United States Patent

[11] 3,619,570

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[73] Assignee **International Research Development Inc.**

[54] **MAGNETIC READING APPARATUS**
16 Claims, 12 Drawing Figs.

[52] **U.S. Cl.** **235/61.11D,** 200/46, 235/61.12, 340/149
[51] **Int. Cl.** **G06k 7/08,** G06k 19/08, H01h 43/08, H01h 43/08, H04q 3/72
[50] **Field of Search** ..... 200/46; 340/149 X, 174.1; 235/61.114, 61.12, 61.11 D

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ABSTRACT: A code reading device for data processing cards employing magnetic cores that are displaceable transversely of a card inserted into an air gap between the confronting pole faces of the magnetic cores. In a code reading position of the card, information on the faces of the card may be read by exposure to the magnetic cores to establish, decrease or increase repulsive or attractive forces between the pole faces causing displacement of the cores to produce digital output signals.

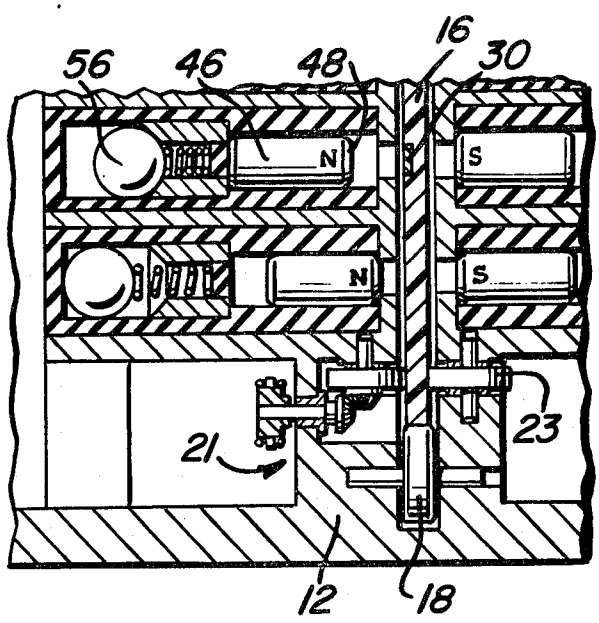


Fig. 1

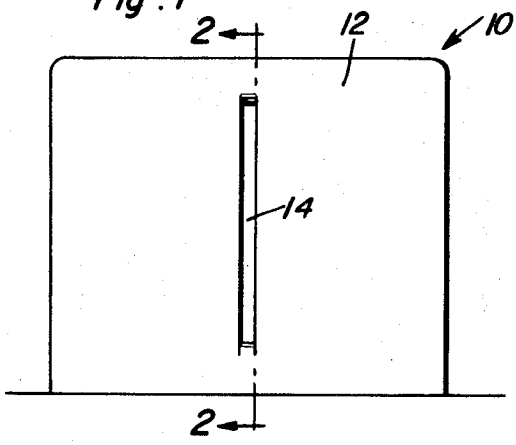


Fig. 2

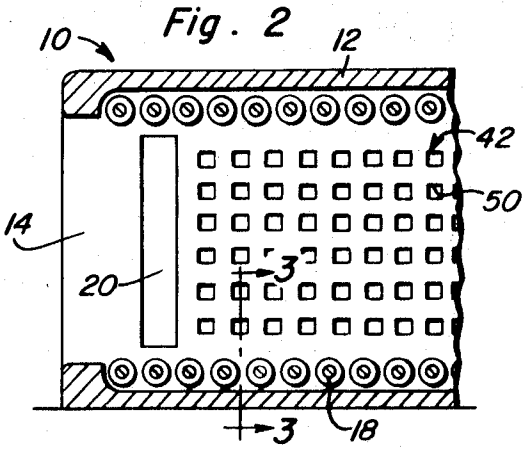


Fig. 3

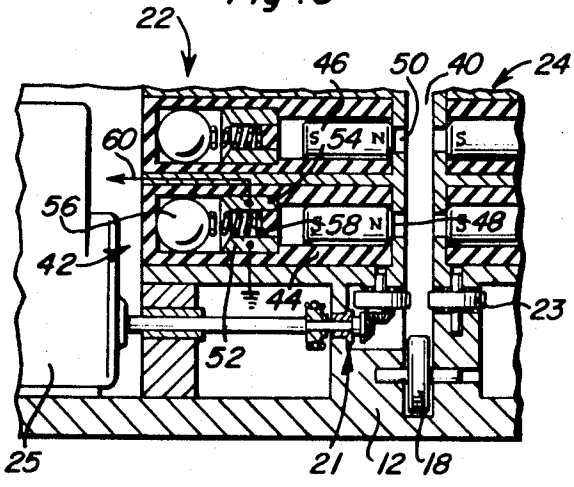


Fig. 3a

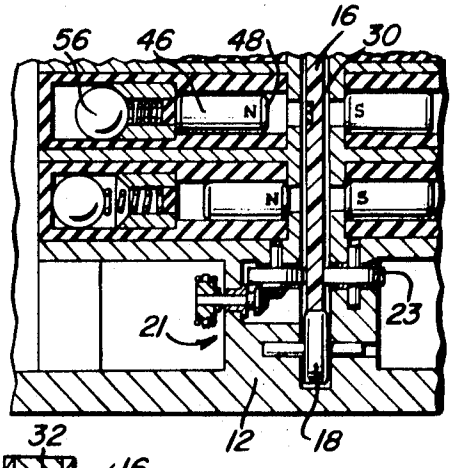


Fig. 6

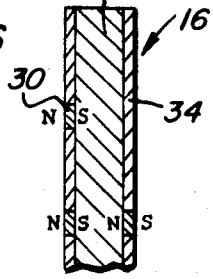


Fig. 5

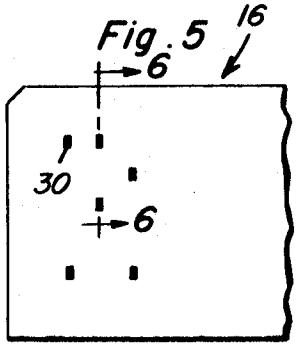


Fig. 4

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Fig . 7

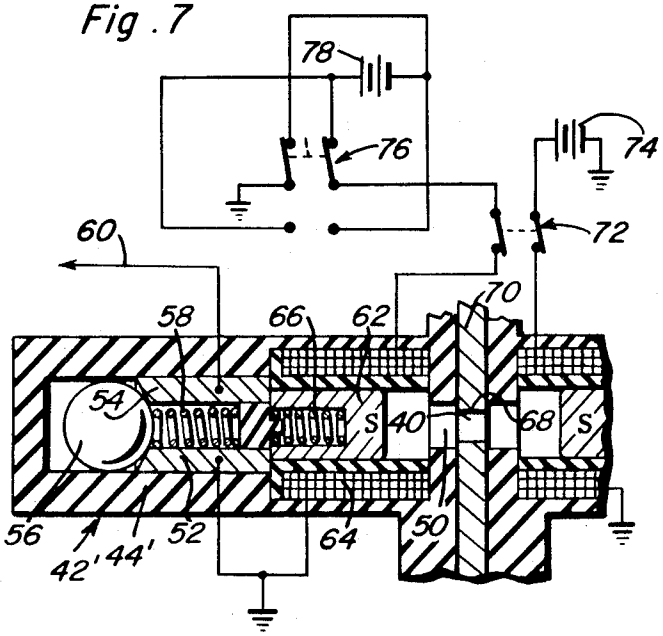


Fig . 7a

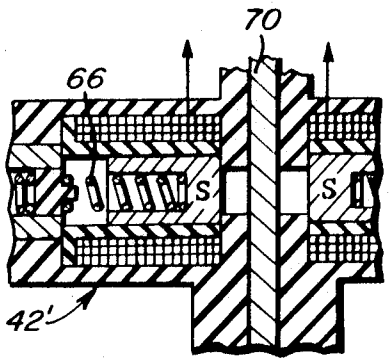


Fig . 8

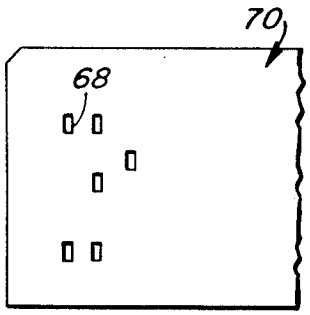


Fig . 10

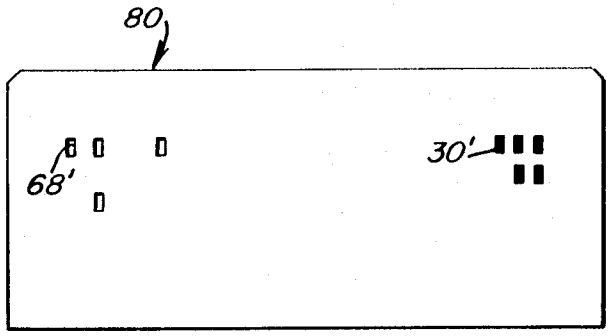
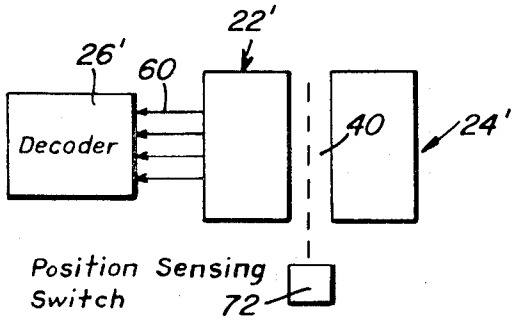


Fig . 9



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MAGNETIC READING APPARATUS

This invention relates the reading of coded information on a data processing card and more particularly to a magnetically operated device into which a data processing card is inserted so that the coded information thereon may be converted into digital signals.

The present invention is concerned with the problem of handling the ever increasing amount of information to be processed in systems utilizing data processing cards. One of limitation on the amount of coded information capable of being encoded on such data processing cards, resides in the fact that both faces of the card cannot be utilized to store different readily readable information. An important object of the present invention therefore is to provide code reading apparatus by means of which different information on opposite faces of a data processing card may be read either simultaneously or sequentially in one operational cycle. A further object is to provide a reading apparatus for such data processing cards capable of reading coded information either in the form of punch holes or magnetic bits.

In accordance with the present invention, code punch holes or magnetic bits on a data processing card are exposed to the pole faces of relatively small magnetic cores on opposite transverse sides of the record card within a magnetic reading apparatus. Thus, when the record card is disposed in a code reading position, each code location thereon will be aligned between confronting poles of the magnetic cores separated by an air gap occupied by the card. The presence or absence of a code hole or magnetic bit will therefore cause displacement of magnetic cores to produce digital output signals. By utilizing magnetically polarized bits, separate information may be encoded on opposite faces of data processing card to which the reading apparatus will respond by means of its magnetic cores. Thus, the amount of information capable of being encoded on the data processing card may be doubled. Further, the reading apparatus may be conditioned for detecting either the presence of magnetic bits or code holes so as to handle either magnetically coded or punch hole data cards or data processing cards having both types of coding.

These together with other objects and advantage which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is an end view of a magnetic reading apparatus constructed in accordance with the present invention.

FIG. 2 is a partial side sectional view through the reading apparatus taken substantially through a plane indicated by section line 2—2 in FIG. 1.

FIG. 3 is an enlarged partial sectional view taken substantially through a plane indicated by section line 3—3 in FIG. 2.

FIG. 3*a* is a partial sectional view similar to FIG. 3 showing readout operation.

FIG. 4 is a diagrammatic illustration of the reading apparatus.

FIG. 5 is a partial side elevational view of one type of data processing card handled by the reading apparatus of the present invention.

FIG. 6 is an enlarged partial sectional view taken substantially through a plane indicated by section view taken substantially through a plane indicated by section line 6—6 in FIG. 5.

FIG. 7 is a partial sectional and diagrammatic view of another form of reading apparatus constructed in accordance with he present invention.

FIG. 7*a* is a partial sectional view through the apparatus illustrated in FIG. 7 shown in another operative condition.

FIG. 8 is a partial side elevational view of another type of data processing card handled by the reading apparatus illustrated in FIG. 7.

FIG. 9 is a diagrammatic view of the reading apparatus of FIG. 7.

FIG. 10 is a side elevational view of a hybrid type of data processing card capable of being handled by the apparatus illustrated in FIG. 7.

Referring now to he drawings in detail, FIGS. 1 and 2 illustrate one form of a magnetic reading apparatus generally denoted by reference numeral 10. The shape and configuration of the apparatus housing 12 may take any suitable form In the embodiment illustrated however, one end of the housing is provided with a slot 14 into which a data processing card 16 such as illustrated in FIG. 5, is inserted. The card may be positioned for travel between edge engaging guide rollers 18 as shown in FIG. 2 so as to assume a card-reading position within the apparatus after passing between a pair of magnetizing heads 20 located adjacent the insert slot 14. Drive mechanism 21 as shown in FIG. 3 and diagrammed in FIG. 4 is associated with the upper and lower rollers 18, and includes card-engaging drive rollers 23 for imparting movement to he card upon energization of motor 25. Energization of the motor is controlled by a suitable sequential reading control 27 as shown in FIG. 4 to sequentially move and hold the card in several reading positions. In the code-reading position, the data processing card will be disposed between but spaced from a pair of magnetic reading assemblies 22 and 24 as diagrammed in FIG. 4 so that information may be retrieved from both faces or sides of the record card. Thus, digital output signals are fed from each of the magnetic reading assemblies to decoding circuits 26. After the information is readout from the record card, it is withdrawn from the apparatus past a pair of erase heads 28.

The record card 16 has shown in FIGS. 5 and 6, is encoded by bits of magnetic material 30 deposited at different code locations on both sides or faces of the card. The record card may be made of a material 32 having a magnetic shielding property or a relatively high magnetic reluctance. The opposite faces of the card are coated with a pressure-sensitive adhesive 34 within which the magnetic bits 30 are embedded or deposited. The magnetic bits are however polarized so as to expose poles of of opposite polarity on opposite faces of the card as shown in FIG. 6 when the card passes between the magnetizing heads 20 connected to a magnetizing circuit 36 for this purpose as diagrammatically shown in FIG. 4. The magnetism is erased however when the card is withdrawn from the reading apparatus by passing between the erasing heads 28 connected to the erase circuit 38. The magnetically polarized bits 30 will accordingly produce digital output signals from both magnetic reading assemblies 22 and 24 when disposed within a flux on air gap 40 between the magnetic reading assemblies within which magnetic fields are established.

Each magnetic reading assembly 22 be displaced by 24 is similar in construction in that it includes a plurality of magnetic reading units 42 aligned with each code location on the record card when in its reading position within the apparatus. Thus, the magnetic reading assemblies present confronting, aligned magnetic units 42 on opposite sides of the flux gap 40 as more clearly seen in FIG. 3 in order to establish the magnetic fields into which the cards are inserted. Each magnetic unit includes a tubular member 44 made of nonmagnetic material which is open at one end so as to expose the end pole face of a magnetic core 46 slidably disposed therewithin. In the embodiment illustrated in FIG. 3, the magnetic cores 46 are permanent bar magnets having pole faces 48 exposed to the flux gap 40 through openings 50 formed in the housing for this purpose. It will also be noted, that the confronting end pole faces of the magnetic cores 46 of aligned magnetic units 42, are of opposite polarity so that the cores are ordinarily held in one limit position as shown in FIG. 3 abutting the housing under the attractive forces between the pole faces of opposite polarity. Each magnetic core 46 may be displaced by a repulsive force to its other limit position as shown in FIG. 3*a* when its end pole face 48 is exposed to a magnetic bit 30 of the same polarity. By separating the magnetic bits 30 on opposite faces of the record card 16 with body 32 of relatively high magnetic reluctance, various magnetic cores 46 in both magnetic reading assemblies 22 and 24 may be displaced to their other limit position to simultaneously produce digital output signals from each magnetic reading assembly because of the repulsive displacing forces exerted on the magnetic cores when aligned with magnetic bits of opposite polarity.

Upon removal of the record card, the displaced magnetic cores will return to he normal limit positions as shown in FIG. 3.

Fixedly mounted within each tubular member 44 of a magnetic unit 42, are a pair of electrical contact elements 52 and 54 adapted to be abutted by the magnetic core when displaced to a limit position under the influence of a magnetic bit on a record card. When the magnetic core 46 abuts the contact elements 52 and 54, it magnetically attracts a contact bridging element 56 which is normally held in an out-of-contact position by a spring 58. The spring 58 has sufficient force to hold the bridging element 56 in its non contact position shown in FIG. 3 against the magnetic attractive force of the magnetic core 46 when in the limit position shown in FIG. 3. In the other limit position shown in FIG. 3*a*, the attractive force of the magnetic core overcomes the bias of the spring 58 so that the element 56 bridges the contacts and thereby establishes a signal in an output signal line 60 associated with each magnetic unit 42 as diagrammatically shown in FIGS. 3 and 4.

FIG. 7 illustrates a modified form of reading apparatus in which each of the magnetic units 42' produces a digital output signal when contacts 52 and 54 fixedly mounted within the tubular member 44', are bridged by element 56 displaced from its noncontact position against the bias of spring 58 to the position illustrated in FIG. 7 by an electromagnetic type of core 62. An electromagnetic solenoid winding 64 is therefore mounted within the tubular member 44' so as to magnetize the core 62 when supplied with a DC current. The core 62 may also be provided with a recess adjacent one end enclosing a spring 66 biasing the magnetic core to a limit position as shown in FIG. 7*a*.

When solenoid windings 64 of confronting magnetic units 42' are supplied with current in the same direction, the associated magnetic cores are magnetized so as to produce pole faces of the same polarity exposed to each other through openings 50' in the air gap 40'. Thus, forces between the end pole faces of the magnetic cores bias the magnetic cores to limit positions against the bias of their springs causing the bridging of the contacts 52 and 54 to produce digital output signals in the output lines 60' associated with the magnetic units. This displacement of the magnetic core 62 to the contact closing limit position, is however produced as shown in FIG. 7 if a coded punch hole 68 in a record card 70 is aligned with confronting magnetic units 42'. On the other hand, if there is no punch hole in the card 70 between confronting magnetic units 42' as shown in FIG. 7*a*, the repulsive force between the adjacent end pole faces of the magnetic cores will not be sufficient to overcome the bias of the associated springs 66 so that the magnetic cores will remain in the noncontact limit position. It will therefore be appreciated that the reading apparatus as illustrated in FIGS. 7 and 7*a* may handle a record card 70 made of a material having a high magnetic reluctance and encoded by punch holes 68 as shown in FIG. 8.

In order to read a card 70 as hereinbefore described in connection with FIGS. 7 and 7*a*, the solenoid windings 64 associated with each of the magnetic units 42', are energized when the record card is in its code reading position between the magnetic reading assemblies 22' and 24' as diagrammed in FIG. 9. Toward this end, a position sensing switch 72 is actuated by the card when it is in its code reading position. Actuation of the position sensing switch 72 as shown in FIG. 7, connects the solenoid windings associated with the magnetic reading assembly 24' to a DC voltage source 74. The solenoid winding 64 associated with the other magnetic reading assembly 22' is connected through the position sensing switch 72 and a reversing switch 76 to a DC power source 78. In the position of the reversing switch 76 as shown in FIG. 7, the direction of current conducted through the solenoid windings 64 of confronting magnetic units, is such as to produce end pole faces on the adjacent confronting magnetic cores of the same polarity.

When the reversing switch 76 as shown in FIG. 7 is displaced to its other operative position, the direction of current through the solenoid windings in the magnetic reading assembly 22' reversed relative to the solenoid windings in assembly 24' so that the adjacent end pole faces of confronting magnetic cores 62 will be of opposite polarity. The reading apparatus will then be conditioned for reading record cards having magnetically polarized bits as hereinbefore described in connection with FIGS. 1 through 6. Thus, in the latter condition of the reading apparatus of FIG. 7, it will operate in the same manner as the apparatus 10 of FIGS. 1 through 4 except for the use of electromagnetic cores 62 rather than permanent magnet cores 46. It will be apparent that the form of the invention illustrated in FIG. 7 through use of the revering switch 76 may handle either magnetically coded cards 16 or punch hole coded cards 70. Furthermore, the reading apparatus of FIG. 7 may also handle hybrid cards 80 as shown in FIG. 10 which are coded by both punch holes 68' and magnetic bits 30' either sequentially or simultaneously by appropriate controlled energization of the solenoid windings 64. Thus, a magnetic reading apparatus may be provided which is extremely versatile in use and may also cooperate with appropriately encoded record cards to substantially increase the amount of information capable of being encoded on the cards.

What is claimed as new is as follows:

1. In combination with record medium having parallel faces on opposite sides, a data readout device comprising means for positioning the record medium in a reading position within an air gap, at least two magnetic cores having aligned and confronting poles on opposite sides of said gap, means slidably mounting said magnetic cores for displacement transversely of said gap between limit positions adjacent to and spaced therefrom, and switch means responsive to displacement of said magnetic cores to the limit positions spaced from the gap for establishing output signals said confronting poles on the magnetic cores magnetically interacting to bias the magnetic cores to one of the limit positions.

2. The combination of claim 1 including magnetically polarized coatings deposited on said faces of the record medium to present pole faces on said parallel faces of the record medium opposite in polarity to the aligned poles of the magnetic cores to which the record medium is exposed, whereby information form both of said faces of the record medium may be simultaneously retrieved.

3. The combination of claim 2 wherein said means slidably mounted magnetic cores includes a plurality of tubular shielding members having opposite ends defining said limit positions of the magnetic cores, one of said ends of each of the tubular members having an opening exposing the aligned poles to the gap.

4. The combination claim 3 wherein said switch means includes a pair of spaced contacts fixedly mounted adjacent one of the limit positions of each of the magnetic cores, contact bridging means magnetically attracted into engagement with said contacts when the core is in said one of the limit positions, and means biasing he bridging means out of contact when the core is in the other of the limit positions.

5. The combination of claim 1 wherein said means slidably mounting the magnetic cores includes a plurality of tubular shielding members having opposite ends defining said limit positions of the magnetic cores, one of said ends of each of the tubular members having an opening exposing the aligned poles to the flux gap.

6. The combination of claim 5 wherein said switch means includes a pair of spaced contacts fixedly mounted adjacent on of the limit positions of each of the magnetic cores, contact bridging means magnetically attracted into engagement with said contacts when the core is in said one of the limit positions, and means biasing the bridging means out of contact when the core is in the other of the limit positions.

7. The combination of claim 1 wherein said switch means includes a pair of spaced contacts fixedly mounted adjacent one of the limit positions of each of the magnetic cores, contact bridging means magnetically attracted into engagement with said contacts when the core is in said one of the limit

positions, and means biasing the bridging means out of contact when the core is in the other of the limit positions.

8. The combination of claim 1 wherein said magnetic cores are electromagnets.

9. The combination of claim 8 including means for reversing the polarity of the aligned poles of the magnetic cores relative to each other to establish attractive or repulsive force between said aligned poles.

10. The combination of claim 9 including means biasing the magnetic cores to one of said limit positions thereof, overcoming the repulsive force between the magnetic cores.

11. The combination of claim 10 wherein the record medium is made of material increasing the magnetic reluctance of the air gap and having code holes formed therein adapted to be registered with he aligned poles of the magnetic cores to permit displacement of the magnetic cores to said one of the limit positions by the biasing means.

12 The combination of claim 1 including means for reversing the polarity of the aligned poles of the magnetic cores relative to each other to establish attractive or repulsive force between said aligned poles.

13. The combination of claim 12 including means biasing the magnetic cores to one of said limit positions thereof overcoming the repulsive force between the magnetic cores.

14. The combination of claim 13 wherein the record medium is made of material increasing the magnetic reluctance of the air gap and having code holes formed therein adapted to be registered with he aligned poles of the magnetic cores to permit displacement of the magnetic cores to said one of the limit positions by the biasing means.

15. The combination of claim 1 wherein said aligned poles of the magnetic cores are of opposite polarity establishing an attractive force therebetween tending to hold the magnetic cores in one of the limit positions.

16. The combination of claim 1 wherein said aligned poles cores are of like polarity establishing a repulsive force therebetween tending to hold the magnetic cores in one of the limit positions.

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