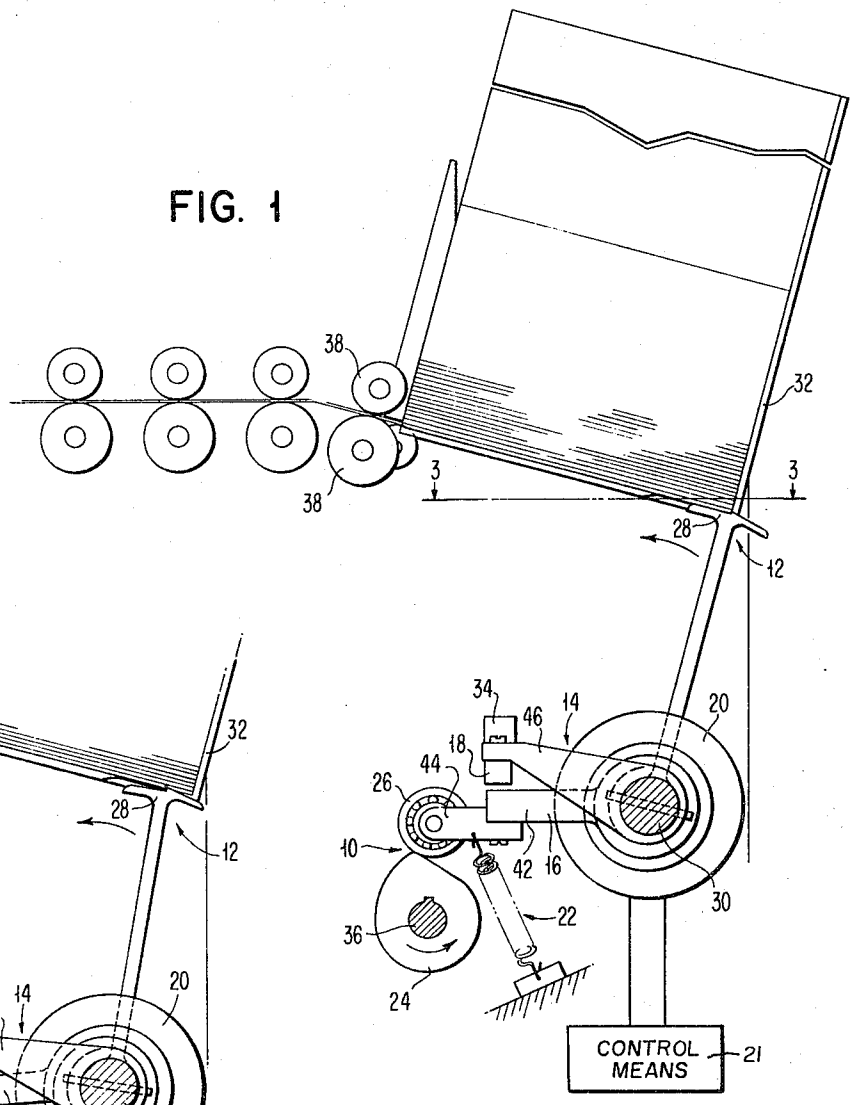
May 14, 1968 E. A. BROWN 3,383,106

RECORD CARD FEEDING CONTROL APPARATUS

Filed Nov. 17, 1966 2 Sheets-Sheet 1

FIG. 1



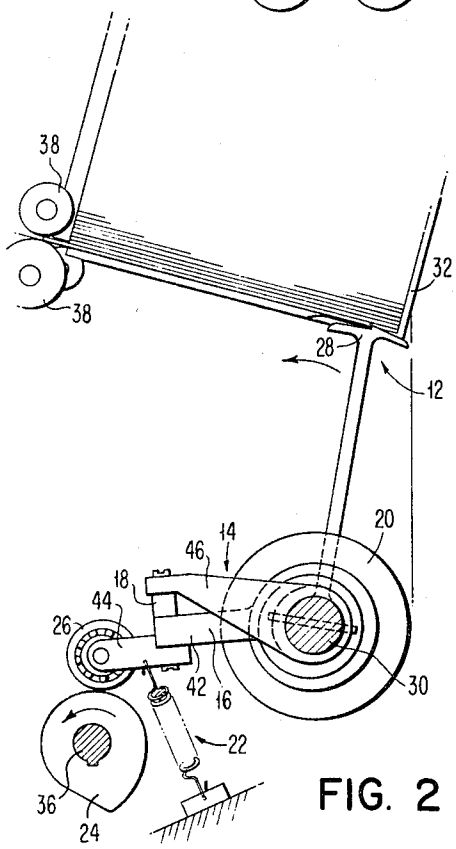


FIG. 2

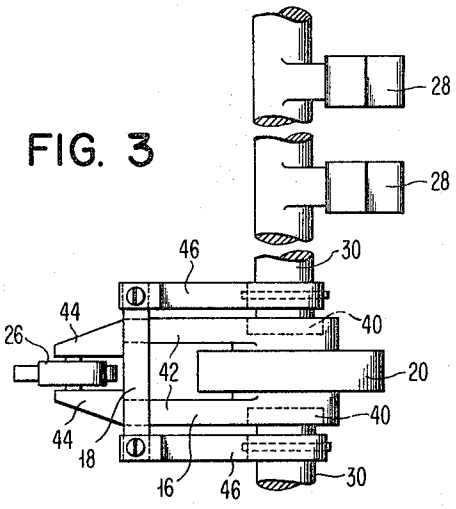
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RECORD CARD FEEDING CONTROL APPARATUS

Filed Nov. 17, 1966 2 Sheets-Sheet 2

FIG. 3



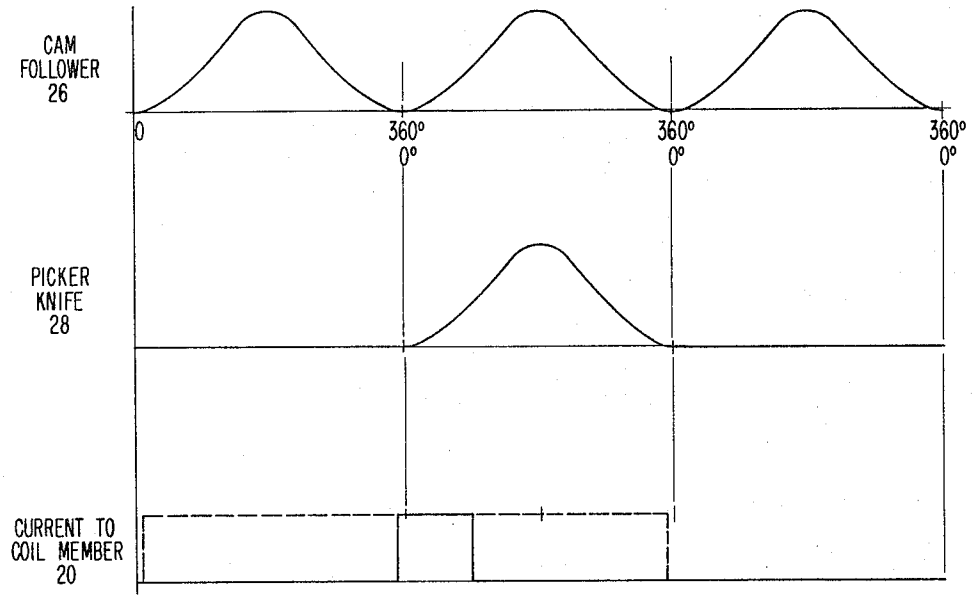


FIG. 4

United States Patent Office 3,383,106 Patented May 14, 1968

3,383,106

RECORD CARD FEEDING CONTROL APPARATUS

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ABSTRACT OF THE DISCLOSURE

A cam is continuously driven to produce a cyclic control motion in a magnetic core member which is attached to an associated cam follower. A device to be actuated, such as a card feeding picker knife, is mounted on a shaft and the magnetic core member is mounted for movement about the shaft. A coil member is also mounted on the shaft in a position to produce, when energized, a magnetic coupling between the core member and an armature member. The armature member is pinned to the shaft and is held in position by non-ferrogmagnetic means so that the device to be actuated is in an initial position. Energization of the coil produces a magnetic coupling when the cam next moves the core member adjacent the armature member to produce a cycle of operation of the device to be actuated.

This invention relates to record card feeding apparatus and more particularly to selectively actuable record card feed control apparatus.

The present invention is particularly applicable to record card feeds used in record card input/output machines operating on line in a data processing system; however, the use is not so limited. Prior art card feeds use picker knife clutches as a means to engage and disengage the operation of the picker knife to provide the facility for selectively feeding a card. Mechanical latches operated by an electromagnet have been used with a spring coupling between the picker knife cam follower and the cam shaft. The disadvantage of this latch mechanism is that some latching clearance must be provided so that on each idle cycle of the cam shaft the picker knives oscillate to the extent of this clearance which may eventually feed an unwanted card. One solution to this problem has been achieved by the use of an electromagnet mounted to retain the picker knives in their feed-ready position. To feed a card the current to the magnet is interrupted and the picker knives move forward under control of the cam. Although this mechanism solves the problem of the latching clearance producing undesired card feeds, this mechanism has an additional disadvantage that, under certain power failure conditions an unwanted card may be fed. It is, therefore, the major object of this invention to provide a card feed control mechanism which produces the combined advantages of the prior art control mechanisms without any of the attendant disadvantages.

It is another object of this invention to provide a card feed control mechanism having great reliability.

It is another object of this invention to provide a low inertial card feed mechanism that is operable at high speeds which utilizes a spring to provide the force to actuate the mechanism.

It is a further object of this invention to provide a card feed control mechanism wherein electrical control can be energized at any point in a cycle, but the control is not effective until the proper point in the mechanical cycle.

It is still a further object of this invention to provide a card feed control mechanism wherein the least possible lead time for a selection decision is needed.

It is another object of this invention to provide a card feed control mechanism controlled by a magnetic control means having no fixed relationship between the coil, the core and the armature thereof.

Briefly, according to the invention, the card feeding control means comprises a card feeding means and a magnetic control means comprising a core member, an armature member and a coil member, the relative positions of which are controlled by a cyclic control means. The armature member is coupled to the card feeding means. When the magnetic control means is energized the armature member is coupled to the core member by the force of magnetic attraction at a certain point in its cyclic motion and means are provided to drive the card feeding means to feed a card under control of the cyclic control means.

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.

FIGURE 1 is a left side view of a record card feeding apparatus embodying the invention, wherein the card feeding apparatus is in the feed-ready position.

FIGURE 2 is a left side view of the record card feeding apparatus embodying the invention in a card feeding position.

FIGURE 3 is a section view taken along lines 3—3 of FIGURE 1.

FIGURE 4 is a timing diagram showing relative times at which various components of the record card feeding apparatus may be actuated.

Referring to the drawings, the card feeding control mechanism comprises a cyclic control means **10** and a card feeding means **12** mounted for movement between a feed-ready position and a feeding position under control of a magnetic control means **14**. Magnetic control means **14** comprises a core member **16**, an armature member **18** and a coil member **20**. Cyclic control means **10** produces relative motion between core member **16**, armature member **18** and coil member **20** when coil member **20** is not energized. When coil member **20** is energized, a magnetic flux is generated in core member **16**. A large flux coupling force results when core member **16** is next brought at or near engagement with armature member **18**, since this is the only point in the cycle at which a complete ferromagnetic path is present. Driving means **22** provides the force to drive card feeding means **12** to feed a card under control of cyclic control means **10**.

The card feed control mechanism thus achieved provides a number of important advantages. One of the most important advantages is the capability to delay the application of the card feed control signal to just a short time before the card feed means will actually start a feeding cycle. Since the core member **16** and the armature member **18** are essentially touching at the time of engagement, there is practically no engaging noise and practically no wear of the control parts. The control mechanism provides a large safety factor in operation, but in case of mechanical difficulty, the mechanism permits a declutching of the control mechanism rather than a breakage of parts.

In the embodiment of the invention shown in the drawings, the cyclic control means illustrated therein comprises a cam means **24** which is continuously driven to produce a cyclic control motion in an associated cam follower **26**. The card feeding means comprises a picker knife **28** mounted upon a shaft **30** for movement in a reciprocating manner for feeding a record card from the card hopper **32**. The control to selectively feed a card comprises magnetic control means and in the embodiment shown, the magnetic control means comprises a core member **16** mounted for movement about the shaft **30**

under the control of cam follower 26. Coil member 20 is energizable to produce a magnetic flux within the core means, and armature member 18 is attached to shaft 30 and is held in a predetermined position by a holding means 34. Holding means 34 keeps the card feeding means in the feed-ready position when coil member 20 is deenergized. However, when the cyclic motion of cam 24 moves the core 16 to a position adjacent to armature 18, if coil 20 has been energized to produce a flux in core 16, a magnetic coupling takes place due to the low reluctance path which then causes the card feed means 12 to feed a card under control of the cam means 24 and a spring means 22 which provides the force to insure that cam follower 26 follows the contour of cam means 24.

In the embodiment shown in the drawings, cam 24 is mounted on a shaft 36 which is continuously driven by suitable means, such as a belt or gears, from a suitable drive motor not shown. Shaft 36 and shaft 30 are journaled in suitable machine side frames not shown. The contour of cam 24 is chosen to produce the fastest acceleration of the card without damaging the edge of the card. The card feeding means comprises a pair of picker knives 28 shaped to engage the trailing edge of the bottom card in the hopper and move the card under a throat knife to the feedrolls 38 which convey the card through the utilization stations of the machine.

Magnetic core member 16, coil member 20 and armature member 18 have no fixed relationship since the relationship is continuously changing due to the action of cam follower 26 moving core member 16. Magnetic core member 16 comprises a substantially U-shaped member having an opening in the closed part of the U which permits the core to be mounted over the card feeding shaft 30. The core member is mounted in suitable bearings so that little frictional drag is produced on shaft 30 as core member 16 is moved relative to the shaft. The open end of the core member comprises two arms 42 which are attached through a nonferromagnetic arm 44 to cam follower member 26.

A spring 22 biases cam follower member 26 into contact with cam 24 so that, as the cam rotates, core member 16 is moved relative to the card feed shaft in a manner determined by the contour of the cam (see FIGURE 4). The contour of the cam is chosen so that at the decision time in the cycle, the arms 42 of the core member are brought in close proximity to or actually touch armature member 18. Armature member 18 is mounted upon two nonferromagnetic arms 46 which are pinned to shaft 30. A small permanent magnet 34 is fixedly mounted to the machine frame (not shown) to hold armature member 18 and the card feed means in a feed-ready position when restored to this position by cam 24.

This mode of operation has the advantage that a low current signal may be used for reliable control since the armature member is already closely adjacent to the core member. For this reason, a high current signal sufficient to attract the armature member over a substantial air gap is not required. This mode of operation has an additional advantage since the electrical signal is not sufficient to attract the armature member over any appreciable air gap, therefore, the signal can be turned on soon after the start of a cycle which will not be effective until the appropriate point in the mechanical cycle.

The magnet coil 20 is mounted over the part of core member 16 which is mounted on the card feed shaft 30. Coil member 20 is freely movable with respect to core member 16 and, if desired, the coil member 20 may be fixedly mounted to the frame of the card machine by means not shown. This provides the advantage that the coil member 20 does not have to be moved by the control mechanism, thereby reducing the mass in the moving system which contributes to a lower inertia and permits faster operation. The coil may be energized at any time in the cycle after the armature has been restored to holding means 34 in the previous cycle.

It is an important advantage that the construction of the magnetic control means permits delaying the decision as to whether a card be fed during a particular cycle to the latest possible time. This is an advantage in card machines operating on line with a data processing system since the data processing system may have to wait almost a complete card machine cycle for the next decision point in the mechanical cycle. In this machine the decision point can be delayed until a point at which the magnet coil produces sufficient flux in the core member to attract the armature when the core is in the position closely adjacent to the armature.

The record card feeding apparatus may be selectively actuated by applying a signal to coil member 20 from a suitable control means 21. The signal may be a FEED A CARD signal from control means 21 which may be an associated Data Processing System, for example. Referring to FIGURE 4, the signal may be applied at any time during the mechanical cycle, and the control will be effective when the core member 16 is next moved adjacent the armature member 18. In a particular embodiment, the signal may be presented at any time between about 4° and 356° point of the cycle since in this embodiment, about 4° represents the lead time required to permit sufficient flux to be built up in core member 16 to couple to armature member 18, or to permit the flux to decay to the point at which armature member 18 will not be attracted. This is shown in FIGURE 4 by a full line waveform during the time when current must be applied to coil member 20 to select a cycle of operation and by dotted line representations of the limits during which the current may be applied to coil member 20 to select a cycle of operation of picker knife 28. It will be recognized by those skilled in the art that these points will vary with the design of the mechanism and the speed of operation.

Once selection is made, the current signal must be of sufficient duration to hold the members in their operative positions during the feeding of the record card. In the particular embodiment shown, energization of coil member 20 to approximately the 90° point of the cycle proved sufficient, since the acceleration of the members was then sufficient to drive the members past the 180° point in the cycle. The contour of cam 24 restores picker knife 28 and armature member 18 from the 180° point to the 360° point of the cycle.

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 various 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 selectively actuable control mechanism comprising:
   - actuator means controllable for movement from a first to a second position;
   - magnetic control means comprising a core member, an armature member and a coil member;
   - means for coupling said armature member to said actuator means;
   - means for cyclically varying the relative position between said coil member, said core member and said armature member so that attraction of said armature can occur at only one point in said cycle; and
   - means for selectively energizing said coil member to couple said core member to said armature member by the force of magnetic attraction when said core member next moves to said one point in the cycle to control movement of said actuator means.

2. The control mechanism of claim 1 further comprising means for moving said actuator means from said first position to said second position under control of said means for cyclically varying the relative position of said magnetic control means to produce one cycle of movement of said actuator means.

3. A selectively actuable record card feed control mechanism comprising:
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
means for coupling said armature member to said record card feeding means;
means for cyclically varying the relative position between said coil member, said core member and said armature member so that attraction of said armature can occur at only one point in said cycle; and
means for selectively energizing said coil member to couple said core member to said armature member by the force of magnetic attraction when said core member next moves to said one point in the cycle to control movement of said record card feeding means.

4. The record card feed control mechanism of claim 3 further comprising means for moving said record card feeding means from said first position to said second position under control of said means for cyclically varying the relative position of said magnetic control means to feed a record card.

5. A selectively actuable record card feed control mechanism comprising:
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
means for coupling said armature member to said record card feeding means;
means for holding said armature in a position so that said record card feeding means is in said first position when said magnetic control means is deenergized;
means for cyclically varying the relative position between said coil member, said core member and said armature member so that attraction of said armature can occur at only one point in said cycle; and
means for selectively energizing said coil member so that said core member is coupled to said armature member by the force of magnetic attraction when said core member next moves to said one point in the cycle to control movement of said record card feeding means.

6. The record card feed control mechanism of claim 5 further comprising means for moving said record card feeding means from said first position to said second position under control of said means for varying the position of said magnetic control means to feed a record card.

7. A selectively actuable record card feed control mechanism comprising:
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
means for coupling said armature member to said record card feeding means by a nonferromagnetic path;
means for cyclically varying the relative position between said coil member, said core member and said armature member so that a complete ferromagnetic path can occur at only one point in said cycle; and
means for selectively energizing said coil member to couple said core member to said armature member by the force of magnetic attraction when said core member next moves to said one point in the cycle.

8. The record card feed control mechanism of claim 7 further comprising means for moving said record card feeding means from said first position to said second position under control of said means for cyclically varying the relative position of said magnetic control means to feed a record card.

9. A selectively actuable record card feed control mechanism comprising a cyclic control means;
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
means for coupling said armature member to said record card feeding means;
a control member actuable by said cyclic control means to move said core member relative to said coil member and said armature member in cyclic fashion between a first and a second position; and
means for selectively energizing said coil member to create a magnetic field within said core so that said core member is coupled to said armature member by the force of magnetic attraction when said core member next moves to said first position.

10. A selectively actuable record card feed control mechanism comprising a cyclic control means;
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
means for coupling said armature member to said record card feeding means by a nonferromagnetic path;
a control member coupled to said core member by nonferromagnetic means;
said control member actuable by said cyclic control means to move said core member relative to said coil member and said armature member in cyclic fashion so that a complete ferromagnetic path can occur at only one point in said cycle; and
means for selectively energizing said coil member to create a magnetic field within said core so that said core member is coupled to said armature member by the force of magnetic attraction when said core member next moves to said one point in said cycle.

11. A selectively actuable record card feed control mechanism comprising a cam means;
a record card feeding means actuable for movement from a first to a second position to feed a record card;
magnetic control means comprising a core member, an armature member and a coil member;
a control member actuable by said cam means to move said core member relative to said coil member and said armature member in cyclic fashion between a first and a second position;
means for coupling said armature member to said record card feeding means;
means for holding said armature in a position so that said record card feeding means is in said first position;
means for selectively energizing said coil member to create a magnetic field within said core so that said core member is coupled to said armature member by the force of magnetic attraction when said core member next moves to said first position; and
resilient means for moving said record card feeding means from said first position to said second position under control of said cam means to feed a record card.

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