnetic information signals that were previously recorded on the card. In this way, the card is passed on to the exit. Since the putting-in position and the taking-out position of the card lie opposite each other, magnetic writing or recording on the card by the operator is difficult.

In another type of card reading mechanism the card is fully inserted in the mechanism by hand and then the card is ejected by the cooperation of a motor driven capstan and a pinchroller. In this type, while the card is being ejected, the head reproduces or records magnetic signals on the card. Before the card is put into the passage, the distance between the capstan and the pinchroller is kept more than the thickness of the card. Following the finish of the insertion of the card, this distance is shortened to pinch the card between the capstan and the pinch roller and in this way the card is ejected. This type of mechanism therefore needs a switching means to switch the capstan-pinchroller spacing. Since it is necessary to put the card in the innermost part of the passage by hand, the card is liable to be damaged. It is also difficult to maintain the travelling speed of the card at a given speed at the time of recording or playback and moreover tracking error as well as error in the angle of tracking are liable to happen because of malfunctions in the variable capstan-pinchroller spacing mechanism.

SUMMARY OF THE INVENTION

The present invention of a drive mechanism for use with information cards comprises a card holding frame, motor driven means for inserting and ejecting the information card into and out of the card holding frame, means for recording or playing back information signals on the information card while it is being driven by the motor driven means, and means responsive to the position of the information card within the card holding frame, including electronic logic means, for controlling the operation of the motor driven means, the electronic logic means being operated by at least three switches mounted on the card holding frame at predetermined locations for contacting the information card.

In one preferred embodiment the motor driven means includes a single motor driven capstan-pinchroller arrangement having a substantially constant, predetermined spacing and exerting a substantially constant gripping force on the card.

Accordingly, it is one object of this invention to provide a drive mechanism for use with information cards

in which all the above described defects of prior art mechanisms have been improved.

It is another object of this invention to provide a drive mechanism for use with information cards in which the information cards are passed into a predetermined position by a drive means and then are taken out by reversing the drive means from the position.

It is a further object of this invention to provide a drive mechanism for use with information cards in which the forward and reverse operation of the information cards is automatically done.

It is still a further object of this invention to provide a drive mechanism for use with information cards in which the position of the information cards under driving condition is controlled and the tracking error between the transducer and the card information track is substantially eliminated.

It is further object of this invention to provide a drive mechanism for use with information cards in which the pressure between the capstan and the pinch roller driving the information cards can easily be controlled.

These and further objects, features and advantages of this invention will be more readily apparent upon reading the following detailed descriptions of certain preferred embodiments of the invention which are to be read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of one embodiment of the invention;

FIG. 2 is a right side view of the apparatus shown in FIG. 1;

FIG. 3 is a plan view of the apparatus shown in FIG. 1;

FIG. 4 is a circuit diagram of the circuit driving the motor of the apparatus shown in FIG. 1;

FIG. 5 is a graphical representation of the output signal waveforms obtained at various points in the circuit diagram shown in FIG. 4;

FIG. 6 is a block diagram of one embodiment of a reproducing system employed in this invention;

FIG. 7 is a graphical representation of the signal waveforms obtained at various points in the block diagram shown in FIG. 6; and

FIG. 8 is a graphical representation of the signal waveforms employed to explain a detecting system in the embodiment in FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 – 3, mounted on the upper surface of a setting plate 2 of the writing and/or reading apparatus are guide rails 20 and the interrupted guide rail 21/22 extending parallel and spaced apart from each other along the longitudinal axis of the setting plate 2. These rails are mounted by screws 24 threaded in the setting plate 2 and passing through oblong holes 23 in the rails so that the rails are adjustable to either the left or right direction as view in FIG. 3. On the inner sides of these rails 20 and 21/22 are formed longitudinal slits 26 whose height is almost equal to or slightly more than the thickness of an information card or magnetic card 5, for instance 0.1 – 0.5 mm. The depths of the innermost part of these slits 26 are such as to accommodate

the width of the magnetic card **5**, for instance 5.5 cm approximately. Thus if the magnetic card **5** is inserted into these slits **26**, a front end **8** of the magnetic card **5** will pass a predetermined locus, namely a passage **30**, guided by the slits **26**. On the front ends of slits **26** of guide rails **20** and **21** (the left ends as viewed in FIG. 3) are formed side expansion portions **27** and **28** and upper expansion portions **29** respectively and these expansion portions make it easy to put the card **5** into the passage **30**. The length of these guide rails **20** and **21/22** can be longer by two to three times the length of the card **5**, for instance about 9.0 cm. The card **5** may be made, for example, using Mylar as a base material with its upper surface having a magnetic substance layer formed thereon and its lower surface is painted.

On the outer side of the guide rail **22** a recessed portion **19** is formed extending to the slit **26**. An elastic roller **17**, made of rubber or the like, is pivoted rotatably in the recessed portion **19**. Since the end of the inner side of this roller **17** extends slightly into the slit **26**, the roller **17** presses elastically upon the side **18** of the card **5** as it passes through the passage **30** and thereby reduces tracking error between the record/playback head **63** and the card **5**.

A space **25** is formed between the rails **21** and **22** near the front end of the passage **30**. The free ends of pivoted levers **31** and **32**, which actuate a drive-starting micro switch K_1 and a drive-suspension micro switch K_2, respectively, extend into the passage **30** from the space **25**. The other ends of these levers **31** and **32** are pivotably fitted on the setting plate **2** by pins **36** and **37**, respectively. Movement of these levers **31** and **32** to the anticlockwise direction as shown in FIG. **3**, actuates the switches K_1 and K_2, respectively, by striking projecting switch buttons **38***a* and **38***b*, respectively.

Near the blind end of the passage **30** a drive-controlling micro switch K_3 and a ready-for-writing micro switch K_4 are respectively fitted on the setting plate **2**. The ends of a pair of actuating levers **33** and **34** are pivotably fitted on the setting plate **2** by pins **39** and **40**, respectively, adjacent the switches K_3 and K_4, respectively. Movement of these levers **33** and **34** to the anticlockwise direction as shown in FIG. **3** causes them to depress the actuating portions **38***c* and **38***d* of switches K_3 and K_4, respectively. The other ends of levers **33** and **34** extend into the passage **30** from the blind end. Between the levers **33** and **34** is provided a plate-shaped stopper **35** fixed on the setting plate **2** by screws. This stopper **35** controls the final stopping position of the front end **8** of the card **5**.

A D.C. motor M is fixed on the bosses **3** and **4** formed on the underside of the setting plate. A belt **7** engages a motor pulley **6** of the motor M and an intermediate pulley **10** of large diameter that is p pivotably fitted on the setting plate **2** through a plate **12**. The pulley **10** is moulded as a single unit with an intermediate pulley **11** of smaller diameter. A belt **13** engages pulley **11** and also engages a pulley **14** pivotably fitted on the setting plate **2** through an adaptor plate **15**.

On a shaft **16** of the pulley **14** is fixed a capstan **41** provided with a rubber coated surface, or the like. Directly above this capstan **41**, as viewed in FIGS. **1** and **2**, a pinch roller **42**, having a rubber coated surface or the like, which is mounted by a shaft **43** in a pair of arms **59** and **60** formed on the front end of a U-shaped supporting lever **58**. The rear end of this lever **58** is pivoted by a shaft **56** supported at both ends by a U-shaped plate **55** fitted on the setting plate **2**.

The shaft **43** is so arranged that the vertical position of the pinch roller **42** can be controlled by a pressure adjusting means consisting of a control lever **44**, a screw **45**, a projecting rod **46** and a coil spring **47**. One end of the shaft **43** is inserted into a piping portion **49** formed at an intermediate portion of the control lever **44**. An arcshaped front end portion **50** of the lever **44** is placed on a supporting plate **48** fixed by screws to the guide rails **21** and **22**. A hole **51** formed in the lever **44** between the front end portion **50** and the piping portion **49** is penetrated by the projecting rod **46** with its lower end being fixed on the supporting plate **48**. A repulsion coil spring **47** carried by the projected rod **46** exists between the suspension portion **46***a* formed on the upper end of the projected rod **46** and the lever **44**. This arrangement elastically presses the front end portion **50** of the lever **44** against the supporting plate **48**. A screw **45** is threaded in the rear end of the lever **44**. The lower end of the screw **45** is pressed upon the supporting plate **48** because of the repulsion strength of the spring **47**. By turning the screw **45** in and out, therefore, the lever **44** is caused to move toward either the anticlockwise or the clockwise direction as viewed in FIG. **2**, making the front end portion **50** a fulcrum. By this movement, one end of the shaft **43** is caused to be depressed or raised. Because the shaft **43** is supported by a pair of arms **59** and **60** of the pivoted supporting lever **58**, both ends of the shaft **43** depress or raise together, thereby keeping the shaft **43** horizontal.

As the pinch roller **42** is depressed or raised with the shaft **43**, the distance or pressing strength between the capstan **41** and the pinch roller **42** accordingly changes. By adjustment of the screw **45**, the distance or pressing strength can be adjusted at will. In order to prevent the rubber of the pressed portions of the capstan and the pinch roller from getting fatigued while the operation of the apparatus is suspended, the capstan-pinch roller spacing is preferably kept greater than zero and more preferably between one-fifth to one-third of the thickness of the card **5**, for instance 20μ to 200μ. Of course this spacing lies in the passage **30** and is coplanar with the slits **26** of the guide rails **20** – **22**.

The setting plate **2** is fitted with three magnetic heads **63***a*, **63***b* and **63***c* for magnetic recording and reproducing and the whole of these three heads is designated as the head assembly **63**. Above this head assembly **63**, as viewed in FIGS. **1** and **2**, a pressure roller **62** is provided having a surface coating layer consisting of rubber or the like. The roller **62** is supported on a shaft **61** mounted between a pair of arms **59'** and **60'** formed at the front end portion of a U-shaped supporting lever **57**. The rear end portion of this lever **57** is pivotably supported by the supporting shaft **56**. The vertical position of the shaft **61** is controlled in a manner similar to the control of the shaft **43** by a pressure adjusting means comprising an elastically biased control lever **71**, a screw **72** threaded in one end of the lever **71**, a projecting rod **73** and a coil spring **74** fitted over the rod **73** to elastically bias the lever **71** downwardly as viewed in FIG. **1**. The lever **71** is pipe-formed at its midsection to receive one end of the shaft **61**. Since the shaft **61** is mounted in the pivoted bracket **57**, both

ends of the shaft are raised and lowered simultaneously.

The distance or pressing strength between the pressure roller **62** and the gap portions **64***a*, **64***b* and **64***c* of the respective heads **63***a*, **63***b* and **63***c* can be regulated at will by screwing the screw **72** in or out. This distance is desirably the same as that between the capstan **41** and the pinch roller **42** and, as in the latter case, it is coplanar with the slits **26** of the rails **20** – **22**.

When using the apparatus **1**, the magnetic card **5** is first inserted in the slits **26** of guide rails **20** and **21** from the front end of the passage **30**. Upon its insertion, the front end **8** of the card **5** touches the actuating lever **31** to move it to the anticlockwise direction, as viewed in FIG. **3**, whereby the drive-starting switch K_1 turns "on." As shown in further detail hereinafter, this causes the motor M to start running in the forward travelling direction of the card **5**. The rotation of the motor shaft is transmitted to the capstan **41** through the motor pulley **6**, the belt **7**, the intermediate pulleys **10** and **11**, the belt **13**, the pulley **14** and the shaft **16** respectively whereby the capstan **41** starts turning in the forward travelling direction of card **5**.

When the card **5** reaches the small gap between the pinch roller **42** and the capstan **41**, whose thickness is less than that of the card **5**, the pinch roller **42** holds the card **5** jointly with the capstan **41**. By the cooperation of capstan **41** and pinch roller **42**, the card **5** is sent into the passage **30** in a forward direction, i.e., to the right as viewed in FIG. **3**. The card **5** is likewise put into a small gap between the pressure roller **62** and the gap portion **64***a* – **64***c* of the heads **63***a* – **63***c* whereby the card **5** is pressed in the gap portion **64** by the roller **62** by means of repulsion strength of the spring **74**.

As the card **5** moves forward in the slits **26**, the front end **8** of the card **5** touches on the actuating lever **32** to move it to the anticlockwise direction, as viewed in FIG. **3**. The drive-suspension switch K_2 is then turned on but, as described in greater detail later, the motor M keeps on running in the forward travelling direction whereby the card **5** keeps on travelling in the forward direction.

As the card **5** travels forward, and shortly before the front end **8** of the card **5** is about to touch the plate stopper **35**, the front end **8** presses the actuating lever **33** to move it to the anticlockwise direction, as viewed in FIG. **3**, whereby the drive-controlling switch K_3 is turned on. On the corner of the front end **8** of the card **5** a notch portion **9** is formed to prevent erasing by mistake. The notch portion **9** can easily be formed, when found necessary, by a mere cutting of a corner of the front end of the rectangular card **5**. If the notch portion **9** is not formed, the front end **8** of the card **5** presses the actuating lever **34** to move it to the anticlockwise direction as shown in FIG. **3** whereby the ready-for-writing switch K_4 is turned on almost simultaneously with the switch K_3. When the switches K_3 and K_4 turn on, the magnetic record reproducing circuit, including the magnetic heads **63**, will be switched into a magnetic recording state. When only the switch K_3 turns on, the circuit turns into a magnetic reproducing or reading state.

When the switch K_3 turns on, as detailed later, the motor M is switched to start rotating in the reverse travelling direction of the card **5**. The capstan **41** is thereby caused to start rotating in the opposite direction, i.e., the reverse travelling direction of the card **5** whereby the card **5** starts reverse travelling almost simultaneously as its front end **8** touches the plate stopper **35**. During the reverse travelling, the card **5** is magnetically read or recorded on in accordance with the existence or nonexistence of the notch portion **9**. The pressure roller **62** presses the card **5** effectively on the gap portions **64***a* – **64***c* of the heads **63***a* – **63***c* in order that the magnetic recording or playback operations can be accomplished accurately.

As the card reverse travels the right side end **18** of the card **5** releases the actuating lever **32** whereby the switch K_2 is turned "off." When the switch K_2 is turned off, the motor M suspends its operation, as detailed later, and the magnetic recording and reproducing circuit turns into a non-actuating state.

In this non-actuating state, the front end **8** of the card **5** is pressed between the capstan **41** and the pinch roller **42** and between the head assembly **63** and the pressure roller **62** respectively by the repulsion strength of the springs **47** and **74**. The card **5** can thereafter simply be removed by hand from the passage **30** whereby the actuating lever **31** is freed from the pressure of the right side **18** of the card **5** and returns to its original position. The switch K_1 is then turned off and the whole mechanism returns to its original state.

Next a description will be made of the electronic logic circuit for driving the motor M, with particular reference to FIGS. **4** and **5**.

Each of the switches K_1, K_2 and K_3 is connected in parallel with a separate capacitor C_1, C_2 and C_3, respectively, to the circuit ground and in series with a separate resistor R_1, R_2 and R_3, respectively, to a positive voltage source such as +4V as illustrated in FIG. **4**.

The junction of the resistor R_1, the switch K_1 and the capacitor C_1 is connected through a capacitor C_4 and along a line A to an input H of a flip-flop circuit FF. The line A is also connected to the cathode terminal of a diode D_4. The junction is also connected through an inverter N_1 to a line B which is connected to the cathode terminal of a diode D_1. The junction of the resistor R_2, the capacitor C_2 and the switch K_2 is connected through an inverted N_2 to a line C which is connected to the cathode terminal of a diode D_5. The junction of the resistor R_3, the capacitor C_3 and the switch K_3 is connected through a capacitor C_5 to a line D which is connected to the input H of the flip-flop circuit FF. The line D is also connected to the cathode terminal of a diode D_2.

The diodes D_1 and D_2 have their anodes connected to the anode of a diode D_3 and effectively constitute an AND gate. The anode of the diode D_3 is also connected through a resistor R_4 to a positive voltage source +4V. The cathode electrode of the diode D_3 is connected to the base electrode of an NPN transistor T_1. The collector electrode of the transistor T is connected to the positive voltage source +4V and its emitter electrode is connected to the base electrode of an NPN transistor T_2.

A resistor R_5 is connected from the base of the transistor T_2 and in series with a resistor R_6 to the negative terminal of the voltage supply. The collector electrode of the transistor T_2 is connected to the positive voltage source +4V and its emitter electrode is con-

nected to a terminal E of the motor M and to the collector electrode of an NPN transistor T_3. The emitter electrode of the transistor T_3 is connected to the emitter electrode of an NPN transistor T_6 and in series with a resistor R_{10} to a negative terminal of the voltage supply. The collector electrode of the transistor T_6 is connected to a terminal F of the motor M and to the emitter electrode of an NPN transistor T_5.

The collector electrode of the transistor T_5 is connected to the positive voltage source +4V. The base electrode of the transistor T_5 is connected to the emitter electrode of an NPN transistor T_4 and in series with the resistors R_8 and R_9 to the negative terminal of the voltage source. The base electrode of the transistor T_6 is connected to the junction of the resistors B_5 and R_6 and the base electrode of the transistor T_3 is connected to the junction of the resistors R_8 and R_9.

The base electrode of the transistor T_4 is connected to the cathode electrode of the diode D_6. The anode of the diode D_6 is connected in series with a resistor R_7 to the positive voltage source +4V. The anode of the diode D_6 is also connected to the anodes of the diodes D_4 and D_5 which effectively constitute a second AND gate.

In the original state, i.e., when the switches K_1, K_2 and K_3 are off, the respective potentials $\overline{K_1}$, $\overline{K_2}$ and $\overline{K_3}$ between the resistors R_1, R_2 and R_3 and the switches K_1, K_2 and K_3 are in a positive state prior to the time t_1 at which the switch K_1 turns on, so that the outputs B and C of the inverter circuits N_1 and N_2 are zero while diodes D_1 and D_5 are on. The output H of one of the pair of input-output terminals of the flip-flop circuit FF is positive while the output $\overline{H}$ of the other terminal is zero whereby the diodes D_4 and D_2 are turned off and on, respectively.

When the diodes D_1 and D_2 are on, the diode D_3 is off so that the transistors T_1, T_2 and T_6 are all off. As stated above, when the diodes D_4 and D_5 are off and on respectively, the diode D_6 is off so that the transistors T_4, T_5 and T_3 are all off. When the transistors T_2, T_3, T_5 and T_6 are off, no current is supplied to the motor M and therefore the motor M is stopped.

When the drive-starting switch K_1 is turned on at time t_1 the potential of the intermediate point $\overline{K_1}$ between the resistor R_1 and the switch K_1 comes down to zero as shown in FIG. 5 and stays in this state until time t_5 when the switch K_1 is turned off. When the potential of the point $\overline{K_1}$ is reduced to zero in this way, the output B of the inverter circuit N_1 raises up as shown in FIG. 5 and the diode D_1 will be turned off by being reverse biased. The output A in FIG. 5 is differentiated by the condenser C_4 and is added to the input-output terminal H of the flip-flop circuit FF whereby the outputs of the pair of input-output terminals H and $\overline{H}$ are inverted, as shown in FIG. 5. The $\overline{H}$ output then rises up and the diode D_2 is turned off by being reverse biased. As the H output is reduced to zero, the diode D_4 is turned on. When both diodes D_1 and D_2 are turned off, the diode D_3 is turned on because it is forward biased. The turning on of diode D_3 also turns on the transistors T_1, T_2 and T_6. As the diodes D_4 and D_5 both turn on as aforesaid, the diode D_6 will turn off and the transistors T_4, T_5 and T_3 will turn off whereby the motor current is supplied by the series circuit of:

the plus terminal of the power source - the transistor T_2 - motor M - transistor T_6 - common emitter resistance R_{10} - and the minus terminal of the power source (earth).

As the current flows from one terminal E to the other terminal F of the motor M, the motor M runs in its normal, forward direction.

At time t_2, the drive-suspension switch K_2 is turned on and the potential of the intermediate point $\overline{K_2}$ between the resistor R_2 and the switch K_2, as shown in FIG. 5, comes down to zero. This state of $\overline{K_2}$ will remain until time t_4 when the switch K_2 is turned off. When the potential of point $\overline{K_2}$ comes down to zero, the output C of the inverter circuit N_2 will rise up as shown in FIG. 5 and the diode D_5 will be turned off by being reverse biased. Since the diode D_4 is still on, the diode D_6 will remain off and, as the result, the motor M will keep on running in the forward direction.

At a time t_3, the drive-controlling switch K_3 is turned on temporarily, and the potential of the intermediate point $\overline{K_3}$ between the resistor R_3 and the switch K_3 will be temporarily reduced to zero. Because of this, the output D in FIG. 5, which is the change in potential of $\overline{K_3}$ differentiated by the condenser C_5, is added to the other input-output terminal $\overline{H}$ of the flip-flop circuit FF and the outputs of the pair of input-output terminals H and $\overline{H}$ of the circuit FF are again inverted. With this inversion the output of the terminal H rises up, thereby reverse biasing the diode D_4 and turning it off, and the $\overline{H}$ output becomes zero, to forward bias the diode D_2 and turn it on.

As stated above, when either or both of the diodes D_1 and D_2 turn on, the diode D_3 will turn off and the transistors T_1, T_2 and T_6 will turn off. When the diodes D_4 and D_5 both turn off, the diode D_6 will turn on whereby the transistors T_4, T_5 and T_3 will turn on. When the transistors T_2 and T_6 both turn off and the transistors T_3 and T_5 both turn on, the current will be supplied to the motor M by the circuit of:

plus terminal of power source - transistor T_5 - motor M - transistor T_3 - common emitter resistor R_{10} - minus terminal of power source (earth).

As the current flows from the terminal F to the terminal E of the motor M, the motor M runs in the opposite direction, i.e., in a reverse direction.

At time t_4, the drive-suspension switch K_2 is turned off and the potential of $\overline{K_2}$ rises so that the output C of the inverter circuit N_2 will become zero. This causes the diode D_5 to be forward biased and therefore turned on and the diode D_6 to be turned off. When the diodes D_3 and D_6 are both turned off, the motor M will suspend motion as in the situation prior to time t_1.

At time t_5, the drive-starting switch K_1 is turned off and the potential of $\overline{K_1}$ will rise. By this rise, the output B of the inverter circuit N_1 becomes zero, and the diode D_1 is turned on by being forward biased. At this point the whole mechanism is returned to its original state.

$\overline{BH}$ and CH in FIG. 5 show the outputs of diodes D_3 and D_4 respectively. FIG. 4 shows the preferred embodiment where a semiconductor switch was employed but in other embodiments a relay contact may also be employed in place of the semiconductor switch.

Up to now the description has only been as to the driving of the information card. With reference now particularly to FIG. 6 a description of the reproducing

of information signals recorded on the information card will be made next. The recording of information signals on the information card is made at the option of the operator under the reverse travelling condition of the card and a detailed description of the recording will be omitted.

The heads **63***a* and **63***b* pass information signals while the head **63***c* passes check signals. The check signals are combined electronically with the information signals and are used for detecting to see if a correct recording has been made on one of the two information tracks on the card. The information signals are recorded on two tracts of the information card while the check signals are recorded on a third track.

The respective information signals and check signal are designated by reference letters A_1, A_2 and A_3, respectively, in FIG. **7** as reproduced by the heads **63***a*, **63***b* and **63***c*, respectively, as shown in FIG. **6**. The reproduced output signals are respectively amplified by amplifiers **102***a*, **102***b* and **102***c* are each further amplified by the amplifying and phase inverting circuits **103***a*, **103***b* and **103***c*, respectively, to produce the outputs designated as B_1, B_2 and B_3, respectively, in FIG. **7** on channels **104***a*, **104***b* and **104***c*, respectively. The signals C_1, C_2 and C_3, which represent the phase-inverted form of the signals B_1, B_2 and B_3 are produced by the circuits **103***a*, **103***b* and **103***c* on their output channels **105***a*, **105***b* and **105***c*, respectively. These phase-inverted signals are obtained by taking the phase-reversed voltage from, for example, the emitter and collector of an amplifying transistor.

The negative going pulses are extracted from the output waveforms B_1, B_2 and B_3 and their inverted waveforms C_1, C_2 and C_3 by the monostable multivibrator circuits **106***a*, **106***b*, and **106***c* connected to the output channels **104***a*–*105a*, **104***b*–**105***b* and **104***c*–**105***c*, respectively. For example, the pulse train D_1 is derived from the output waveform B_1 and its inverted waveform C_1 while the pulse train D_2 is derived from the head output waveform B_2 and its inverted waveform C_2 and the pulse train D_3 is derived from the head output waveform B_3 and its inverted waveform C_3. And these pulses are added to the monostable multivibrator.

The output waveforms of the multivibrator circuits **106***a*, **106***b* and **106***c* are E_1, E_2 and E_3 respectively as seen in FIG. **7**. The output waveforms E_1 and E_2 correspond to the signals detected from the information signal tracks and the signals E_1 and E_2 are fed to the output circuits **107***a* and **107***b*, respectively, which process or otherwise utilize the signals.

The output waveforms E_1 and E_2 are also added, together with the signal E_3, to an OR circuit **108** from which an OR output waveform F is obtained. In the waveform F, a train of pulses is formed in which a pulse is generated at predetermined intervals on each bit. Because the rise portion of each pulse of the OR output waveform F is of the same phase as that of the output waveforms E_1, E_2 and E_3 of the monostable multivibrators **106***a*, **106***b* and **106***c*, it is not suitable for a clock pulse.

The output of the OR circuit **108** is further added to a delay circuit **109** so that its output waveform G is slightly delayed as compared with the OR output waveform F. The output waveform G is suitable for use as a clock pulse. However, in this embodiment the output waveform G of the delay circuit **109** is further added to a phase inverting circuit **110** to produce a phase-inverted waveform H from the waveform G. The output H is used to trigger a monostable multivibrator **111**. A clock pulse waveform I is formed by the monostable multivibrator **111**. The clock pulse waveform I is added to the clock pulse circuit **112**.

In the above described system the clock signals are generated without specially providing an independent track to record the clock signals on the magnetic recording medium. A circuit for detecting dropout of the clock is pulse shown in FIG. **8**. The output waveform G of the delay circuit **109** in FIG. **7**, functioning as clock pulses, in employed. With the fall portion of the pulses in the waveform G the monostable multivibrator **111** is triggered to form an output waveform J'. The existence of the waveforms G and J can be ascertained by the passing of these waveforms. If there is a dropout of the signals, there is at first a portion where the pulse doesn't generate the waveforms G' of delay circuit **109**. As the result, a pulse will not be generated in the output waveforms J' of the monostable multivibrator triggered by the fall portion of the waveforms G' whereby the dropout will be detected by the circuit **108** and in accordance with this detection it is possible to give a warning or to suspend the functioning of the apparatus.

Although illustrative embodiments of this invention have been described in detail above with reference to the accompanying drawings, it is to be understood that this invention is not limited to these precise embodiments and that various changes and modifications may be effected therein by one skilled in art without departing from the scope or spirit of the invention.

What is claimed is:

1. A drive mechanism for use with an information card reading and recording system comprising a chassis, a pair of parallel guide rails mounted on the chassis for guiding both edges of an information card, a stop member mounted on the chassis, the guide rails and the stop member together defining a passage having an open end and a blind end to receive the information card, drive means for selectively driving the information card in a forward direction into the passage and in a reverse direction out of the passage, the drive means including a motor, a capstan mechanically driven by the motor and rotatably mounted between the guide rails and immediately adjacent to the passage, and a pinch roller, means for resiliently supporting the pinch roller in a parallel, spaced-apart relationship with the capstan to define a substantially uniform space therebetween through which the information card is drawn by the co-operative rotation of the capstan and the pinch roller, a magnetic transducer for selectively recording information on the card and reproducing information from the card, the magnetic transducer being mounted immediately adjacent to the passage, bias means for depressing the information card into contact with the magnetic transducer, the bias means including a pressure roller and means for resiliently and rotatably mounting the pressure roller on the chassis in a parallel, spaced-apart relationship with the magnetic transducer, the space between the pressure roller and the magnetic transducer, the space between the cap-

stan and the pinch roller, and the guide rail slits all being coplanar with each other, drive control means including first switch means responsive to the insertion of the information card into the passage and being provided immediately adjacent to the passage and between the open end of the passage and the drive means for actuating the drive means to drive the information card in the forward direction, second switch means responsive to the movement of the information card in the passage and located at the blind end of the passage for reversing the driving direction of the drive means when the information card reaches the blind end of the passage, third switch means responsive to movement of the information card in the passage and located immediately adjacent the passage and between the drive means and the blind end of the passage for deactivating the drive means when the information card is at a predetermined position in the passage during its travel in the reverse direction whereby a portion of the information card is thereafter resiliently gripped between the capstan and the pinch roller, and fourth switch means located at the blind end of the passage and responsive to the movement of a select portion of the information card for activating the magnetic transducer to record information on the card during the card's travel in the reverse direction after the fourth switch means has contacted the select portion of the card at the end of the card's forward travel and for deactivating the recording function of the magnetic transducer during the card's travel in the reverse direction in the absence of the select portion of the card.

2. A drive mechanism for use with an information card reading and recording system comprising a chassis, a pair of parallel guide rails mounted on the chassis for guiding both edges of an information card, a stop member mounted on the chassis, the guide rails and the stop member together defining a passage having an open end and a blind end to receive the information card, drive means for selectively driving the information card in a forward direction into the passage and in a reverse direction out of the passage, the drive means including a motor, a capstan mechanically driven by the motor and rotatably mounted immediately adjacent to the passage, and a pinch roller, means for resiliently supporting the pinch roller in a parallel, spaced-apart relationship with the capstan to define a substantially uniform space therebetween through which the information card is drawn by the co-operative rotation of the capstan and the pinch roller and to exert a substantially constant, uniform pressure on the information card after its insertion into the passage and before its removal therefrom, a magnetic transducer mounted immediately adjacent to the passage, bias means for depressing the information card into contact with the magnetic transducer, the bias means including a pressure roller and means for resiliently and rotatably mounting the pressure roller on the chassis in a parallel, spaced-apart relationship with the magnetic transducer, drive control means including first switch means responsive to the insertion of the information card into the passage and being provided immediately adjacent to the passage and between the open end of the passage and the drive means for actuating the drive means to drive the information card in the forward direction, second switch means responsive to the movement of the information card in the passage and located at the blind end of the passage for reversing the driving direction of the drive means when the information card reaches the blind end of the passage, and third switch means responsive to movement of the information card in the passage and located immediately adjacent the passage and between the drive means and the blind end of the passage for deactivating the drive means when the information card is at a predetermined position in the passage during its travel in the reverse direction whereby a portion of the information card is thereafter resiliently gripped between the capstan and the pinch roller.

3. A drive mechanism as recited in claim 2 wherein the first, second and third switch means comprise first, second and third normally open switches, respectively, which are closed upon contact of a sufficient force with the information card, and the drive control means includes electronic logic means for activating the motor in the forward and reverse directions and for stopping the motor, the electronic logic means including an electronic bistable circuit having at least first and second input/output leads for producing two separate, continuous output signals which are inverted with respect to each other, the bistable circuit inverting both of its output signals upon the selective application of a signal pulse to either of its first and second input/output leads, an electronic reversing switch having first and second control inputs for supplying current in a forward direction to the motor when a control signal is supplied to the first control input and for supplying current to the motor in a reverse direction when a control signal is supplied to the second control input, a first AND gate having its output connected to the first control input and one of its inputs connected to the second input/output lead of the bistable circuit, a second AND gate having its output connected to the second control input and one of its inputs connected to the first input/output lead of the bistable circuit, means responsive to the closing of the first switch for supplying a signal pulse of relatively short duration upon the initial closing of the first switch to the first input/output lead of the bistable circuit and for supplying a continuous control signal to the other input of the first AND gate as long as the first switch is closed, means responsive to the closing of the third switch for supplying a pulse of a relatively short duration to the second input/output lead of the bistable circuit upon the initial closing of the third switch, and means responsive to the closing of the second switch for supplying a continuous control signal to the other input of the second AND gate as long as the second switch is closed.

4. A drive mechanism as recited in claim 2 wherein the guide rails each have a longitudinal slit for receiving the information card, the slits being parallel to each other.

5. A drive mechanism as recited in claim 4 wherein one of the rails has a hollow indentation which extends into the slit in the one rail and further including an elastic roller and means for rotatably mounting the roller on the chassis such that it rotates about an axis perpendicular to the longitudinal axes of the slits and extends into the indentation to contact the information card and regulate the position of the information card in a direction perpendicular to the direction of travel of the information card.

6. A drive mechanism as recited in claim 2 wherein the pressure roller and the pinch roller are each provided with separate, adjustable means for regulating the pressure which they assert against the information card.

7. A drive mechanism according to claim 6, wherein the pressure regulating means of the pinch roller comprises a lever arm having one end pivoted on one of the rails, a shaft having one end fitted in a recess in the lever arm, the pinch roller being rotatably supported by the shaft, means for pivotably mounting both ends of the shaft on the chassis, and adjustable means for resiliently pressing a free end of the lever arm toward the one rail in order to bias the pinch roller toward the capstan.

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