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[54] **CONTROLLABLE TURNSTILE**

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[52] **U.S. Cl.** **49/46,** 188/82.2, 188/82.3, 188/82.7

[51] **Int. Cl.** **E06b 11/08**

[58] **Field of Search** 188/82.2, 82.3, 82.34, 82.4, 188/82.7; 49/46, 47; 192/43.1, 46

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[57] **ABSTRACT**

This invention describes a controllable turnstile for allowing metered movement in either of two directions. A cogwheel assembly is located on the same shaft as a turnstile and is controlled by a pair of separately operated pawls. A push pawl prevents counterclockwise rotation, but allows clockwise rotation whereas a pull pawl prevents clockwise rotation, but allows counterclockwise rotation. Each pawl is biased by a spring into an undetented position and is normally held in a detented position by the application of power to a pair of separately controllable solenoids. In the absence of power both pawls are released and the turnstile is free wheeling in either direction.

2 Claims, 4 Drawing Figures

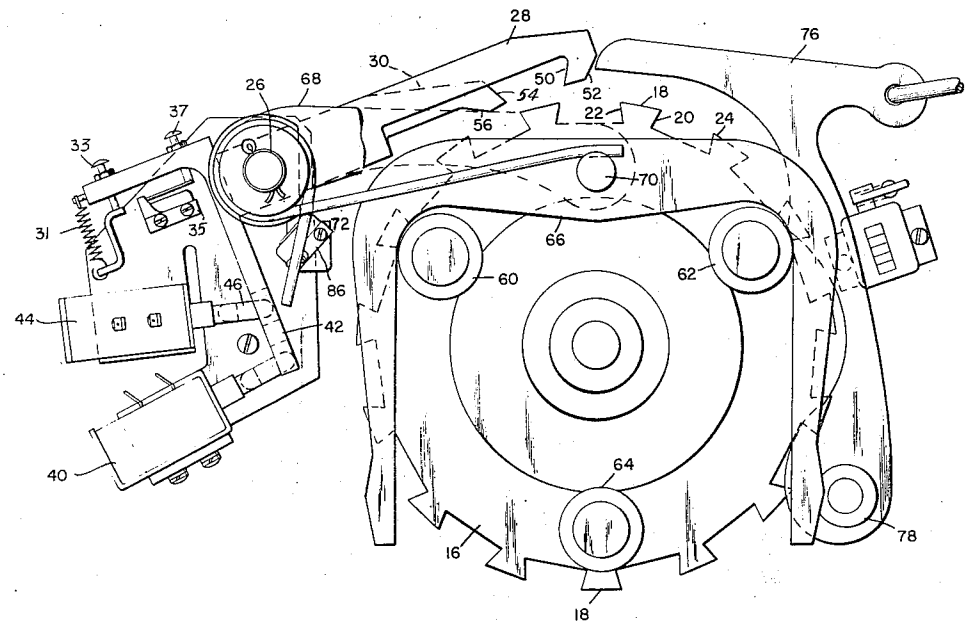


Fig. 4.

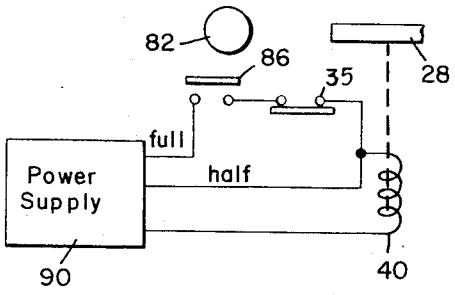
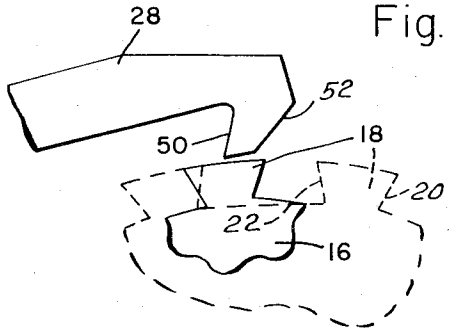


Fig. 3.



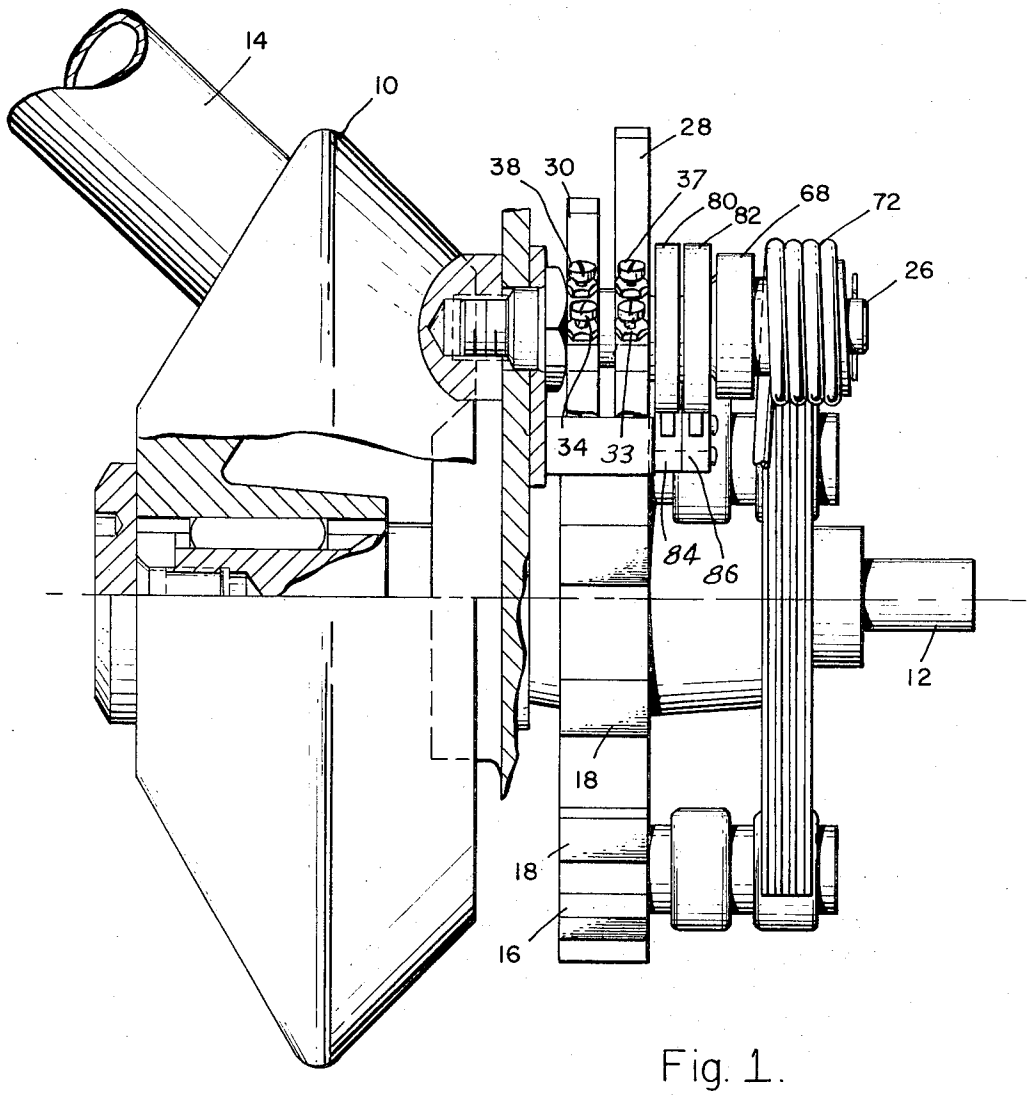


Fig. 1.

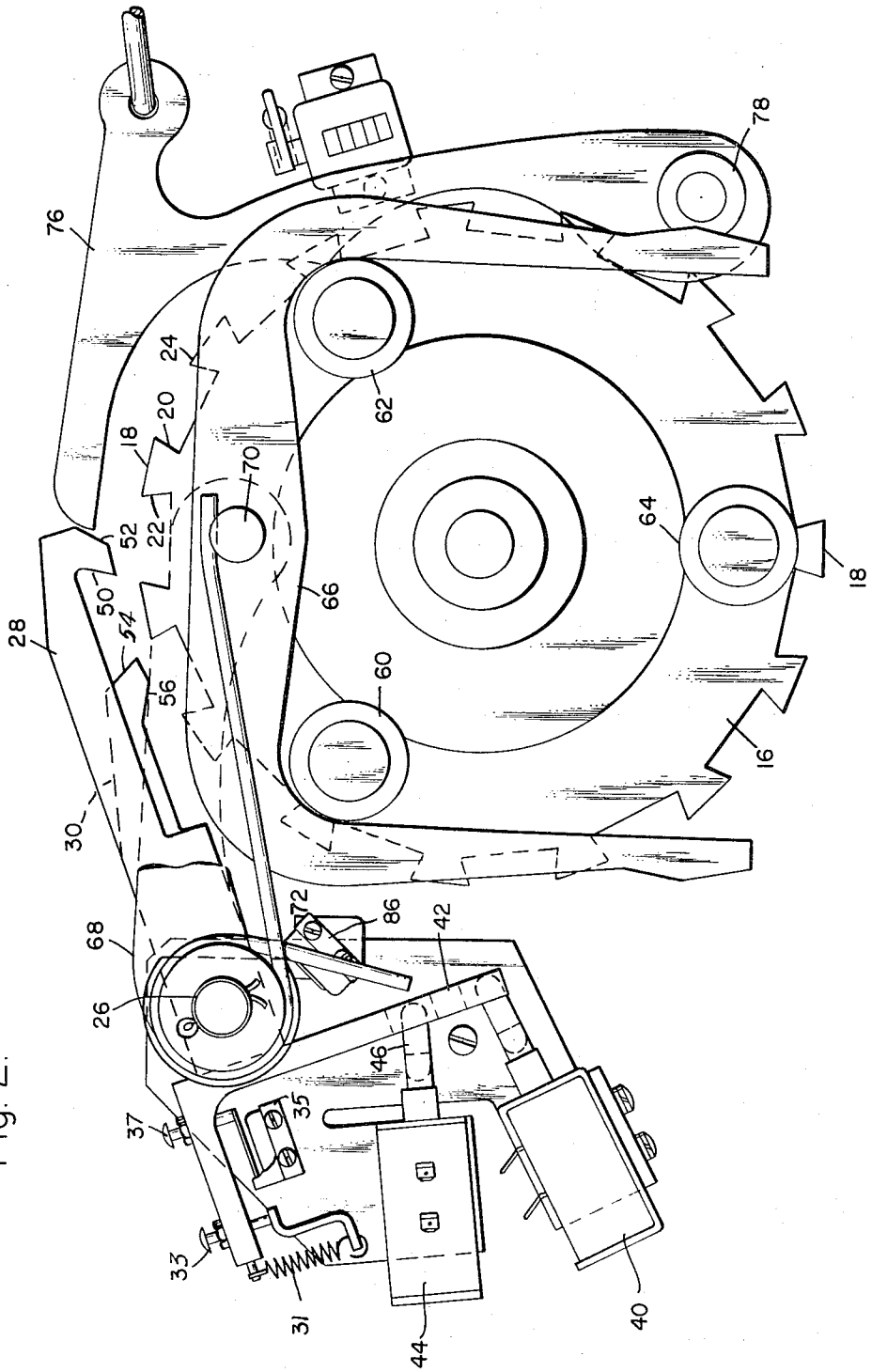

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Fig. 2.

CONTROLLABLE TURNSTILE

This invention relates to a controllable turnstile and more particularly to a turnstile that is controllable in either of two directions.

The present invention is concerned primarily with controlling the entrance and exit to a rapid transportation system where passengers have the capability of purchasing prepaid tickets to a plurality of different destinations. The turnstile is made to respond to logic means which interrogates the ticket and the determines the validity of the ticket in order to meter the passage of the passenger into the systems. Similarly the ticket must again be interrogated to determine the validity of the ticket as actually used by the passenger, by comparing the point of departure of the customer and the kind of ticket being presented. Should the logic associated with the turnstile determine that the ticket is valid for the trip actually made, the turnstile mechanism will be impulsed to allow the passenger to exit from the transportation system.

It can be appreciated therefore that the turnstile mechanism must be capable of allowing passage in either of two directions independently and under separate control.

In the prior art turnstile mechanisms have achieved control in a given direction only. Rotation in the opposite direction was usually not a requirement since most prior art systems were limited to a fixed charge for use of the complete transportation system and hence, it was only necessary to meter access to the system and allow free exit. In such systems, a simple ratchet or spring loaded keeper device would be sufficient to allow free exit through the same turnstile.

The modern turnstile operating with prepaid tickets having a plurality of traveling options is expected to operate in unattended areas. The turnstile must maintain positive control. In addition it is necessary for safety purposes that in the event of an emergency or power failure that the turnstile become free wheeling in both direction.

The present invention describes a simple, fool-proof mechanical turnstile that is separately controllable in either direction and is securely locked when not in use so as to prevent movement of the turnstile without the insertion of a proper valid ticket. In the event of a fire occasioned by a power loss the turnstile becomes automatically free wheeling in either direction thereby allowing passengers to exit from the system and also to allow emergency personnel to immediately enter the system whenever their services are required.

In the present invention there is described a rotatable shaft having a cog tooth wheel assembly on one side and a plurality of spaced apart tubes for passenger control on the other side. In the conventional configuration three tubes are used for a complete revolution to thereby meter the passage of three passengers for one revolution of the shaft. A first push pawl has a leading edge for contacting one edge of a single cog to prevent rotation of the shaft in a counterclockwise direction and a cammable trailing edge adapted to be cammed by the cogs should the shaft be rotated in a clockwise direction. Similarly a separate pull pawl has a leading edge for contacting the other side of a single cog so as to prevent clockwise rotation of the shaft and a cammable trailing edge adapted to be cammed out of position by the cogs should the shaft be rotated in a counterclockwise direction.

Both pawls are individually controlled by separate solenoids that hold each pawl in a detented position against a spring action to thereby lock the shaft from rotating in either direction. A signal indicating an allowable clockwise rotation of the shaft will result in the solenoid controlling the pull pawl to be de-energized thereby allowing the pull pawl to be raised by the spring action which allows the shaft to rotate one-third of a revolution. A rotating cam operated upon by the cog assembly closes a switch which applies full power to the solenoid causing it to fully detent and lock the cog wheel from moving. The fully detented position of the pawl is detected by a second switch which removes full power from the solenoid and applies only half power which is all that is necessary to maintain either pawl in a locked position. It has been recognized that the power necessary to fully detent a pawl is greater than the power necessary to maintain the pawl in a detented position.

Similarly should the logic equipment associated with the gate control indicate that a proper counterclockwise rotation of the cog wheel is desired then the solenoid holding the push pawl will be de-energized allowing the biasing spring to raise the push pawl from the cogs. Passenger rotating of the turnstile will rotate the shaft and the cog wheel. One-third of a revolution later a second cam will close and an associated switch will apply full power to the solenoid controlling the push pawl which will fully detent the push pawl and lock the cog wheel against rotation in either direction.

As mentioned previously seating of the push pawl will close a second switch which will remove full power and maintain a half power condition for holding the pawls in a detented position awaiting the next action by a passenger.

The cog wheel has three bearings located on one side of the cog wheel for defining an equalateral triangle. A generally U-shaped homing device controlled by a spring loaded riser arm is used to provide a stiff action to the turnstile mechanism. Movement of the turnstile and the cog wheel will cause the bearing members to rotate causing the homing device to move in an up and down direction against the action of the spring loaded riser arm. Movement of the riser arm causes the shaft containing the cams to rotate which in turn controls the switches for applying full power to the individual solenoids.

Further objects and advantages of the present invention will be made more apparent by referring now to the accompanying drawings wherein:

FIG. 1 is a side view of the turnstile mechanism constructed in accordance with the teachings of the present invention;

FIG. 2 is a rear view illustrating the cog wheel assembly shown in FIG. 1;

FIG. 3 illustrates the timing position between the cog teeth and the cams; and

FIG. 4 illustrates the application of full power for detenting the pawls.

Referring now to FIG. 1 there is shown a triangulated hub assembly **10** mounted on a shaft **12** for holding a plurality of turnstile tubes **14** adapted to meter the passage of passengers through a suitable gate opening. Upon the presentation of valid ticket the turnstile mechanism is enabled thereby allowing the exertion of pressure on any tube **14** to rotate the hub **10** resulting in a rotation of shaft **12.**

Mounted on a side opposite the hub **10** is a cog wheel **16** having a plurality of cogs **18** located on the periphery thereof. In the preferred embodiment the number of cogs is a multiple of the number of passenger tubes **14** located in the hub **10.** In the present embodiment there are **15** cogs thereby allowing the passage of five cogs for each one-third rotation of the shaft **12** which is indicative of the passage of one passenger through the turnstile.

The individual cogs **18** have sides **20** and **22** that are preferrably at an angle to the land portion **24** which angle is less than 90°. The sides **20** and **22** of each of the cogs **18** could be vertical, however, experience has shown that the security of the turnstile mechanism is immeasurably increased by having a slight angle that is less than 90°.

Located on one side of the rotating cogwheel **16** is a shaft **26** for holding a first pull pawl **28** and a push pawl **30.** Both the push pawl **30** and the pull pawl **28** are free to rotate about shaft **26** and are not otherwise attached to the shaft. Each of the pawls **28** and **30** is spring loaded in a normally disengaged position as shown in FIG. **2** by means of a pair of springs **31** and a second spring (not shown). Clearance between the individual pawls **28** and **30.** and the cogwheel teeth **18** is provided by means of adjusting screws **33** and **34** located on each of the pawls. A pair of normally closed switches **35** and one not shown, one for each pawl **28** and **30,** is controlled and operated by a pair of screws **37** and **38** located on each pawl for opening normally closed switches **35** and **36** respectively whenever the individual pawl is completely detented in the cogwheel assembly. The function of switches **35** and **36** is to disconnect the full power applied to the solenoids after the pawls have been fully detented. This function will be described in more detail in connection with FIG. **4.**

Pawl **28** is controlled by a solenoid **40** in such a manner that energizing the solenoid pulls lever **42** which is attached to the pawl **28** thereby causing the pawl to rotate about the shaft **26** and contact the cogwheel assembly **16.**

In a similar manner, solenoid **44,** when energized will pull linkage **46** attached to the push pawl **30** thereby causing the pawl to rotate about shaft **26** and contact the cogwheel assembly **16.** The operating end of the pull pawl **28** is shaped in the form of a hook having a leading edge **50** adapted to contact the edge **20** of a cog **18** so as to prevent clockwise rotation of the cogwheel assembly **16.** Opposite the leading edge **50** is a trailing edge **52** having a cammable surface adapted to be contacted by side **22** of the cog **18** so as to cam the pull pawl **28** when the cogwheel assembly **16** is rotated in a counterclockwise direction. It can be appreciated therefore that the pull pawl **28** when energized will therefore prevent clockwise rotation of the cogwheel assembly **16,** but will otherwise not interfere with counterclockwise rotation since the pull pawl **28** will be cammed out of position during the counterclockwise rotation.

A review of the push pawl **30** will show a leading edge **54** adapted to contact edge **22** on a cog **18.** With the push pawl in a detented position the leading edge **54** will contact edge **22** of cog **18** and prevent counterclockwise rotation of the cogwheel assembly **16.** On the side opposite the leading edge **54** on the push pawl **30** is a trailing edge **56** having a cammable surface adapted to be cammed by the surface **20** of a cog **18** when the push pawl **30** is in a detented position. Hence, with the push pawl **30** detented the cogwheel assembly is prevented from rotating in a counterclockwise direction but is free to rotate in a clockwise direction.

The operating mode for the turnstile assembly is for both solenoids **40** and **44** to be energized thereby causing the pull pawl **28** and the push pawl **30** to be fully detented. In this position clockwise rotation of the cog wheel assembly **16** is prevented by means of the contacting of the leading edge **50** on the pull pawl against edge **20** of the cog **18.** Counterclockwise rotation of the cog wheel assembly is prevented by the leading edge **54** of the push pawl **30** contacting the edge **22** of the cog tooth **18.** Since the push pawl **30** and the pull pawl **28** are side by side, the operating surfaces could work on the same tooth segment or in adjoining segments as illustrated in FIG. **2.** As will be explained in connection with FIG. **4,** full power is only applied to solenoids **40** and **44** during the initial detenting of the pawls **28** and **30** and, once detented, only half power is applied to hold them in the detented position.

The operation of the turnstile is restrained against a free-wheeling action when in the operating mode by means of three equally spaced rollers **60, 62,** and **64** located on the side of the cog wheel assembly **16.** The number of rollers is determined by the number of turnstile tubes **14** located in the hub **10.** A homing device **66** shaped in the general form of a U is adapted to contact two of the rollers at any given time as the cog wheel assembly **16** is rotated. The homing device **66** is centrally supported by a riser arm **68** pivoted at one point on shaft **26** and at the other point on shaft **70** that is fixedly attached to the central position of the homing device **66.** A compression spring **72** is wrapped around the shaft **26** and contacts shaft **70** on the riser arm **66** so as to continuously urge the homing device in a downward position to thereby restrain the movement of the turnstile assembly when actuated by a passenger. In other words, the passenger pushing on the passenger tube **14** will rotate the hub **10** and thereby rotate the cog wheel assembly **16** against the action of the spring **72** so as to prevent free-wheeling of the turnstile when in a proper operating mode.

In the preferred embodiment a damper arm **76** connected to a suitable dash pot or damper assembly (not shown) has a bearing wheel **78** adapted to contact the lower end of one of the U-shaped extensions of the homing device **66** to thereby provide an additional restraint on the rotation of the cog wheel assembly **16.** The purpose of the damper assembly is to prevent a passenger from pushing on the turnstile tube **14** in a fast and sudden movement that could either injure himself or possibly injure the passenger ahead or in back of him.

The shaft **26** not only supports the riser arm **68,** but is attached to the riser arm so that movement of the riser arm in a vertical up and down direction as controlled by the rotation of the cog wheel assembly **16** will cause the shaft **26** to rotate. Located on the shaft **26** and attached to the shaft is a pair of cams **80** and **82** that are adapted to contact and control a pair of switches **84** and **86,** respectively.

Referring now to FIG. **3,** there is shown a preferred relationship between the pawl **28** and a tooth **18** on the cog wheel assembly **16** for adjusting the cam **82** to close switch **86** used to apply full power to the solenoid **40.** The position shown in FIG. **3** represents the posi-

tions of the cog tooth **18** after a passenger has been properly admitted and the cog wheel assembly has rotated five cog teeth. The riser arm **68** is moved in a vertical direction once for every five cog teeth, which rotates shaft **26** and cams **80** and **82.**

Cam **82** is adjusted to close and contact the switch **86** at the time that the leading edge **50** is centrally located on the fifth cog tooth **18** at which time the cam **82** will close switch **86** as shown in FIG. **4** to thereby apply full power from a suitable power supply **90** through the normally open contacts **86** and through the normally closed contacts of switch **36** to the solenoid **40.** Subsequent rotation of the cog wheel assembly **16** by the passenger will result in the pull pawl **28** being pulled down with full power into the fully detented position to thereby prevent further clockwise rotation of the cog wheel assembly **16** since the leading edge **50** will now be contacting the edge **20** of the cog tooth **18.** At the time that the pawl **28** is fully detented, the normally closed switch **35** is opened by means of adjusting arm **37** for removing full power from the solenoid **40.** The solenoid **40** will continue to receive half power which is sufficient to maintain the pawl **28** in a closed position.

The adjustment for the push pawl **30** is the same as just illustrated in connection with FIG. **3,** only in this case cam **80** is adjusted to close switch **84** which will then apply full power from the power supply through the normally open contact of switch **84** and through the normally closed contacts of switch **36** to the solenoid **44.** The full detenting of the pawl **30** will cause switch **36** to be opened thereby applying half power to the solenoid **44** during the holding operation.

It can be appreciated, therefore, that the turnstile device just described is capable of individually metering passage in either direction in a safe and reliable manner. In addition, should an emergency develop and power be lost from the system, then the operation of spring **31** and the one not shown will immediately cause pawls **28** and **30** to be lifted from their detented position to allow the turnstile to be rotated in either direction without restriction.

What is claimed is:

1. A controllable turnstile for allowing metered movement in either direction comprising:

a rotatable shaft having a toothed wheel on one side and a plurality of spaced-apart tubes for passenger control on the other side, each of said teeth having a first edge and a second edge;

a first pawl having a leading edge contacting said first edge for preventing clockwise rotation of said shaft, said first pawl having a trailing edge cammable by said teeth in the presence of counterclockwise rotation of said shaft;

a second pawl having a leading edge contacting said second edge for preventing counterclockwise rotation of said shaft,

said second pawl having a trailing edge cammable by said teeth in the presence of clockwise rotation of said shaft, said first pawl and said second pawl being individually controllable for selectively allowing either clockwise or counterclockwise rotating of said shaft;

a first solenoid for detenting said first pawl between said teeth and a second solenoid for detenting said second pawl between said teeth; and

power serving means including first cam means for sensing the position of said first pawl in an undetented position and applying full power to said first solenoid and limit switch means for detecting detenting of said first pawl and reducing the power to said first solenoid.

2. A system according to claim **1** further including second cam means for sensing the position of said second pawl in an undetented position and applying full power to said second solenoid, and limit switch means for detecting detenting of said second pawl and reducing the power to said second solenoid.

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