March 18, 1969 TAKEO ASADA 3,433,475

AUTOMATIC TICKET GATE

Filed Oct. 3, 1967 Sheet 1 of 2

FIG.1.

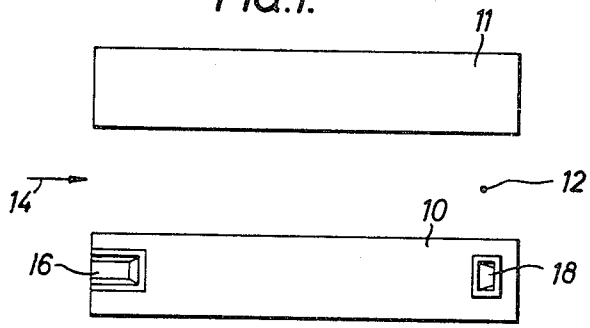


FIG.2.

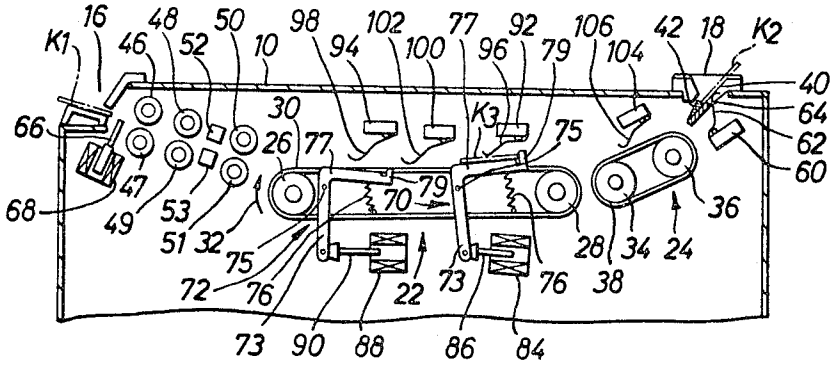
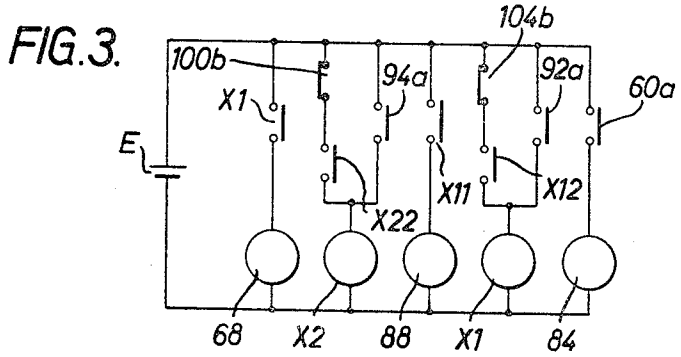


FIG.3.



INVENTOR
TAKEO ASADA
BY Christensen, Hanson & Matthews
ATTORNEYS

March 18, 1969 TAKEO ASADA 3,433,475

AUTOMATIC TICKET GATE

Filed Oct. 3, 1967

Sheet 2 of 2

FIG. 4.

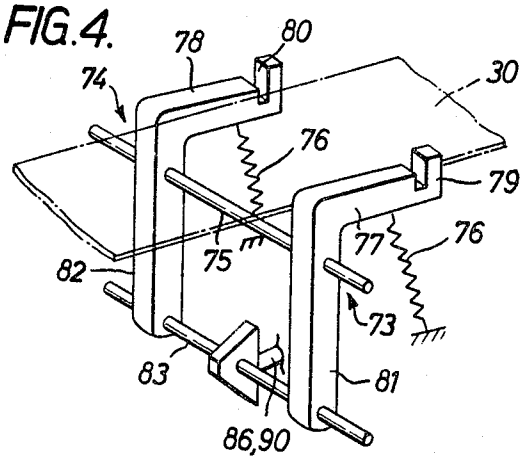


FIG. 5.

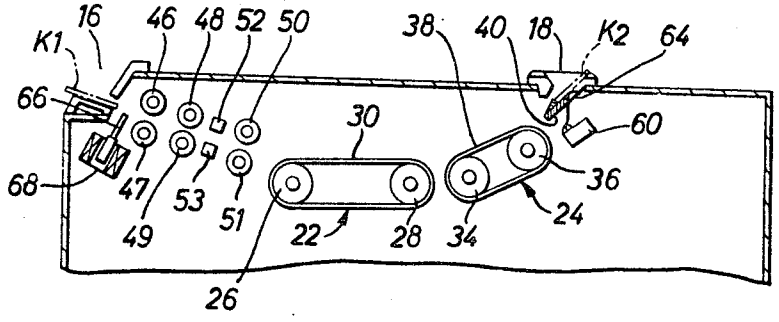
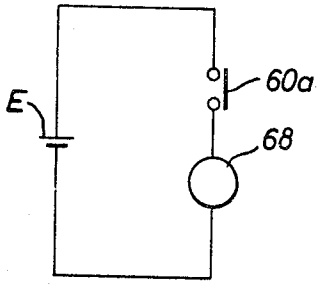


FIG. 6.



INVENTOR
TAKEO ASADA
BY Christensen, Sanborn & Matthews
ATTORNEYS

United States Patent Office 3,433,475
Patented Mar. 18, 1969

3,433,475

AUTOMATIC TICKET GATE

Takeo Asada, 22–5 Taikoyama, Okukaiinji, Nagaoka-cho, Otokuni-gun, Kyoto, Japan

Filed Oct. 3, 1967, Ser. No. 672,586
Claims priority, application Japan, Oct. 11, 1966, 41/67,076
U.S. Cl. 271—57 4 Claims
Int. Cl. G07b 11/02

ABSTRACT OF THE DISCLOSURE

A device for an automatic ticket gate having ticket conveying means between an inlet and outlet. A means between the inlet and outlet for checking the validity of the ticket. A stopper means movable into the path of travel of the ticket to stop the movement of a sequent ticket until the preceding ticket has been removed from the outlet.

This invention relates to an automatic ticket gate, and more particularly to improvements in the manner in which the ticket is conveyed from a ticket inlet to a ticket outlet slot of the gate.

There is known an automatic ticket gate, which comprises a pair of opposed elongated structures defining the opposite sides of a gateway to and from an area to which admission is restricted to a bearer of a specific ticket or card. Any person who wishes to pass through the gate is supposed to insert his ticket into an inlet slot formed at one end of one of the structures. The ticket is checked with respect to its validity by a suitable device enclosed in the structure and then returned to the bearer from an outlet slot formed in the opposite end of the structure. If the ticket inserted has been recognized false or invalid, the gate is closed and/or an alarm is sounded to summon a station employee in charge of the gate.

The ticket inserted into the inlet slot is conveyed within the structure onto the outlet slot. If the gate is so arranged as to accept many passengers in rapid succession, each of them must receive his own ticket again and not ony other person's from the outlet slot.

In one prior art arrangement, a ticket inserted into the inlet slot is checked as it is being conveyed through the structure and then temporarily stored below the outlet slot until the owner of that ticket comes near the outlet slot, ready to pick up the ticket therefrom. If a succeeding ticket comes while the previous one is still stored, the former will piled upon the latter. In that case, the stored ticket are sent out in the order they have been piled, that is, the lowest one is sent out first. Indeed, the arrangement greatly has improved the passage efficiency of a gate, but involves some difficulties. Suppose, for example, that a passenger who inserted a ticket into the inlet slot forgets to pick it out of the outlet slot. The ticket will remain in the outlet slot and when a succeeding passenger comes, his ticket will be sent out together with the previous one. Consequently, he may have to pick up the two tickets and cannot immediately tell which is his own.

Accordingly, the primary object of the invention is to provide an automatic ticket gate in which unless the previous ticket that peeps out of the ticket outlet slot of the gate is picked up therefrom, the succeeding one cannot reach the outlet slot, so that there will be no possibility of a plurality of tickets remaining in the outlet slot ready to be picked up together.

The automatic ticket gate of the invention comprises at least one elongated structure defining one side of a

gateway. The structure is provided with a ticket inlet at one end thereof and a ticket outlet at the opposite end thereof. The ticket that has been inserted into the inlet is conveyed by a suitable means onto the outlet, during the course of which the validity of the ticket is checked.

The characteristic of the invention is the provision of at least one ticket stopping or arresting means between the ticket inlet and outlet. The stopping means is so designed and arranged that it remains inoperative, that is, it does not stop any succeeding ticket so long as there exists no previously inserted ticket in the outlet, but that it becomes operative, that is, it gets ready to stop or arrest any succeeding ticket when there exists a previously inserted ticket in the outlet yet to be picked up. As many stoppers or arresters as are desired may be provided, depending upon the distance between the ticket inlet and outlet. One stopper may take the form of a door placed just inside the ticket inlet so as to open and close the inlet. Another may take the form of a hooked lever mechanism arranged alongside a ticket conveyed belt. Preferably, the stopper is such that it can hold or stop a single ticket at one time.

In case there are provided a plurality of stoppers, the arrangement must be such that each of them is conditioned ready to stop a succeeding ticket when the stopper just in front of it has stopped a previously inserted ticket, and that once they have stopped a ticket, they are restored to the original inoperative condition only when the previous ticket has been picked out of the outlet or released from the stopper just in front of them.

The invention will be better understood from the following detailed description of some preferred embodiments thereof with reference to the accompanying drawings, wherein like reference numerals denote like parts and wherein:

FIG. 1 is a schematic plan view of the automatic ticket gate of the invention;

FIG. 2 is an enlarged, longitudinal section of one of the gateway defining structures of FIG. 1, showing the interior mechanism somewhat schematically;

FIG. 3 is a circuit diagram of the electrical control for the mechanism of FIG. 2;

FIG. 4 is a fragmentary perspective view of the principal portion common with the two stoppers shown in FIG. 2;

FIG. 5 is a view similar to FIG. 2, but showing another emobdiment of the invention; and

FIG. 6 is a circuit diagram of the electrical control for the mechanism of FIG. 5.

Referring first to FIG. 1, there are shown an opposed pair of elongated structures **10** and **11** defining the opposite sides of a gateway **12** to and from, for example, a platform of a railway station. Passengers are supposed to pass through the gate in the direction of an arrow **14**. A ticket inlet slot **16** is formed in the top wall of the structure **10** at one end (left-hand end in FIG. 1) thereof and a ticket outlet slot **18**, in the same top wall at the opposite end thereof. In the illustrated embodiment, the other structure **11** only serves to define the opposite side of the gateway **12**. However, it may be of the same construction as the structure **10** and perform the same function for another gateway which may be formed at the other side of the structure **11**.

Turning to FIG. 2, the structure **10** houses a first conveyer means **22** and a second conveyer means **24**. The first conveyer means comprises an endless belt **30** passing about a pair of pulleys **26** and **28**. A suitable drive connection to a motor, not shown, rotates the pulleys clockwise as indicated by an arrow **32**, thereby causing the belt **30** to run in the same direction. The inserted ticket is conveyed by the belt **30** onto the second conveyer,

which carries the ticket as far as just below the outlet slot **18**. The second conveyer **24** also comprises an endless belt **38** passing around a pair of pulleys **34** and **36** ganged with the pulleys **26** and **28** so as to rotate in the same direction.

The ticket that has been brought under the outlet slot **18** is caused to be hurled upwardly onto a sloping plate **40**, with its rear or lower end resting on a projection **42** formed on the lower end of the plate **40**, so that the ticket is held there, with its forward or upper end peeping out of the outlet slot **18** ready to be pulled out therefrom.

The ticket that has been inserted into the inlet slot **16** is further drawn in by means of a pair of rollers **46** and **47** and then **48**, **49** and **50**, **51**. When the ticket has its forward and rear ends nipped by the rollers **48**, **49** and **50**, **51**, respectively, a ticket checker (**52**, **53**) reads the information recorded on the ticket as it passes by and checks its validity. The information may be recorded in the form of punched holes arranged in a predetermined code. The ticket checker may comprise a light source **52** and a photoelectric device **53** which operates in response to the light passing through the punched holes in the ticket. The ticket that has passed the ticket checker is then brought onto the first conveyer belt **30**.

Below the outlet slot **18** there is provided a ticket detector **60** for detecting the presence of a ticket on the plate **40**. The detector may be a microswitch provided with an actuating lever **62** having its forward end peeping out of an aperture **64** formed in the plate **40**. When a ticket has been placed on the plate **40**, it pushes the actuating lever **62**, thereby actuating the microswitch **60**.

Just inside the inlet slot **16** there is provided a door or barrier bar **66** adapted to be driven by a solenoid **68**. When the solenoid has been energized in the manner to be described hereinafter, the door closes the slot **14** thereby preventing insertion of a ticket therethrough.

A pair of ticket stoppers or arresters **70** and **72** are provided for stopping or arresting a ticket as it is being conveyed on the first conveyer belt **30**. The two stoppers are of the same construction and as shown in detail in FIG. 4 comprise a pair of bell-crank levers **73** and **74** which are pivotable about a common fixed shaft **75**. The levers **73** and **74** are biased clockwise about the shaft **75** by means of a pair of coil springs **76**. In this biased position, the levers have their respective horizontal arms **77** and **78** with their stopper ends or hooks **79** and **80** held below the level of the upper surface of the belt **30**. The vertical arms **81** and **82** of the levers **73** and **74** are rigidly connected by a shaft **83** for simultaneous movement. To the shaft **83** is secured a plunger designated by **86** in the first stopper **70** and by **90** in the second stopper **72**. Solenoids **84** and **88**, when energized, pull in the plungers **86** and **90**, respectively, whereupon the levers **73** and **74** are turned counterclockwise against the biasing force of the coil springs **76**, until the horizontal arms **77** and **78** with its hooks **79** and **80** are raised above the level of the belt **30**, so that any ticket thereon is arrested by the hooks and raised from the belt surface.

A detector **92** is provided to sense the ticket that has been arrested and raised by the first stopper **70** and another detector **94**, to sense the ticket that has been caught and raised by the second stopper **72**. In the illustrated embodiment, each detector is shown as a microswitch having actuating levers **96**, **98** so arranged that a ticket arrested and raised by the stopper levers pushes the levers **96**, **98** thereby actuating the microswitches **92**, **94**.

A detector **100** is provided between the first and second stoppers **70** and **72** for detecting the passage of a ticket thereby. Here again, a microswitch may be used as the detector and have an actuating lever **102** adapted to be pushed by a ticket on the belt **30**.

Still another detector **104**, which may also be a microswitch as shown, is provided to detect the ticket being conveyed by the second conveyer belt **38**. The microswitch has an actuating lever **106** adapted to be pushed by the ticket on the belt **38** so as to actuate the microswitch.

Suppose a ticket K1 has been inserted into the inlet slot **16**. The ticket is passed through the checker (**52**, **53**) and then conveyed by the first and second conveyers and finally brought onto the sloping support plate **40** in the outlet slot **18** as shown at K2. Here on the plate **40**, the ticket pushes the actuating lever **62** of the microswitch **60**, whereupon its normally open contact **60***a* (FIG. 3) is closed. This causes an electric current to be supplied from a source E to the solenoid **84**. Upon energization of the solenoid, the first stopper **70** operates, that is, the hooked levers **73** and **74** are simultaneously turned counterclockwise about the fixed shaft **75** against the biasing force of the springs **76**, so as to bring the first stopper **70** into a raised position ready to stop a ticket coming on the belt **30**.

Under the condition, when the ticket K2 has been pulled out of the outlet slot **18**, the microswitch **60** is restored so as to deenergize the solenoid **84**, thereby restoring the stopper **70** to its original lowered inoperative position.

However, if another ticket has been inserted into the inlet slot before the ticket K2 has been pulled out of the outlet slot, the new ticket will be arrested by the first stopper as shown at K3, so that it will not be conveyed as far as the outlet slot **18** to be piled upon the previous ticket K2. The ticket K3 as arrested by the first stopper **70** actuates the microswitch **92** to close its normally open contact **92***a*, whereupon a relay X1 (FIG. 3) is energized to close its contact X11 thereby to energize the solenoid **88**. This conditions the second stopper **72** ready to arrest any ticket coming on the belt **30**, as will be easily understood from the foregoing description.

Suppose that the ticket K2 in the outlet slot **18** has been pulled out therefrom while the ticket K3 is being arrested by the first stopper. Then the switch **60** is restored, so that the solenoid **84** is deenergized and, consequently, the first stopper **70** is lowered down to its original inoperative position below the level of the surface of the belt **30**. This places the ticket on the horizontal lever arms **77** and **78** of the first stopper onto the running belt **30**, which then conveys the ticket onto the second belt **38**. While the ticket is being conveyed on the second belt, it actuates the microswitch **104**. Until that time, the relay X1 has been kept energized through its own self-holding contact X12 and the normally closed contact **104***b* of the microswitch **104**. However, when the switch **104** has been actuated in the above manner, its normally closed contact **104***b* is opened As a result, the relay X1 is deenergized to open its contact X11 that has been kept closed. This deenergizes the solenoids **84**, thereby restoring the original inoperative condition of the second stopper **74**. However, when the ticket that actuated the switch **104** has arrived at the outlet slot **18** to lie on the sloping plate **40**, the switch **60** is actuated as previously mentioned, so that the solenoid **84** is energized and consequently the first stopper **70** is raised into the operative position ready to stop a ticket coming on the belt **30**.

Mention has already been made that when a ticket exists in the outlet slot **18** and at the same time a succeeding ticket is on the first stopper **70**, the second stopper is in its raised operative position ready to stop a following ticket coming on the belt **30**. Under the condition, if a third ticket has been inserted into the inlet slot **16**, the ticket will be arrested by the second stopper **72**. This ticket on the second stopper actuates the microswitch **94** to close its normally open contact **94***a*. This causes a relay X2 to be energized, whereupon its normally open contact X21 is closed to energize the solenoid **68**, which moves the door **66** to close the inlet slot **16**, thereby preventing insertion any more ticket therethrough.

When the ticket K3 that has been caught by the first stopper **70** is released, it is conveyed by the belt **30** onto the second belt **32**, on which the ticket actuates the switch **104**, thereby deenergizing the solenoid **88**, as previously

mentioned. This restores the second stopper **72** to its original inoperative condition, so that the third ticket on the stopper **72** is placed on the conveyor belt **34**. As the ticket is conveyed by the belt **34**, it actuates the microswitch **100** to open its normally closed contact **100***b*. Until the opening of this contact, the relay X2, once energized, is kept so by the contact **100***b* and the self-holding contact X22 of the relay X2. However, upon opening of the contact **100***b*, the relay X2 is deenergized. This opens the contact X21, thereby deenergizing the solenoid **68**, whereupon the door **66** opens the inlet slot **16** for insertion of a ticket.

Thus, when all the ticket stoppers are stopping a ticket, insertion of any more ticket into the inlet slot is prevented, while so long as any one of the stoppers is not holding any ticket, the inlet slot remains open.

The arrangement of FIG. 2 includes three stoppers including the one **66** just inside the inlet slot. There may be provided as many of them as occasions requires. If the distance between the inlet and outlet slots **16** and **18** is so great that before the previous passenger who has inserted his ticket into the inlet slot arrives at the outlet slot, a following passenger may insert his ticket into the inlet slot, there may be provided as many stoppers as the distance requires. However, if the distance is so short that only a single passenger exists in the distance at one time, the stopper at the inlet slot will suffice.

FIGS. 5 and 6 shows an arrangement for the latter case. Here, when the ticket K2 has arrived at the outlet slot **18**, it actuates a microswitch **60** to close its normally open contact **60***a*. This energizes a solenoid **68**, which drives the door **66** to close the inlet slot **16**. Under the condition, when the ticket K2 has been pulled out of the outlet slot **18**, the switch **60** is restored and the solenoid **68**, deenergized so that the door **66** opens the inlet slot **16**. However, so long as the previous ticket K2 remains in the outlet slot, the inlet slot is kept closed, thereby preventing insertion of any ticket thereinto.

Having illustrated and described some preferred embodiments of the invention, it is understood that they are merely representative and that there may be many changes and alterations within the scope of the invention as defined in the appended claims. For example, instead of being supported by the sloping plate **40**, the ticket may completely come out of the outlet slot **18** to rest horizontally on the top wall of the structure **10** near the outlet slot, with necessary changes in the arrangement of the microswitch **60**, etc. which will be apparent to those who have read the foregoing specification.

What I claim is:

1. In an automatic ticket gate comprising a structure defining a gateway at one side thereof and having a substantial length therealong, a ticket inlet formed in said structure at one end thereof, a ticket outlet formed in said structure at a distance spaced from said ticket inlet, means for conveying said ticket inserted through said inlet onto said outlet, means for supporting said ticket that has come out of said outlet and means for checking the validity of tickets inserted through said inlet; ticket stopping means provided in said structure between said ticket inlet and outlet and being capable of an operative condition ready to stop a ticket and an inoperative condition not to stop any ticket; and control means for bringing said stopping means into said operative condition to remain so so long as there exists a previously inserted ticket in said outlet, and alternatively into said inoperative condition to remain so so long as there exists no previously inserted ticket in said outlet.

2. The device of claim **1**, wherein said ticket stopping means comprises a plurality of stoppers arranged one after another in the direction in which a ticket inserted into said inlet is conveyed by said conveying means to said outlet, each of said stoppers being so arranged that it is brought into the operative condition when the stopper just in front of it has stopped the previously inserted ticket, and that each said stopper that is in the operative condition is restored to the inoperative condition after said stopper just in front of it has released said previous ticket it has been holding, and wherein that one of said stoppers that is disposed nearest to said outlet is so arranged that it remains in the operative condition ready to stop a succeeding ticket so long as there exists a ticket in said outlet, and in the inoperative condition to pass a succeeding ticket so long as no ticket exists in said outlet.

3. The device of claim **2**, wherein one of said stoppers is disposed near said inlet and so arranged that it keeps said inlet closed so long as there exists a ticket in said outlet and keeps said inlet open so long as no ticket exists in said outlet.

4. The device of claim **1**, wherein said stopping means includes a member so disposed near said inlet that it keeps said inlet closed while there exists a previous ticket in said outlet and keeps said inlet open so long as there exists no previously inserted ticket in said outlet.

References Cited

UNITED STATES PATENTS

3,147,970	9/1964	Davidson	271—57
3,283,163	11/1966	Folmar	271—57

RICHARD E. AEGERTER, *Primary Examiner.*