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Metering devices and magnetic cards
for use with such devices

This invention relates to metering devices and to magnetic cards for use with such devices.

In particular, this invention relates to such metering devices and cards wherein the magnetic card is used as a token, for example where the metering device is a vehicle parking meter. With these metering devices, the token value of the card can be modified, that is to say decremented, by re-writing magnetic data borne by the card as the card is moved along a transport path past a magnetic head within the device. Each card may have its token value decremented successively by a large number of different metering devices, and in this situation it is important that timing control is provided so that the token value of the card which has been modified by one metering device can then be accurately read by another metering device in which the card is moved at nominally the same, but in practice usually at a slightly

different speed.

Card sensing means are normally provided adjacent the transport device and the card is normally moved by an electrical motor drive. It has been proposed to provide a tachogenerator attached to the motor and to servo lock the speed of reading and writing magnetic data on the card to the output of the tachogenerator to provide the above-mentioned timing control. Another proposal for this timing control has been to provide optical stripes on the card and an optical read head in the device from which a clocking signal is derived to control the magnetic reading and writing. Both the above proposed tachogenerator and optical read head have the disadvantage of being expensive extra non-circuit items to be provided in the metering device.

An object of the invention is to provide an improved means of timing control for re-writing data on magnetic cards in metering devices.

According to the invention there is provided a metering device for use with an elongate magnetic data bearing card, including drive means for moving such a card along a transport path within the device, card sensing means adjacent the transport path, and a magnetic head adjacent the transport path with a reading circuit and a writing circuit connected thereto, in which the device is for use with such a card having first and second magnetic strips aligned along the length of the card, the first magnetic strip being adjacent one end of the card, a first non-magnetic region extending along the length of the card between the first and second magnetic strips and a second non-magnetic region extending along the length of the card from the second magnetic strip towards the other end of the card, the first magnetic strip having data which is not to be modified by the device and which comprises timing information and the second magnetic strip having data which is to be modified by the device and which comprises information determining a token value of the card, and in which the device is arranged to modify the token value of the

card during a passage of the card wherein the first magnetic strip precedes the second magnetic strip past the magnetic head, processing means being responsive to information from the card sensing means and to said
5 timing information received from the reading circuit in said passage of the card such that it switches the writing circuit on while the first non-magnetic region is passing the magnetic head, then writes modified data on the second magnetic strip at a rate determined by said
10 timing information and then switches the writing circuit off while the second non-magnetic region is passing the magnetic head.

According to the invention there is also provided an elongate magnetic data bearing card for use with a
15 metering device as described in the previous paragraph, the card having first and second magnetic strips aligned along the length of the card, the first magnetic strip being adjacent one end of the card, a first non-magnetic region extending along the length of the card between the
20 first and second magnetic strips and a second non-magnetic region extending along the length of the card from the second magnetic strip towards the other end of the card, the first magnetic strip having data which is not to be modified by the device and which comprises timing
25 information, and the second magnetic strip having data which is to be modified by the device and which comprises information determining a token value of the card.

Reading and then writing along the same track in a single passage of the card has the advantages of
30 enabling timing control to be acquired from the card itself and then applied for re-writing on the card using only a single magnetic head. The provision of the non-magnetic regions which precede and follow the second magnetic strip in a writing operation and the procedure
35 of switching the writing circuit on and then off while these non-magnetic regions pass the magnetic head ensures that the ill-defined pulses which necessarily accompany

these switching operations are not reproduced as ill-defined magnetic transitions on the card. If such ill-defined transitions were produced on the card, then an accumulation of them from successive re-writings on the card could cause significant problems in correct reading of the re-written data.

A metering device as described in the antepenultimate paragraph may be for use with such a card having a third magnetic strip which is adjacent the other end of the card and is aligned along the length of the card with the first and second magnetic strips, the third magnetic strip having data which is not to be modified by the device and which comprises timing information, in which said passage of the card during which the device is arranged to modify the token value of the card is in a direction out of the device, in which case the device is arranged to read the data on the second magnetic strip at a rate determined by the timing information on the third magnetic strip during a preceding passage of the card in a direction into the device.

This arrangement facilitates the provision of a compact length transport path, which is advantageous where it is desirable for the overall size of the metering device to be small, for example where it is a vehicle parking meter.

A metering device as described in the penultimate paragraph may be for use with such a card in which the three aligned magnetic strips are centrally disposed with respect to the width of the card, in which case following insertion of the card into the device orientated so that the third magnetic strip enters the device before the second magnetic strip the device is arranged to read and then modify the data on the second magnetic strip prior to ejection of the card, and in which case following insertion of the card orientated so that the first magnetic strip enters the device before the second magnetic strip the device is arranged to read the data on the

second magnetic strip but not to modify it prior to ejection of the card.

Such a bidirectional use of a magnetic card having centrally disposed data for either decrementing the value of the card or for reading its value without decrementing it has been previously proposed for use with parking meters and it is a further advantage that this facility can be incorporated in devices and cards according to this invention.

Embodiments of the invention will now be described with reference to the accompanying drawing, in which

Figure 1 shows a plan view of a magnetic data bearing card according to the invention, and

Figure 2 shows a metering device for use with the magnetic card of Figure 1, the mechanical arrangement of the device being shown in schematic side view and the associated electrical circuits being shown diagrammatically in schematic blocks.

Referring now to the drawings, an elongate magnetic data bearing card C has three magnetic strips M1, M2 and M3 aligned along the length of the card and centrally disposed with respect to the width of the card. The magnetic strip M1 is adjacent one end R of the card C, a non-magnetic region N1 extends along the length of the card between the magnetic strips M1 and M2, another non-magnetic region N2 extends along the length of the card from the magnetic strip M2 towards the other end F of the card and the magnetic strip M3 is adjacent that end F of the card. The magnetic strips M1 and M3 each have data which is not to be modified by the metering device and comprise timing information in that data. The magnetic strip M2 has data which is to be modified by the metering device and that data comprises information determining a token value of the card C.

A metering device for use with the card C has a drive wheel W for moving the card C along a transport path P by frictional contact with the card C. The length of

the path P between an opening O and an end stop E is equal to twice the length of the card C and the drive wheel W is positioned half way along the length of the path P. A magnetic head H is positioned adjacent the path P opposite the drive wheel W, and two photo-electric sensors S1 and S2 are also positioned adjacent the path P, the sensor S1 being half way along the length of the path P and the sensor S2 being behind the sensor S1 towards the end stop E. The sensors S1 and S2 are connected to a sensing circuit 11, the drive wheel W is driven by an electric motor (not shown) controlled by a motor control circuit 12, and the magnetic head has a reading circuit 13 and a writing circuit 14 connected thereto. The circuits 11, 12, 13 and 14 are connected to processing circuit means 10 which includes a suitably programmed microprocessor.

The operation of the device for decrementing the token value of the card C is as follows. The card C is manually inserted into the path P through the opening O orientated so that the end F precedes the end R. A recess in the opening O extends into the path P up to point RC and enables the card to be manually held while being inserted until the end F of the card is in line with the sensor S1 and the end R of the card is in line with the opening O. In response to the end F of the card reaching and covering the sensor S1, the drive wheel W is rotated to engage and drive the card C forward in a direction into the device all the way to the end stop E while all the magnetic data on the card C is successively read from the magnetic strips M3, M2 and M1 via the reading circuit 13. The rate at which all this data is read is determined by the timing information on the magnetic strip M3. When the end F of the card C reaches the end stop E the sensor S1 is uncovered (with the sensor S2 covered) and the processing means 10 responds to this information from the sensing circuit 11 to reverse the direction of rotation of the drive wheel W via the motor control circuit 12 so as to move the card C in a direction

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out of the device. In this backward movement of the card C the data on the magnetic strip M1 is first read via the reading circuit 13. The processing means 10 responds to the information from the sensing circuit 11 indicating the start of this backward movement together with the timing information read from the magnetic strip M1 to switch on the writing circuit 14 while the mid point G1 of the non-magnetic region N1 of the card C is passing the magnetic head H, then to decrement the token value of the card C by writing modified data on the magnetic strip M2 at a rate determined by the timing information received from the magnetic strip M1. The end F of the card C reaches and uncovers the sensor S2 (with the sensor S1 covered) when the mid point G2 of the non-magnetic region N2 reaches the magnetic head H. In this position of the card C, its end R has not reached the recess RC in the opening O and so the card is not manually accessible. The processing means 10 responds to the information from the sensing circuit 11 at this point to switch off the writing circuit 14 and to reverse the direction of rotation of the drive wheel W to move the card C forwards again towards the end stop E. During this second forward drive of the card the rewritten data on the magnetic strip M2 is read via the reading circuit 13 into the processing means 10 for the purpose of verification. When the card C reaches the end stop E for the second time the sensor S1 is again uncovered (with the sensor S2 covered) and the processing circuit means 10 responds to this information being received for a second time from the sensing circuit 11 to reverse the direction of rotation of the drive wheel W so as to move the card C in a direction out of the device without operation of the magnetic head H for either reading or writing until both the sensors S2 and S1 are uncovered by the passage of the end F of the card at which time the drive wheel W is stopped. The card C has then been ejected from the device, that is to say the end R of the

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card is in line with the opening O and a portion of card C is manually accessible for removal via the recess RC in the opening O.

5 The operation of the device for reading the data on the card C without decrementing its token value, normally in order to display the token value to the user, is as follows. The card C is manually inserted into the path P through the opening O orientated so that the end R precedes the end F. The processing means 10 is responsive to a difference in the data on the magnetic strips M1 and M3 to control a sequence in which the card is moved once fully forwards to the end stop E while reading all the magnetic data on the card C and then moved once fully backwards to eject the card C from the device.

15 Some possible variations of the card and metering device as described above, within the scope of the invention, are as follows. The use of the metering device to display the token value of the card without decrementation may not be required, in which case the magnetic strips M1, M2 and M3 need not be centrally disposed with respect to the width of the card enabling it to be used bi-directionally with a single drive wheel and magnetic head. If a transport path of compact length using only a single drive wheel is not required, then it is possible to provide a metering device in which reading the data on the magnetic strip M2 and re-rewriting the data on that strip take place during passages of the card past a magnetic head in the same direction and not in opposite directions as described above. In this case, and assuming the bidirectional facility for a read-only operation is also not required, only one of the magnetic strips M1 or M3 may be required with one of the non-magnetic regions, N2 or N1 respectively, extending from the magnetic strip M2 to an end of the card.

CLAIMS

1. A metering device for use with an elongate magnetic data bearing card, including drive means for moving such a card along a transport path within the device, card sensing means adjacent the transport path, and a magnetic head adjacent the transport path with a reading circuit and a writing circuit connected thereto, in which the device is for use with such a card having first and second magnetic strips aligned along the length of the card, the first magnetic strip being adjacent one end of the card, a first non-magnetic region extending along the length of the card between the first and second magnetic strips and a second non-magnetic region extending along the length of the card from the second magnetic strip towards the other end of the card, the first magnetic strip having data which is not to be modified by the device and which comprises timing information and the second magnetic strip having data which is to be modified by the device and which comprises information determining a token value of the card, and in which the device is arranged to modify the token value of the card during a passage of the card wherein the first magnetic strip precedes the second magnetic strip past the magnetic head, processing means being responsive to information from the card sensing means and to said timing information received from the reading circuit in said passage of the card such that it switches the writing circuit on while the first non-magnetic region is passing the magnetic head, then writes modified data on the second magnetic strip at a rate determined by said timing information and then switches the writing circuit off while the second non-magnetic region is passing the magnetic head.
2. An elongate magnetic data bearing card for use with a metering device as claimed in claim 1, the card having first and second magnetic strips aligned along the length of the card, the first magnetic strip being adjacent one end of the card, a first non-magnetic region extending along



the length of the card between the first and second magnetic strips and a second non-magnetic region extending along the length of the card from the second magnetic strip towards the other end of the card, the first magnetic strip having data which is not to be modified by the device and which comprises timing information, and the second magnetic strip having data which is to be modified by the device and which comprises information determining a token value of the card.

3. A metering device as claimed in claim 1, the device being for use with such a card having a third magnetic strip which is adjacent the other end of the card and is aligned along the length of the card with the first and second magnetic strips, the third magnetic strip having data which is not to be modified by the device and which comprises timing information, in which said passage of the card during which the device is arranged to modify the token value of the card is in a direction out of the device, and in which the device is arranged to read the data on the second magnetic strip at a rate determined by the timing information on the third magnetic strip during a preceding passage of the card in a direction into the device.

4. An elongate magnetic data bearing card as claimed in claim 2 for use with a metering device as claimed in claim 3, the card having a third magnetic strip which is adjacent the other end of the card and is aligned along the length of the card with the first and second magnetic strips, the third magnetic strip having data which is not to be modified by the device and which comprises timing information.

5. A metering device as claimed in claim 3, the device being for use with such a card in which the three aligned magnetic strips are centrally disposed with respect to the width of the card, in which case following insertion of the card into the device orientated so that the third magnetic strip enters the device before the second magnetic



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- strip the device is arranged to read and then modify the data on the second magnetic strip prior to ejection of the card, and in which following insertion of the card orientated so that the first magnetic strip enters the
- 5 device before the second magnetic strip the device is arranged to read the data on the second magnetic strip but not to modify it prior to ejection of the card.
6. An elongate magnetic data bearing card as claimed in claim 4 for use with a metering device as claimed in
- 10 claim 5, in which the three aligned magnetic strips are centrally disposed with respect to the width of the card.
7. A metering device substantially as described herein with reference to the accompanying drawing.
8. A magnetic card substantially as described herein
- 15 with reference to the accompanying drawings.
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