

LOADING/UNLOADING UNIT FOR CARD MEDIA

The present invention relates to a loading/unloading unit for card media or IC card (referred simply to "card" hereunder) in a read/write device of a personal compute
5 or the like, more specifically to an electrically powered loading/unloading unit for inserting or ejecting a card into or out of a connector within the read/write device by an electrical power.

10 Generally, it is conventional to load (insert) and unload (eject) a card in a personal computer or the like by manual means. In case of loading a card in a connector, a user uses his/her fingers to push a card 41 into a connector 42 for making electrical connection as
15 shown in FIG. 4. On the other hand, in case of unloading the card 41, an ejection lever 43 is depressed in the direction by an arrow, which in turn pushes one end 46 of an ejection arm 45 by an end portion 44 of the ejection lever 43. Then, the ejection arm 45 pivots
20 clockwise about a shaft 47 as shown by a double-chain line in FIG. 2. A projection at the other end 48 of the ejection arm 45 abuts against an insertion edge 50 of the card 41, thereby pushing it in the direction to eject the card 41 from the connector 42.

25 Unfortunately, however, such a conventional manual loading/unloading mechanism has a security problem because even a card containing data of confidential nature can be freely ejected by simply actuating the ejection lever by anybody and at any time. Also, the
30 ejection may be effected while the compute is in access to the card, thereby destroying the data in the card and the computer. Additionally, the card loading stroke is large and there requires a relatively large insertion force to the connector. In other words, relatively poor
35 feeling to the operator to indicate when the card is fully inserted or loaded along with a possible biased

force to the card tends to accompany unduly strong force to be applied to the card, which may break or damage the card. It is therefore an object of the present invention to provide a unit capable of loading and
5 unloading a card reliably and smoothly by an electrical power.

In order to achieve the above subject, the loading/unloading unit for card media according to the present invention features in the provision of pushing
10 arms pivotally disposed adjacent to the card moving path in an engagable relationship with a card, a feeding roller rotating in abutment against the side surface of the card, and an actuation lever pivotally supported to the shaft of the rotary driving means of the feeding
15 roller and operating in energized by resilient means to push the feeding roller against the side surface of the card and in ganged manner with a switch.

Further provided are a gear chain to transmit an electrical driving force to the rotary means and a card
20 holder slidable in the card moving direction. The card holder includes card support legs to abut against the card to be loaded, a rack to engage the gear chain, and cam means in engagement with an extending portion of the rotary shaft of the feeding roller. Also provided is
25 resilient means for energizing in the unloading direction of the card holder. The pushing arm and the card holder are coupled to each other so that the pushing arm operates in accordance with the movement of the card holder.

30 Preferably, at least the pushing arms, the feeding roller and the driving force transmission gear chain are disposed at one side of the centerline of the card moving path, the direction of rotation of the feeding roller is chosen to the same as that of the pinion to
35 mate with the rack of the gear chain, and the feeding

roller is chosen to rotate faster than the pinion in the circumferential rotary speed.

The present invention having the aforementioned configuration operates as follows. The pushing arms
5 engage the trailing edge of the card to feed it into the connector in the read/write device when pushed at the rear end. After loading into the connector, the pushing arms remain engaged at the trailing edge to prevent the card from being rejected.

10 In other words, at the initial stage of the loading, the card to be inserted abut against the feeding roller at the side surface thereof. The card pivots the actuation lever against the resilient means to actuate the switch which initiates the driving
15 electrical power to be transmitted to the feeding roller by way of the gear chain. The card is moved toward the connector by the rotary force of the feeding roller and abuts against the card support legs at the leading edge of the card to move the card holder.

20 Since the mounted rack engages the pinion of the gear chain by the movement of the card holder, the card holder receives the driving force directly from the pinion for the movement. At this time, the cam means engaging the extension portion of the feeding roller
25 acts to separate the feeding roller from the side surface of the card.

As the card holder moves, the pushing arms pivoted to engage the trailing edge of the card holds the card at the rear end of the card to move as a unitary member
30 with the card holder and ultimately pushes the card into the connector.

Ejection of the card can be effected by moving the gear chain in the opposite direction. The pinion, then, drives the rack to move the card holder in the ejecting
35 direction. The card support legs hold the insertion

edge of the card to eject or extract it from the connector.

Also, by the time when the engagement between the rack and the pinion is released, the pushing arms move
5 in ganged with the movement of the card holder to release the engagement with the card by pivoting away from the moving path of the card. On the other hand, the feeding roller controlled by the cam means engages the side surface of the card. The resilient means to
10 energize the card holder in the ejecting direction assists disengagement between the rack and the pinion and also reliable engagement between the feeding roller and the side surface of the card.

The feeding roller brought into an engagable
15 condition with the side surface of the card is driven in the reverse direction to apply pressure to the card side surface by the resilient means of the actuation lever to move the card in the ejecting direction. When the card is ejected to a predetermined position, the feeding
20 roller is set completely free to pivot the actuation lever to actuate the switch which stops rotating the gear chain.

If the pushing arms, the feeding roller and the driving force transmission gear chain are disposed at
25 one side of the centerline of the card moving path, a pair of identical units for a pair of cards can be stacked in a back-to-back relationship or an axial symmetry. Also, if the feeding roller and the pinion are chosen to rotate in the same direction to each other
30 with the feeding roller rotating faster circumferential speed than the pinion, the pinion and the rack can be engaged and disengaged with high degree of reliability, thereby enabling smooth switching from the high speed, low torque driving by the feeding roller to the low
35 speed, high torque driving by the pinion.

Now, one embodiment of the loading/unloading unit of card media according to the present invention will be described by reference to the accompanying drawings. Shown in FIG. 1 is a simplified plan view of major parts of the mechanism of one embodiment of the present invention. In this embodiment, a card 12 manually brought to a guide 10 at the insertion edge 12a is electrically inserted to contact pins 22 of a connector 20 by a motor 16 by way of gear chain 18.

10 Represented by a reference numeral 24 is an actuation lever pivotally supported to a rotary shaft 28 of a driving gear 26 in a coaxial manner. The actuation lever 24 is biased counter-clockwise (in the direction of an arrow A in FIG. 1) for normally applying a pressure to an actuator 38 of a switch 36 by an action strip 34 of one arm 32 by using a coil spring 30. Rotatably mounted at the other arm 40 of the actuation lever 24 is a rubber roller 44 which is driven to rotate by a gear 42 engaging the driving gear 26.

20 Also, the rubber roller 44 is energized by the coil spring 30 to extend into the moving path of the card 12 so as to engage therewith. The rotary shaft 46 of the rubber roller 44 has an extended portion to engage a cam groove 54 in an arm 52 extending at the side portion of a bottom plate 50 of a card holder 48 so that the actuation lever 24 pivots as the cam groove 54 moves.

Mounted on the bottom plate 50 of the card holder 48 is a rack 56 in engagement with a pinion 58. Represented by 60 is an upper plate of the card holder 48 to be coupled to the bottom plate 50 by way of card support legs 62, 62 for supporting the leading or insertion end 12a of the card 12. The card holder 48 is energized by the card ejecting direction (shown by an arrow B) by a coil spring 68 between pins 64, 66 mounted on the upper plate 60 and the guide 10, respectively. Formed in the upper plate 60 are elongate holes 70a, 70b

for slidably receiving action pins 74a, 74b of the pushing arms 72a, 72b, respectively.

The pushing arms 72a, 72b are formed with elongate grooves or slots 76a, 76b and are energized in the ejection direction (arrow B) by coil springs 78a, 78b, respectively. Inserted in the elongate grooves 76a is an extension portion of the rotary shaft 28 of the driving gear. On the other hand, inserted in the elongate groove 76b is a fixed shaft 80. Accordingly, the pushing arms 72a, 72b are rotatably supported by the rotary shaft 28 and the fixed shaft 80 at one ends 82a, 82b in the elongate grooves 76a, 76b by the spring force of the coil spring 78a, 78a, respectively. Also, the pushing levers 72a, 72b are slidable along the rotary shaft 28 and the fixed shaft 80. Represented by 84a, 84b are hook portions integral parts of the pushing arms 72a, 72b and engagable with the trailing edge 12b of the card for hugging the card 12.

The gear chain 18 comprises a speed decreasing gear chain 18a from an output shaft of the motor 16 to the pinion 58 and a speed increasing gear chain 18b from the pinion 58 to the driving gear 26. For example, the pinion 58 and the rubber roller 44 rotate in the same direction in such a manner that the rubber roller 44 has a faster circumferential speed than the pinion 58 and are disposed at one side with respect to the centerline M-M of the card moving path.

In this embodiment as shown in FIGs. 1 and 2, a first unit 1 and a second unit 2 are identical to each other and stacked in the back-to-back manner to provide an axial symmetrical configuration for a pair of cards.

However, it is to be noted that the present invention is not limited to such particular configuration. Shown in FIG. 3 is a simplified view along the line III-III in FIG. 1, wherein represented by reference symbols S and G

are a card holder (retaining compartment) and a driving mechanism, respectively.

Now, operation of the loading/unloading unit for card media in the above embodiment will be described in detail. In FIG. 1, the card 12 is inserted into the entrance of the guide 10 at the insertion edge 12a. The rubber roller 44 engaging a corner 12c of the card 12 is depressed against the spring force of the coil spring 30. The actuation lever 24 rotates clockwise (shown by an arrow C) so that the action member 34 releases the actuator 38. Then, the switch 36 operates to drive the motor 16. The driving force of the motor 16 is transmitted to the rubber roller 44 by way of the pinion 58.

Initially, the rubber roller 44 rotates counter-clockwise (arrow D). Since the outer periphery of the rubber roller 44 is pushed against the side edge 12d of the card 12 by the coil spring 30, frictional force between the rubber roller 44 and the side surface of the card 12 moves the card 12 in the insertion direction (arrow E) toward the connector 20 as the rubber roller 44 rotates. When the leading edge 12a of the card 12 reaches the card support legs 62, the card 12 moves along with the card holder 48.

The rack 56 mounted on the bottom plate 50 of the card holder 48, then, engages the pinion 58 to grab the card 12 between the bottom plate 50 and the upper plate 60 by the card holder 48, thereby starting to move the card 12 by the driving force of the pinion 58.

Substantially simultaneously, the rotary shaft 46 of the rubber roller 44 is pushed by a sloped side 54a of the cam groove 54 in the bottom plate 50, thereby separating the outer periphery of the rubber roller 44 from the side edge 12d. This ensures that the circumferential speed of the rubber roller 44 does not interfere with the rotation of the pinion 58. At the initial stage of

switching from the high speed, low torque drive by the rubber roller 44 to the low speed, high torque drive by the pinion 58, two rotations of different speeds may overlap. However, the higher circumferential speed of
5 the rubber roller 44 only helps quicker engagement between the rack 56 and the pinion 58 and causes no adverse effect.

As the card holder 48 moves, the action pins 74a, 74b engaging respectively the elongate holes 70a, 70b in
10 the upper plate 60 actuate the pushing arms 72a, 72b. Since the pushing arms 72a, 72b pivot about the respective shafts 28, 80 at the ends 82a, 82b of the elongate grooves at the initial stage of movement, the hook portions 84a, 84b are brought into engagement with
15 the trailing edge 12b of the card 12.

Such engagement of the pushing arms 72a, 72b acts as the retention force for the card 12 when the freedom of rotation is lost. The pushing arms 72a, 72b slide with the shafts 28, 80 being guided along the elongate
20 grooves 76a, 76b against the tensile force of the coil springs 76a, 76b against the tensile force of the coil springs 78a, 78b as the card holder 48 moves, thereby moving the card 12 and the card holder 48 as a unitary member in the loading direction (arrow E). Ultimately,
25 the driving force of the low speed, high torque pinion 58 drives the hook portions 84a, 84b of the pushing arms 72a, 72b to push the card 12 at its trailing edge 12b until the loading edge 12a is forced to be inserted into the contact pins 22 in the connector 20 to complete the
30 loading or connecting operation (See FIG. 2).

When a need arises to eject or unload the card 12, the motor 16 is rotated in the reverse direction from a control panel or an appropriate program. The low speed, high torque pinion 58 drives the card holder 48 in the
35 ejecting direction (arrow B) by way of the rack 56. The card support legs 62, 62 hold the leading edge 12a of

the card 12 to extract the card 12 from the contact pins 22 in the connector 20. The pushing arms 72a, 72b move with the hook portions 84a, 84b engaged the trailing edge 12b of the card 12 during the movement in the effective length in the elongate grooves 76a, 76b. However, when the shafts 28, 80 hit the ends 82a, 82b of the elongate grooves 76a, 76b, the movement of the card holder 48 pushes the action pins 74a, 74b which slide in the inner surfaces of the elongate holes 70a, 70b, thereby pivoting the pushing arms 72a, 72b. As a result, the engagement between the pushing arms 72a, 72b with the trailing edge 12b of the card 12 is released to establish the moving path for the card 12.

As a result of the movement in mutual position of the rack 56 and the pinion 58 to disengage therebetween at the final stage of movement, the rotary shaft 46 of the rubber roller 44 held at the linear portions 54c of the cam groove 54 in the bottom plate 50 is set free by way of the sloped side 54a and the pocket 54b in the cam groove 54 by the movement of the card holder 48. The outer periphery of the rubber roller 44 is pressed against the side edge 12d of the card 12 by the energizing force of the coil spring 30. The coil spring 68 assists smooth switching from the low speed drive by the pinion 58 to the high speed drive by the rubber roller 44.

Subsequently, the card 12 is ejected by the rotation of the rubber roller 44 which becomes free at the complete unloaded position as illustrated in FIG. 1. The actuation lever 24 pivots by the force of the coil spring 30 and the action member 34 pushes the actuator 38 to actuate the switch 36, thereby stopping the motor 16. At this stage, the card 12 can be removed easily by hand.

As described hereinbefore, the loading/unloading unit for card media according to the present invention

features in driving the card by electrical power,
thereby enabling to control by software using a
password, thereby providing security to any confidential
information stored in the card. Also, the particular
5 configuration of positioning the card loading/unloading
mechanism on the same plane as the card enables to
realize a compact design of such units for a pair of
cards by disposing the mechanism at one side of the
card. Additionally, the use of separate systems of
10 different speeds for the pull-in mechanism to bring the
card media to the front position of the connector and
the driving mechanism to electrically engaging the card
media with the contact pins achieves quicker pull-in
operation and reliable engagement with improved
15 operational feeling of the unit.

FIG. 1 is a plan view of one embodiment of the
loading/unloading unit for card media according to the
present invention in the modes of fully loading and
unloading the card media.

20 FIG. 2 is a plan view of the unit in FIG. 1 in the
fully loaded mode of the card media into the connector.

FIG. 3 is a simplified front view along the line
III-III in FIG. 1.

FIG. 4 is a plan view of a conventional
25 loading/unloading unit for card media.

We Claim:

1. A loading/unloading unit for card media for loading and unloading a card media to a read/write apparatus, comprising a pushing arm pivotally disposed adjacent to a moving path of a card media and engagable with the card media; an actuation lever supporting a feeding roller rotating in contact with a side surface of the card media and operating in ganged relationship with a switch by being energized in the direction to push said roller to the side surface of the card media by resilient means rotatably supported on the shaft of the driving rotary means of said feeding roller; a gear chain to transmit an electrical power to said rotary means; a card holder slidable in the direction of movement of the card media and provided with card support legs to abut against the card media to be inserted and a rack to mate with said gear chain and also having cam means to engage an extension portion of the rotary shaft of said feeding roller; and resilient means to energize said card holder in the ejecting direction; wherein said pushing arm and said card holder are coupled together in such a manner that said pushing arm operates in ganged relationship with the movement of said card holder.

2. The loading/unloading unit for card media in claim 1, wherein at least said pushing arm, said feeding roller, and said driving force transmission gear chain are disposed at one side of the centerline of the moving path of the card media.

3. The loading/unloading unit for card media in claim 1 or 2, wherein the directions of rotation of said feeding roller and the pinion to engage said rack of said gear chain are the same with each other, and the circumferential rotary speed of said feeding roller is chosen to faster than that of said pinion.

