ABSTRACT: A reader and encoder for information carried on cards such as credit cards and the like provides a plurality of tones as an output in response to a perforated record-carrying card which is inserted into the reader. A four-motion feeding mechanism including a feed dog traverses a substantially rectangular path normal to the material support, through which support the feed dog extends during the process of card feeding. Projecting from the feed dog towards and extending into a confronting column of feed perforations in the card, are feed pins aligned to feed the card along a straight path predetermined by the column of feed perforations formed in the card. Edge guides and a solenoid-operated card stop are provided to hold the card in the correct position prior to commencement of operation of the feeding mechanism so that feeding will be accurate, at a continuous speed; and all the information represented by the perforations will be sensed by a plurality of vertically reciprocated, spring-biased feeler pins or probes connected to actuate switches in response to extension of the probes through code-bearing perforations representing coded information punched into the card. Each of the switches controlled by the probes is adapted to actuate an oscillator generating a predetermined audio tone which is supplied to a speaker. A shaft positioner is provided for arresting the motor shaft near a predetermined position.
FEEDING MECHANISMS FOR CARD READERS

BACKGROUND OF THE INVENTION

When reading of indicia on cards must be accomplished by a reading device with great accuracy, it is imperative that registration of indicia relative to the position of sensing devices be assured. For that reason, it is also extremely important that such a reading device should include means for positively separating the feeding function from the reading function with respect to timing, so that the probability of feeding during reading and the converse will be minimized. Accordingly, the feeding mechanism employed must be highly accurate, reliable, and adapted to prevent stalling, slipping, or pivoting of the card or misreading of the indicia on the card. Furthermore, the indicia-sensing devices or mechanism should be protected from damage by the card or the feeding mechanism such as bending of the sensing mechanism by the card during feeding. Conversely, the card should be protected from injury by the sensing and feeding mechanism. In the case of credit card readers and the like, economy of the reading unit is a matter of significant importance.

SUMMARY OF THE INVENTION

In accordance with my invention, communications apparatus in the form of an encoder is used to provide an output signal in response to the reading of a card-contained, material, such as a card-reading material. The record-bearing material carries rows of code-bearing indicia, such as perforations. The encoder includes devices for sensing indicia and for generating coded signals in response to the indicia. The record-bearing material is placed on a material supporting surface and is carried across that surface by means of a four-motion feeding mechanism, so that the means for sensing the indicia may read each row of indicia individually, one by one, between feeding motions. Further, in accordance with my invention the mechanism for feeding the material may be in the form of a feed dog, which can engage with longitudinally spaced modifications in the material, such as perforations, recesses or apertures in a credit card. The four motions of the feeding mechanism include extension, forward motion, retraction, and rearward motion with respect to the material supporting surface.

In a more specific aspect of the invention, the feed dog may include one or more projections adapted to project substrate into a track of equally spaced apertures or perforations in a card material. Preferably, the projections are in the form of pins. In one form of my invention, each of the devices for sensing indicia is in the form of a probe pin linked to a corresponding circuit, making and breaking means in order to operate a corresponding one of several signal generators which combine to produce coded signals.

According to a further aspect of my invention, a stop is inserted through the material supporting surface prior to operation of the feeding mechanism in order to align a credit card or the like. In addition, it is desirable to include a stop-controlling or stop-motion mechanism for assuring that the material-feeding and indicia-sensing fingers, etc., are retracted from contact with the material upon termination of operation of the encoder.

Further in accordance with my invention, the feeding mechanism and the reading mechanism are driven by a single shaft to provide accurate timing, position control, and hence registration. In this integral and positive relationship, feeding and reading must occur at different times. The use of a single shaft is also economical.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an encoder and credit card reader in accordance with this invention;

FIG. 2 is a partially sectional view of the encoder shown in FIG. 1 with cover plates removed or cut away for purposes of illustration;

FIG. 3 is a front sectional elevational view of the encoder shown in FIG. 1 taken generally along line A-A in FIG. 1.

FIG. 4 is a sectional elevational view taken generally along line B-B in FIG. 3.

FIG. 5 is a fragmentary sectional view taken generally along A-in FIG. 1 and emphasizing the construction of a four-motion feeding mechanism employed in the encoder;

FIG. 6 is a fragmentary sectional view also taken generally along line A-A in FIG. 1 and emphasizing the construction of the perforation probing and switching mechanism employed in the encoder; and

FIG. 7 is a schematic block diagram of the system employed in an encoder made in accordance with this invention.

Referring to FIG. 1, a credit card 10 has eight columns of code-bearing perforations 23 to be encoded and transmitted by telephone to a computer and one column of feed perforations 27. The card 10 is inserted into a slot 11 in an encoder and credit card reader 12 so far as a spring stop 33 in slot 11 permits. Then the user dials a predetermined telephone number for connecting to a computer which contains the information required to evaluate the credit status of the owner of the credit card 10. When the computer is prepared to receive signals from the reader 12, a tone is heard on a telephone receiver 14 by the operator of the reader 12. The operator then places the telephone hand set 13 on the reader 12 with the telephone receiver 14 resting on a platform 16 and sets the button for operating a sensitive switch 19. The telephone transmitter 15 of hand set 13 is placed on a pivotably supported speaker 17 affixed to the reader 12 for sending tone signals for processing by the computer. The control circuit 61 for the reader 12 is prepared after actuation of the sensitive switch 19 and a pushbutton switch 21 located on top of the reader 12.

Then a feeding mechanism 22 is actuated and the code-bearing perforations 23 in the credit card 10 are read by the probes 24. The probes 24 control switches 25 which operate a number of tone generators within a tone unit 59, portions of which are shown in FIG. 2.

Thus, for each row of perforations 23 on the card 10 representing a distinct code character (other than the columns of feed perforations 27) a corresponding set of tones will be generated and transmitted by the transmitted transmitter 18 to the computer. When the last row of code-bearing perforations 23 is reached, a predetermined code character, different from the others, will be generated and will be effective to terminate operation of the reader 12 and to operate a stop-motion device 30 for retracting both the feeding mechanism 22 and the code-bearing perforations 23 in the credit card 10 through the reader 12 and the probes 24. Positioning of the probes 24 and the feeding mechanism 22 below the card-supporting surface 29 upon which the credit card 10 is supported permits the credit card 10 to be removed.

In order that each row of the eight columns of code-bearing perforations 23 can be correctly read by the eight probes 24, the credit card 10 must be aligned and advanced, or fed, accurately at the appropriate time. Thus, the feed dog 30 used has feed pins 31 for projecting on each stroke into several projections in the column of feed perforations 27. Each card 10 has a substantially identical column of feed perforations 27, as all cards are fed and read with the same high degree of accuracy.

Upon insertion of the card 10 into the slot 11 under the dust cover 18 in the reader 12, the edges of the card 10 are guided by guide surfaces 32 formed by the dust cover 18 and support 18' and when the card 10 has been fully inserted, a spring stop 33 retractable by operation of a solenoid 34 will stop the card 10. Then the card 10 will be properly aligned so that when the feed pins 31 are driven above the card-supporting surface 29 by the drive system, the feed pins 31 will function without binding or interference into the feed perforations 27, and during the feed stroke, they will advance the card 10 by the exact distance between consecutive feed perforations 27, assuming the spring stop 33 has been retracted as described below.

Four feed pins 31 are shown. It is preferable to employ at least three tapered pins 31 to maintain alignment of the card. Tapering down to a thick base, the pins 31 also are tilted forward so that they will catch in feed perforations 27 more...
readily, tend to correct alignment, and can be removed from the feed perforations readily. The feed dog 30 is driven by a three cornered or constant breadth feed cam 35 secured eccentrically to a flattened camshaft 41. The feed cam 35 has two arcs of constant radii joined by two transitions of varying radii. Thus the end of the feed cam 35 having a greater radius relative to the camshaft 41 will push on the sides of a square hole comprising a cam follower 36 in a feed arm 37. The feed arm 37 supports the feed pins 31 at one end and is carried at the opposite end by a feed arm spring 38 which permits considerable freedom of longitudinal and pivoting motion by the feed arm 37. The feed cam 35 will drive the feed arm 37 in four directions, seriatim. The motion of the feed arm 37 will be momentarily substantially unidirectional, while the major radius of the cam is in contact with a single side of the square follower hole 36. As will be understood, the feed cam 35 and cam follower 36 can have other shapes. For example, the feed cam 35 could be substantially square with rounded corners and the shape of the appropriate corresponding exterior cam follower surface would be circular.

The rounded shape of the bearing surfaces of the lobe 39 at the end of the feed cam 37 enhances the freedom of reciprocating motion of the camshaft 37. A bracket arm 40 is slotted vertically to provide lateral support for the lobe 39 so that it will remain upright and will reciprocate in the same plane. The edge of the lobe 39 opposite the feed arm spring 38 bears on the surface below the card supporting surface 29. The camshaft 41 is journaled on a supporting bracket 42 in which a slot 43 is formed for the feed arm 37 to permit its vertical and horizontal reciprocation.

Referring to FIG. 6 when the card 10 is inserted into the slot 11, the probes 24 have all been retracted as explained above so as to permit location of the card in an appropriate position for feeding. The eight probes 24 are held in alignment by a probe block 50 having a slot formed therein for the feed dog 30, with five probes on one side and three on the other slidable supported for vertical reciprocation in cylindrical holes 26 as shown in FIG. 4. The probes 24 can be raised only when the flatter surfaces of a pair of probe cams 51 are facing downwardly so that the probe cam followers 52 can rise, driving the probes 24 into the code-bearing perforations 23. The probe cam followers 52 are urged upwardly in response to the pressure of the finger springs 53 which are held at their opposite ends by a spring block 54. Each finger spring 53 is biased to raise the probe cam follower 52 linked to it. It will be noted in FIG. 4 that the finger springs 53 are linked to the probe cam followers by extension through horizontal slots 55 in the probe cam followers 52. Openings 56 defined by the cam engaging surfaces of the probe cam followers 52 are large enough so that, when the position of a probe cam 51 will permit upward motion of a corresponding follower 52, such motion will be controlled only by the presence of the absence of a code bearing perforation 23 in the card 10. In addition, the probe cams 51 are double radius cams, one radius being drawn from a point off center relative to the camshaft 41, and they are adapted to provide only two motions, up and down, rather than the four motions of reciprocation provided by the constant breadth feed cam 35. As shown in FIG. 6, one probe 24 is extending through the card 10 and the corresponding finger spring 53 coupled to the probe 24 is contacting the contact bar 57 which is connected to ground as indicated in FIG. 7. At the opposite end 58 of each cam follower 53 a line is connected to couple the finger spring with a tone unit 59 which will generate a particular tone identifying the particular finger spring 53. Accordingly, if the first of the eight finger springs 53 contacts the contact bar 57, then a corresponding oscillator in the tone unit 59 will be actuated to produce an output at the amplifier 60 and the speaker 61. There are two probe cams 51 carried by the flattened camshaft 41 located on opposite sides of the feed cam 35.

The camshaft 41 is journaled in the support bracket 42 and is driven by the pulley 62 which is connected by a rubber belt 63 to the output pulley 64 of a motor 65 having low inertia, high torque, and a velocity in the order of 5,000 rpm. At the opposite end of the camshaft 41 is secured a stop-motion cam 66 which may be substantially identical in shape to the probe cam 51. As small displacement, microswitch 67 is supported with its actuating plunger 68 in contact with the surface of the stop-motion cam 66, so that the position of the cams can be determined for the purpose of stopping the feed cam 35 and the probe cans 51 with the probes 24 and the feed dog 30 retracted below the card supporting surface 29. This facilitates card removal.

Referring to FIG. 7, the start switch 21 and sensitive switch 19 are employed to activate the control circuit 61 subsequent to insertion of a credit card 10 into slot 11, and after the telephone receiver 14 has been placed on the pivoted pressure plate 18 to operate the sensitive switch 19. Accordingly, the control circuit 61 will then operate the solenoid 34 to retract the stop spring 33 in order that the card 10 can be advanced by the feed dog 30. The motor 65 is actuated by the control circuit 61 at the same time for the purpose of driving the camshaft 41 which carries the probe cans 51, the feed cam 35, and the stop-motion cam 66. During operation of the motor 65, one or more of the spring fingers 53 will contact the contact bar 57 when the cam follower 52 is probed by the probe block 50. Upon production of a signal comprising a predetermined combination of tones by the unit 59, a holding circuit 69 from the tone unit 59 will cause the control circuit 61 to shut off as soon as the microswitch 67 is operated by the stop-motion cam 66. The low inertia motor 65 will stop rapidly, with the pins 31 and probes 24 below the card-supporting surface 29. As explained above, the tones generated pass from the unit 59 through the amplifier 60 to the speaker 61 where the juxtaposed telephone transmitter 15 passes the tones to the telephone lines for processing.

A return tone at the telephone receiver 14 is fed to a receiver 70 by a microphone 20. A tone-sensing unit 71 operates a solenoid 72 and a light 73 in response to the correct tone. For example, this kind of system is useful in connection with control of an embosser for credit cards or a cash register lock circuit connected to the output of the reader 12.

1. An encoder adapted for alternately feeding and reading indicia in record-bearing media having a column of feed perforations, including a feeding mechanism comprising a feed arm having a pivot leg and a feeding leg joined by an elbow, said pivot leg having a lobe at the end thereof, said feeding leg having a feeding dog on the end thereof, said lobe being supported by support means secured to said encoder and permitting said arm to slide longitudinally relative to the surface of said feed dog and to pivot about said lobe as a center in a direction substantially normal relative to the surface of said feed dog, said feed dog having a feed pin extending therefrom, said feed arm defining surfaces of a cam follower adjacent to said elbow, a feed cam secured to a camshaft journaled for rotation is in said encoder whereby said cam cooperates with said cam follower surfaces to drive said feed arm and said feed dog to periodically insert said feed pin into one of said feed perforations, and a reading mechanism for reading indicia in the record-bearing media timed with said feeding mechanism comprising a probe cam secured to said camshaft probes adapted to be alternately between a rest and an operative position by said probe cam and probe switch coupled to each probe for operation thereby during engagement of the corresponding probe with the indicia in the record-bearing media, while said probes are in their said operative positions.

2. The encoder of claim 1, further comprising releasable stop means for aligning the record-bearing media prior to the operation of said feeding mechanism.

3. The encoder of claim 1, further comprising means for stopping the operation of said feeding mechanism when the record-bearing medium has reached a predetermined position.
4. The encoder of claim 3, in which said feed mechanism stopping means comprises switch means, camshaft drive means operatively connected to said switch means for rotating said camshaft, and a stop cam secured to said camshaft, and effective when said medium has reached said predetermined position to operate said switch means to thereby deactuate said drive means.

5. The encoder of claim 1, in which there are a plurality of said feed pins extending from said feed dog, each of said pins being tapered inwardly toward their free end and tilted with respect to the end of said feed dog.

6. The encoder of claim 1, further comprising a support member for carrying the record-bearing medium on one of its surfaces, said lobe support means comprising resilient means biasing said lobe against an opposing surface of said medium support member.