

Sept. 6, 1966

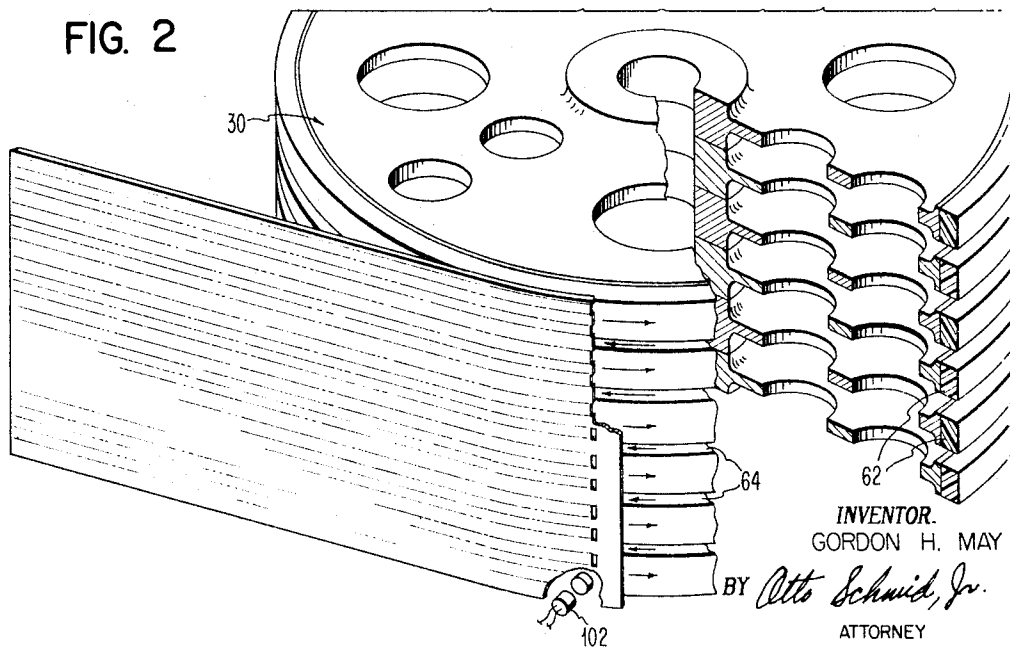
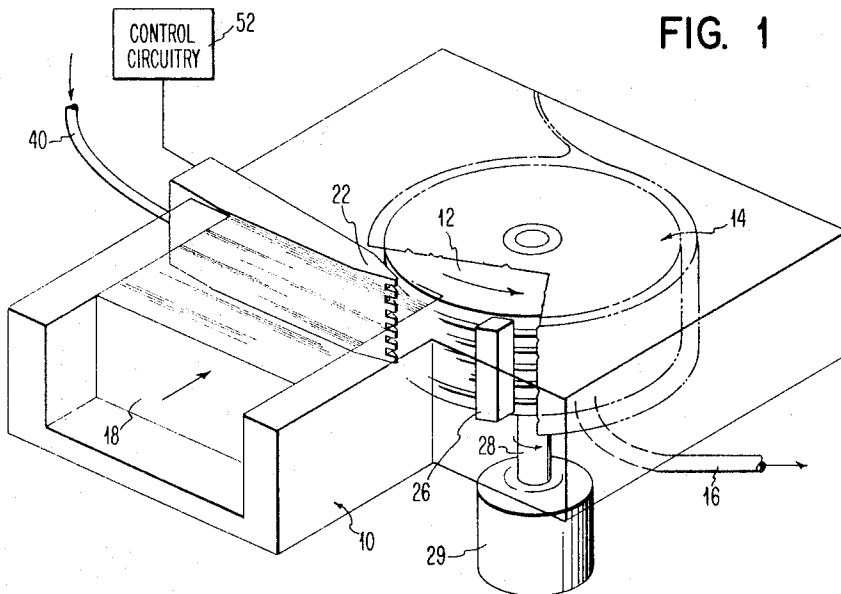
G. H. MAY

3,271,024

HIGH SPEED CARD FEED

Filed Dec. 23, 1963

3 Sheets-Sheet 1



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HIGH SPEED CARD FEED

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3 Sheets-Sheet 2

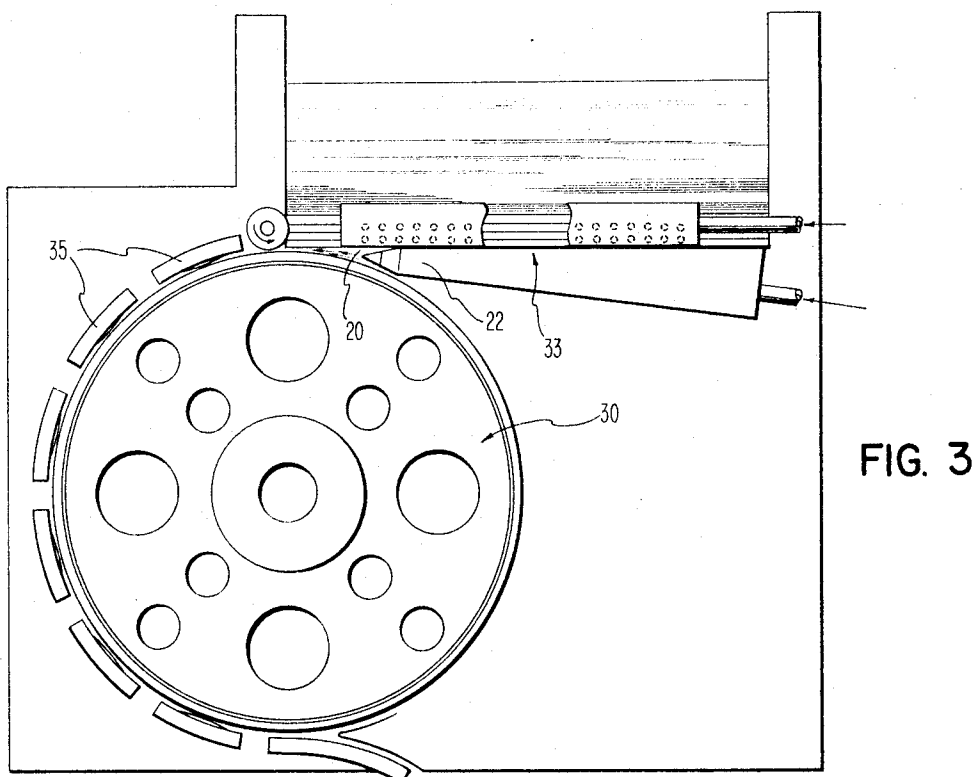


FIG. 3

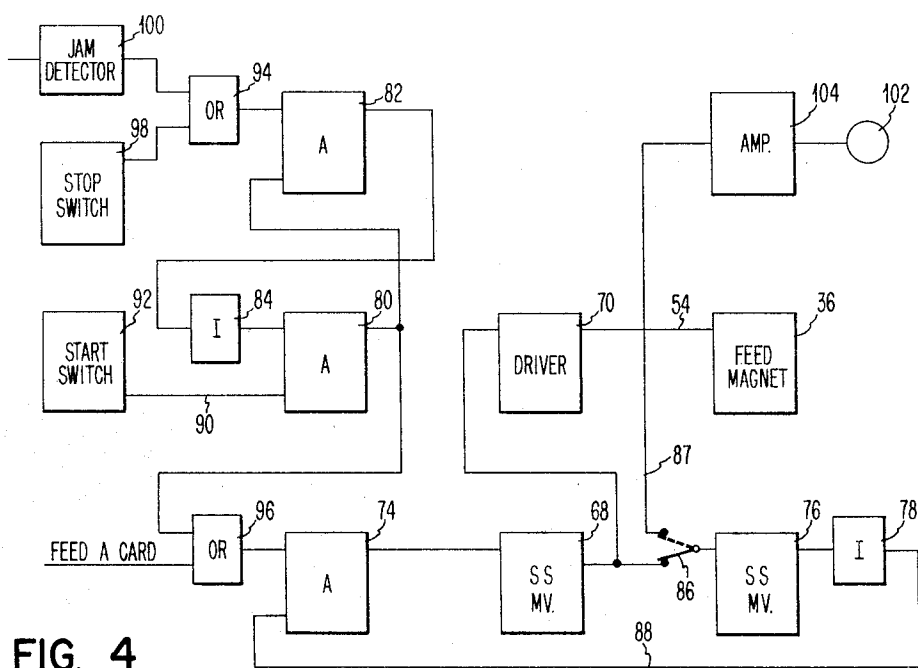


FIG. 4

Sept. 6, 1966

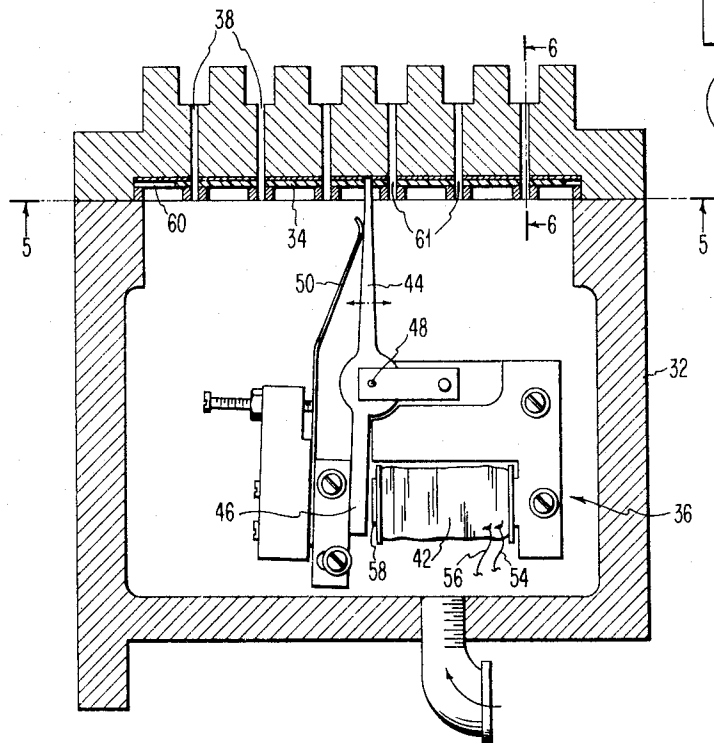
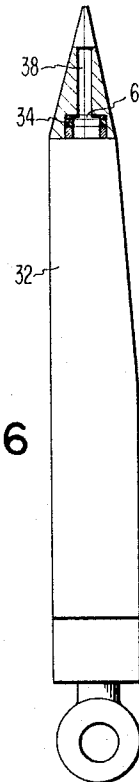
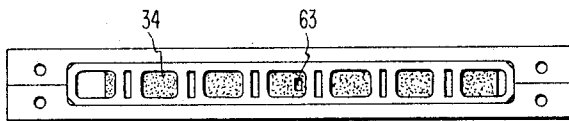
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3 Sheets-Sheet 3



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3,271,024

HIGH SPEED CARD FEED

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11 Claims. (Cl. 271-27)

This invention relates to a sheet feeding device and, more particularly, to a device for feeding record cards at high speed.

Previous attempts to increase the rate of feeding record cards have resulted in various vacuum-assisted feeding means. Feeding speeds have been further increased by applying a progressively greater vacuum force for a progressively smaller period of time. However, this technique for increasing the feeding rate is limited due to the record cards being held together by the vacuum force acting through the data holes. It has also been found that even in the case of record cards with no data holes, due to the porous nature of the cards, high vacuum forces act through the cards to pull several cards together. This action makes the card feeding unreliable since the cards may jam and fail to feed, or the cards may be fed at an irregular rate. An attempt has been made to solve this problem by using a nonporous card material, such as Mylar film for example, but this card does not possess all the advantages of the standard record card. It is therefore an object of this invention to provide a record card feeding means for selectively feeding record cards from a hopper at a high feeding rate.

It is another object of this invention to provide a high speed card feed wherein the feeding is controlled by selectively forming an air bearing between a feeding means and the record card.

It is a further object of this invention to provide a feeding means for selectively feeding a single card at high speed on signal from an associated data processing system.

It is a still further object of this invention to provide a high speed card feed for continuously feeding cards with constant spacing.

According to the invention, a record card feeding means is provided for selectively feeding record cards at high speed from a hopper by means of a vacuum force acting to pull the record cards toward contact with a frictional feeding means. A high velocity stream of fluid is directed to overcome the vacuum force so that a fluid bearing is provided between the feeding means and the record card. Selective control is provided by interrupting the fluid stream so that the vacuum force pulls the record card into contact with the frictional feeding means, and a card is fed thereby.

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

FIG. 1 is a diagrammatic, schematic view of a record card feeding means embodying the invention.

FIG. 2 is a perspective view, partly in broken section, of the card feeding means of FIG. 3.

FIG. 3 is a top view, partially in section, of a specific embodiment of the record card feeding means of FIG. 1.

FIG. 4 is a schematic block diagram of the electronic control circuitry for the record card feeding means of FIG. 1.

FIG. 5 is a sectional view of the feeding control means taken along lines 5-5 of FIG. 7.

FIG. 6 is a top view, partially in section, of the feeding control means of FIG. 7.

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FIG. 7 is a side view, partially in section, of the feeding control means of FIG. 1.

Referring to the drawings, there is shown a record card feeding means for feeding record cards from a hopper 10 comprising a rotating feeding means 12 which is disposed within an airtight enclosure 14. Vacuum producing means (not shown) are coupled to vacuum line 16 to produce a partial vacuum within the enclosure 14. A plurality of record cards 18 are stacked in feeding position within the hopper, and an end portion 20 of the hopper is open so that feeding means 12 is adjacent the end of the record card in the hopper. The vacuum force from enclosure 14 acting through the feeding means 12 and the atmospheric pressure acting through end portion 20 of the hopper combine to move the bottom record card toward the feeding means 12. A feeding control means 22 is provided to feed a high velocity stream of fluid between the feeding means 12 and the end of the record card. This stream of fluid functions to create a fluid bearing between the feeding means and the record card so that the vacuum force is overcome and the record card is not fed. Control means 24 are provided to selectively block the fluid feeding means 22 for a predetermined time so that the vacuum force pulls the record card into contact with the feeding means 12 and the record card is fed past a processing station 26 along a card path to a utilization device. This operation produces the additional advantage that the high velocity stream of fluid also pulls the card close to the surface of the feeding means so that warped cards are more easily fed. It should be understood that the presence of the high velocity fluid between the feeding surface and the record card not only creates an air bearing but also holds the record card in close proximity to the feeding surface due to the reduction in pressure created by the high velocity fluid, i.e., the Bernoulli effect. The provision of a means for exerting a large pressure on the stack of cards is thereby eliminated since the cards are pulled up to a position close to the feeding means by the high velocity stream of fluid. The only record card follower required is one to maintain the cards in an upright position.

An embodiment of the high speed card feed comprising the invention is shown in FIG. 1. The feeding means comprises a drive roll 30 which is mounted for rotation about axis 28 by drive motor 29. The drive roll is mounted so that the periphery of the roll is adjacent to opening 20 in the bedplate of hopper 10. Drive roll 30 is mounted within airtight enclosure 14. Drive roll 30 is constructed so that the vacuum is actuatable through portions of the drive roll, as will be described later, so that the vacuum acting through the openings in the drive roll and the atmospheric pressure outside tends to move the record card into contact with the drive roll so that the card will be driven by frictional engagement with the drive roll along a card path comprising the drive roll and suitable card guide means 35 to a utilization device. Card guide means 35 comprises a series of shoes having spring biased portions to keep the record cards in engagement with the drive roll so that the card is driven by frictional contact with the drive roll. However, as explained above, the vacuum level necessary for very high speed feeding acts on several cards at a time so that unreliable feeding results. The control means to selectively control the feeding of cards from the hopper to the utilization device comprises a means for applying a high velocity stream of air to the periphery of the drive roll at the point where the drive roll approaches the record card.

Electronic control circuitry 52 is provided to selectively control the feeding of the high velocity stream of air and thereby control the feeding of the cards. In the embodiment shown, the control means comprises a nozzle assembly by which six separate streams of air are formed. The streams of air are controlled by a slider valve means

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which is selectively actuatable by an electromagnetic device 36. The nozzle assembly 32 comprises an airtight enclosure having six output ports 38 through which air is ejected at high velocity when the slider valve member 34 is open. Air is transmitted to the enclosure from a suitable pump means (not shown) by means of a pipe 40. The fluid for the nozzle assembly may have a pressure in the range of 5 to 10 p.s.i. For the embodiment shown, air at 8 p.s.i. and approximately 1½ c.f.m. has been found adequate. If desired, the vacuum force (approximately 40 inches of water) for the card feeding means and the fluid for the feeding control means and the separating means may be generated from a fan within an enclosure along with suitable regulating means for the vacuum and fluid pressure levels. The inlet for pipe 40 is located adjacent the operating coil 42 of electromagnet 36 so that the air will provide a cooling source for the coil to prevent overheating within the enclosed chamber.

The slider valve member 34 is actuated by an extension 44 of the armature 46 of the electromagnet 36. Armature 46 is pivotably mounted at point 48, and when the electromagnet is de-energized the armature is biased by spring 50 to a position whereby arm extension 44 is to the right (FIG. 7) and the slider valve 34 is open. To close slider valve 34 so that no air is forced out of ports 38, electromagnet 36 is energized by a suitable electric signal from the control circuitry 52 over lines 54. Line 56 may be coupled to a reference potential, such as ground, to complete the circuit. This action pulls the armature down into contact with the pole pieces 58 and extension arm 44 moves to the left (FIG. 7) against the bias of spring 50, thereby closing shutter valve 34 so that no air moves through ports 38. Slider valve 34 comprises an elongated flat member mounted for transverse sliding movement within a recess 60 of the nozzle assembly housing. The member 34 has six openings 61 which mate with ports 38 and an additional hole 63 into which extension arm 44 is mounted. The slider valve is made of any suitable material which is light in weight so that the inertia is minimized, and also a material that can be accurately machined to the desired tolerance. One suitable material is a nylon which is suitable for bearing applications and is impregnated with graphite, such as that sold under the trade name of Nylatron for example.

The drive roll 30 functions to frictionally engage the record card to move the card along the card path. A roll 31, which is turning in the opposite direction from drive roll 30, is provided to prevent feeding of more than one card at a time. The distance between roll 31 and roll 30 is set greater than the thickness of one record card but less than the thickness of two cards. A separating means may be used as a further aid to separating the cards near the feeding end of the hopper. The separating means comprises a series of small nozzles 33 which are mounted to direct a continuous stream of air toward the edges of the cards in the hopper so that separation of the cards is facilitated. The frictional surface is provided by the outer driving portions 62 of the roll. Driving portions 62 may be made of any suitable frictional material, and a polyurethane material having a 60-65 durometer surface hardness has been found suitable for this purpose. A polyurethane material having a 90 durometer surface hardness has been found suitable for reverse roll 31.

In the embodiment shown, drive roll 30 comprises six driving portions 62, each of which spans the area covered by two rows of data hole positions. This spacing insures sufficient contact surface between the card and the roll so that the cards will not be damaged by the sudden contact of the drive roll. The stream of air from ports 38 is directed to the midpoint of driving surfaces 62, and this point is aligned with the area between two rows of data hole positions. Thus, the maximum effect of the air is realized since the air is directed to that area of the card in which no data holes are punched. Five vacuum producing areas are provided in the drive roll, and these areas

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are between the six driving portions 62 of the roll. The vacuum force on the roll is produced by the partial vacuum inside enclosure 14 working through the drive portions of the wheel. The vacuum areas are aligned with the portion of the record card between two lines of data hole positions. Thus, the result is that by proper choice of the vacuum level and the air pressure level in the control means, a control can be established whereby positive feeding of the cards results from application of an electrical control pulse to electromagnet 36 which controls the slider valve.

The electrical control circuit 52 comprises means for controlling the feeding of cards in three different modes. The first mode of operation is the feeding of cards one at a time in response to an external signal, such as a signal from an associated data processing system for example. A second mode of operation comprises feeding the cards continuously at a selected rate. The third mode of operation comprises feeding the cards continuously with a predetermined spacing between cards.

To feed cards selectively on a single cycle basis, there is provided an external signal, such as the signal FEED A CARD from an electronic data processing system for example. The signal is coupled through OR circuit 96 as one input of AND circuit 74. The other input from AND circuit 74 is provided by the output on line 88 through inverter 78 from a single shot multivibrator 76, and this inverted output is normally up so that AND circuit 74 is conditioned. The output of AND circuit 74 is coupled to energize a single shot multivibrator 68, and the output of single shot multivibrator 68 is coupled to a suitable driver circuit 70 to produce an electronic control pulse on line 54. The output on line 54 is coupled to energize the magnet 36 to thereby cause a card to be fed from the hopper along the card path to the utilization device. The period of single shot multivibrator 68 is chosen to set the card feeding rate since this circuit determines the time that feed magnet 36 is energized. For example, for a 4,000 cards-per-minute feeding rate, a time of 15 milliseconds is provided for each card feed cycle. This is typically utilized by choosing a period of 7 milliseconds for the period for feeding air from ports 38. The feed magnet 36 pick time is 1.5 milliseconds, and the period of single shot multivibrator 68 is chosen as 6.5 milliseconds so that air from ports 38 is cut off for this period, and a card is fed. The signal FEED A CARD is then down so that AND circuit 74 will then be deconditioned, and no further cards are fed until another signal is received. However, to prevent a second FEED A CARD signal from being acted upon before the first card has been fed, single shot multivibrator 76 is actuated through switch 86 to generate an output through inverter 78 on line 88. This output deconditions AND circuit 74 for the duration of the output of single shot multivibrator 76. It can thus be seen that the minimum time between card feed cycles is set by the period of the output of single shot multivibrator 76.

To feed cards continuously, a START line 90 is brought up on the machine by any suitable means, such as a pushbutton switch 92 for example. This output provides one input to AND circuit 80. The output of AND circuit 82 is coupled through inverter 84 to the other input of AND circuit 80. Thus, when the START signal is present and OR circuit 94 is not conditioned, AND circuit 80 is conditioned so that an output is coupled through OR circuit 96 to condition AND circuit 74. The operation is then similar to that described above for single cycle operation with the exception that the card feeding operation will be continuous. This occurs because AND circuit 74 is sequentially conditioned as soon as the output from single shot multivibrator 76 goes down after feeding the previous card so long as AND circuit 80 remains conditioned. An output from a STOP control 98, such as a pushbutton switch or an output from jam detection device 100, energizes OR circuit 94 and thereby deconditions AND circuits 74, 80, 82.

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In some instances it may be desirable to feed cards with constant spacing between the cards. The first card is fed as stated above; however, switch 86 which connects the output of single shot multivibrator 68 to the input of single shot multivibrator 76 is moved to the dotted position (FIG. 2). Switch 86 is a double pole switch which in the embodiment shown comprises a control panel switch controlled by the machine operator. A sensing means 102, such as a solar cell and light, is provided to sense the trailing edge of the first card, and this output is amplified in amplifier 104 and coupled by line 87 to the input of single shot multivibrator 76. The output duration of single shot multivibrator 76 is set so that the desired spacing between cards is achieved, and this output is coupled to condition AND circuit 74 so that another feed cycle is initiated. Thus, it can be seen that the cards are fed continuously with the intercard spacing determined by the period of single shot multivibrator 76. To stop the feeding of the cards, a STOP signal generates a signal through OR circuit 94 as before to decondition AND circuits 74, 80, 82 and prevents the feeding of additional cards.

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

What is claimed is:

1. A record card feeding means for feeding record cards from a hopper, comprising:
 - a feeding means disposed adjacent a record card in said hopper;
 - means for producing a vacuum force on the periphery of said feeding means adjacent said record card;
 - means for directing a high velocity stream of fluid to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
2. A record card feeding means for feeding record cards from a hopper, comprising:
 - a feeding means disposed adjacent a record card in said hopper;
 - means for producing a vacuum force on the periphery of said feeding means adjacent a first predetermined portion of said record card;
 - means for directing a high velocity stream of fluid to a second predetermined portion of said record card to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
3. A record card feeding means for feeding record cards from a hopper, comprising:
 - a rotatable feeding means having a frictional surface disposed adjacent a record card in said hopper;
 - means for producing a vacuum force on the periphery of said feeding means adjacent said record card;
 - means for directing a high velocity stream of fluid to a predetermined portion of said record card to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force;
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said frictional surface of said feeding means to feed said record card.
4. A record card feeding means for feeding record cards from a hopper, comprising:
 - a rotatable feeding means having a frictional surface disposed adjacent a record card in said hopper;

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- means for producing a vacuum force on the periphery of said feeding means adjacent said record card;
 - means for directing a high velocity stream of fluid to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force;
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card from the hopper; and
 - card guiding means positioned to keep said card in contact with said frictional surface whereby the record card is fed along a predetermined card path.
5. A record card feeding means for feeding record cards from a hopper, comprising:
 - hopper means for maintaining the record cards in stacked relationship in a first position;
 - a feeding means disposed adjacent a record card in said hopper;
 - means for producing a vacuum force on the periphery of said feeding means adjacent said record card;
 - means for directing a high velocity stream of fluid to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force and for moving the lowermost record card to a second position closer to said feeding means; and
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
 6. A record card feeding means for feeding record cards from a hopper, comprising:
 - a hopper having a card exit portion;
 - a rotatable feeding means having a frictional surface disposed adjacent a record card exit portion of said hopper;
 - means for producing a vacuum force in a plurality of positions on the periphery of said feeding means adjacent said record card;
 - means for directing a plurality of high velocity streams of fluid between said record card and said feeding means in said record card exit portion of said hopper to pull said record card into close proximity to the feeding means and to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
 7. A record card feeding means for feeding record cards from a hopper, comprising:
 - hopper means comprising a record card exit portion for maintaining the record cards in stacked relationship with the leading end of a card in said record card exit portion of said hopper;
 - a rotatable feeding means disposed adjacent said leading end of the record cards in said hopper;
 - means for producing a vacuum force on the periphery of said feeding means adjacent said record cards;
 - means for directing a high velocity stream of fluid from the trailing end of said record card toward said leading end of said record card to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
 - means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
 8. A record card feeding means for feeding record cards from a hopper, comprising:
 - a hopper means comprising a record card exit portion;
 - a rotatable feeding means disposed adjacent a record card exit portion of said hopper;
 - means for producing a vacuum force on the periphery of said feeding means so that the record card in said

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- card exit portion of said hopper means tends to be moved into contact with said feeding means responsive to said vacuum force;
- means for directing a high velocity stream of fluid between said record card and said feeding means in said card exit portion of said hopper means to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
- means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
9. A record card feeding means for feeding record cards from a hopper, comprising:
- hopper means having a record card exit portion;
- a rotatable feeding means disposed adjacent a record card exit portion of said hopper;
- means for producing a substantially airtight enclosure about said feeding means;
- means for producing a vacuum in said enclosure, said vacuum force operable through said card exit portion of said hopper means to pull said record card toward said feeding means;
- means for directing a high velocity stream of fluid between said record card and said feeding means to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force; and
- means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card.
10. A record card feeding means for feeding record cards from a hopper, comprising:
- hopper means having a record card exit portion;
- a rotatable feeding means having a frictional surface disposed adjacent a record card in said hopper;
- a substantially airtight enclosure about said feeding means;
- means for producing a vacuum force within said enclosure, said vacuum force operable through said card exit portion of said hopper means to pull said record card toward said feeding means;
- means for directing a high velocity stream of fluid between said record card and said feeding means in said record card exit portion of said hopper means to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force;
- means for selectively interrupting said high velocity fluid stream so that said vacuum means pulls said record card to said feeding means to feed said record card from said hopper means; and

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- card guiding means positioned to keep said record card in contact with said frictional surface of said feeding means whereby the record card is fed along a predetermined card path.
11. A record card feeding means for feeding record cards from a hopper, comprising:
- hopper means comprising a record card exit portion;
- a rotatable feeding means having a frictional surface disposed adjacent a record card in said hopper;
- a substantially airtight enclosure about said feeding means;
- means for producing a vacuum force within said enclosure, said vacuum force operable through predetermined portions of said feeding means adjacent said record card exit portion of said hopper means to pull said record cards toward said feeding means;
- means for directing a plurality of high velocity streams of fluid between said record card and said feeding means in said record card exit portion of said hopper means to pull said record card into close proximity to said feeding means and to create a fluid bearing adjacent to said feeding means for overcoming said vacuum force;
- electrically operated valve means for selectively interrupting said plurality of high velocity fluid streams so that said vacuum means pulls said record card to said frictional surface of said feeding means to feed said record card from said hopper means; and
- card guiding means positioned to keep said record card in contact with said frictional surface of said feeding means whereby the record card is fed along a predetermined card path.

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