May 27, 1969 H. L. BYLAND ETAL 3,445,962

TURNSTILE MECHANISM

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Fig. 1

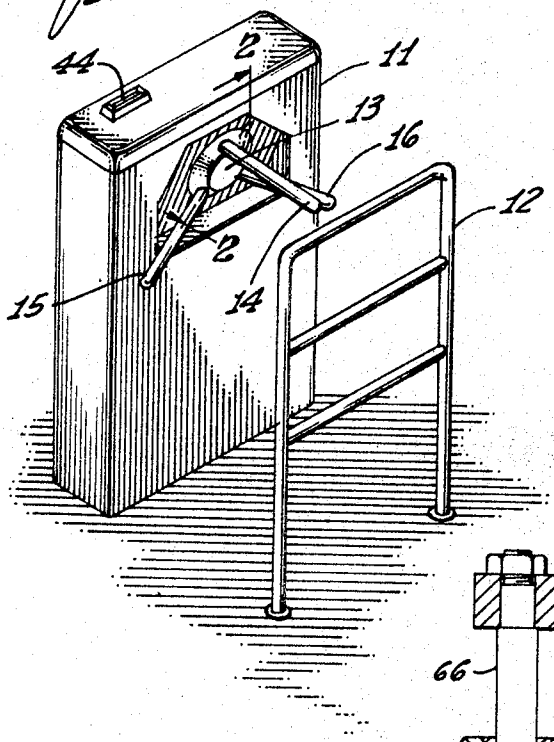
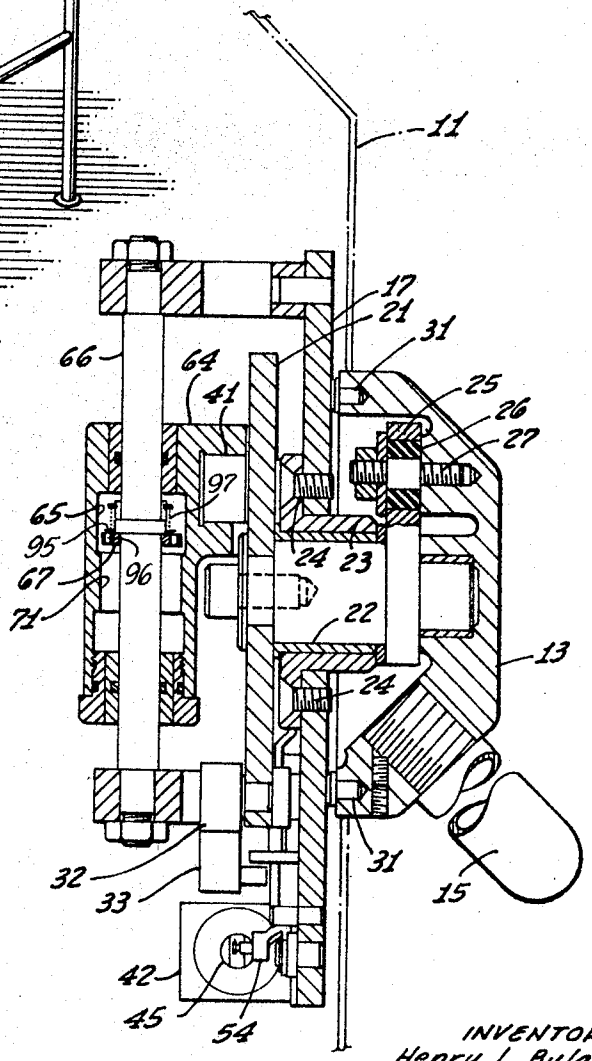



Fig. 2




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Fig. 3

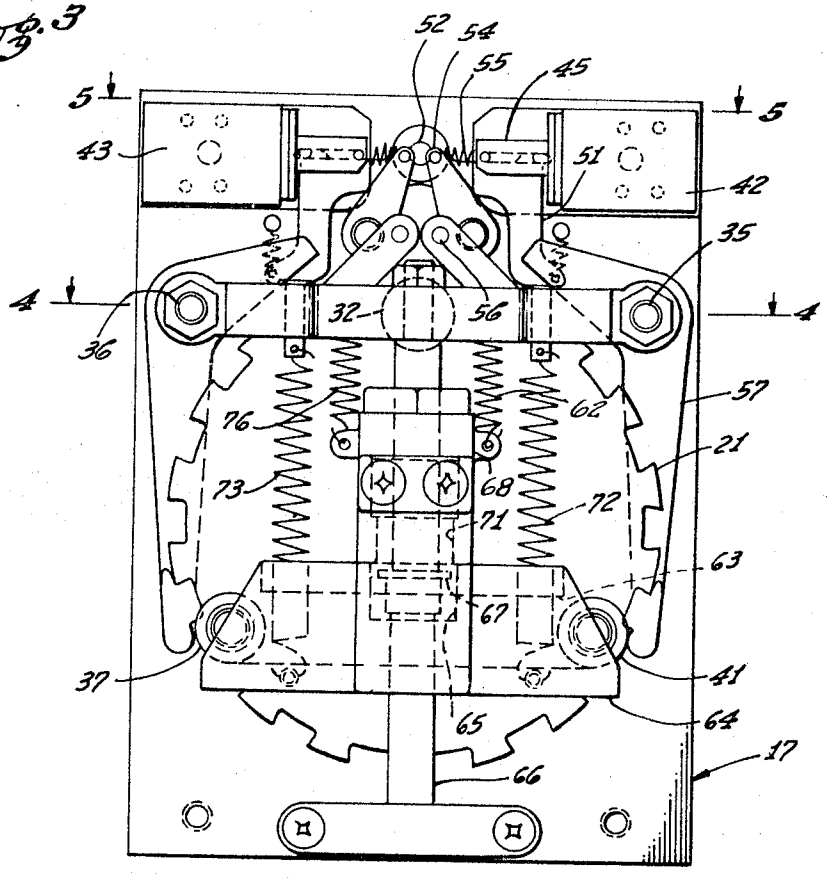
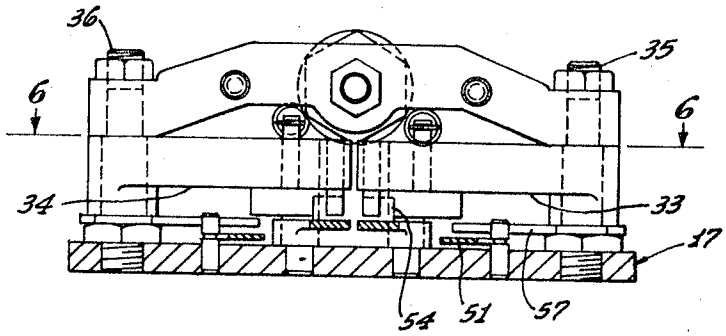



Fig. 4




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Fig. 5

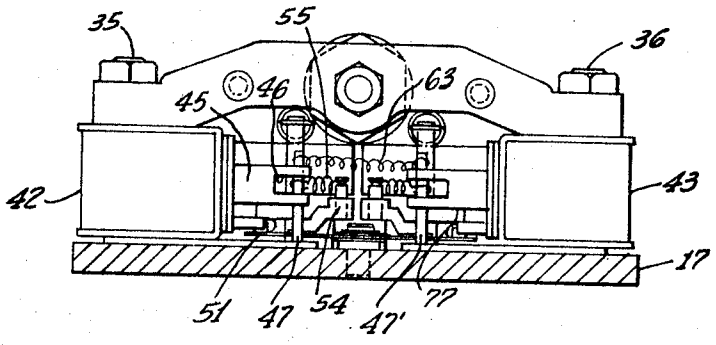
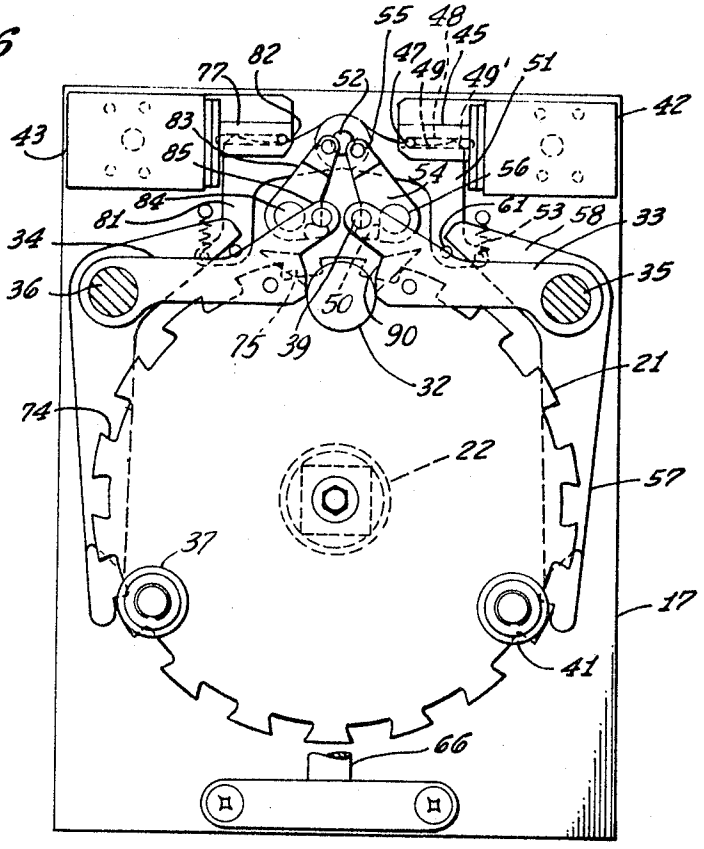



Fig. 6




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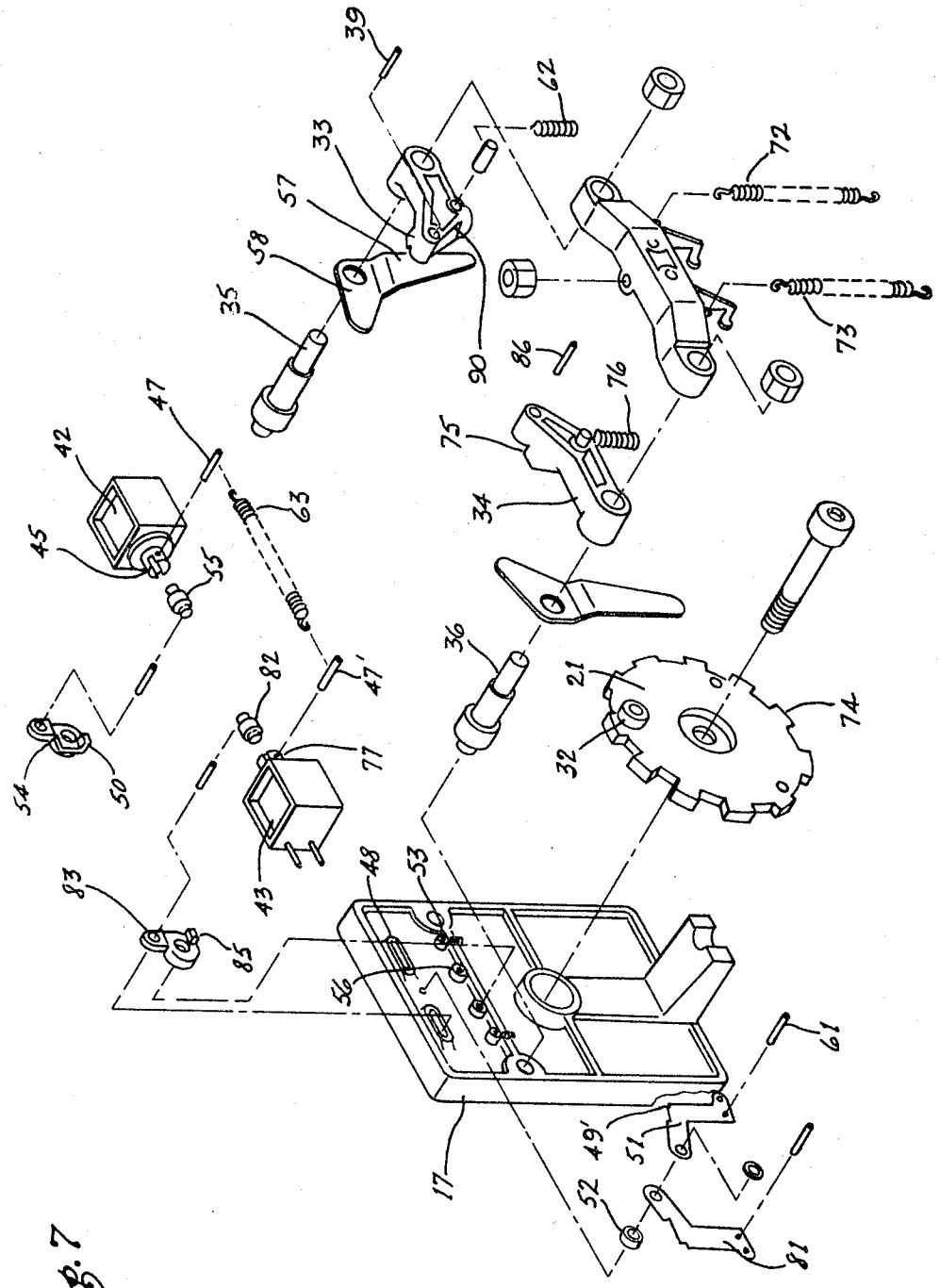



Fig. 7

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3,445,962

# TURNSTILE MECHANISM

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U.S. Cl. 49—47
12 Claims

## ABSTRACT OF THE DISCLOSURE

A turnstile mechanism is disclosed being operable by energizing a solenoid which removes a locking pawl from engagement with a roller attached to a plate being movable with the turnstile barrier arms. A second roller engages a dampening assembly during rotation of the barrier arms while a second locking pawl remains in a locking-ratchet position to prevent rotation of the barrier arms in the reverse direction. The barrier arms are attached to a hub which is mounted by resilient bushings so as to cushion movement thereof.

This invention relates to barriers employed for controlling gateways or passages of various kinds, and more particularly to a turnstile barrier of the type employing three arms rotating about an axis inclined at an angle of 45° to the vertical, and in which the arms are arranged at a 45° inclination to said axis whereby one arm occupies the horizontal barrier position across the passage while the other arms extend downwardly at the side of the passageway. Such passage control barriers are employed to control access to transportation systems, vehicles, and to various public places. They are usually freed by insertion of a token, such as a coin or a ticket in a slot, allowing the passenger or customer to push the horizontal barrier arm, which is thereby moved into a non-barrier position and the passenger or customer is enabled to proceed through the controlled passageway.

Turnstile barriers in the past have generally been bulky, massive, and inherently inflexible mechanical devices. Those turnstiles previously known to the art require a great deal of expensive precision machine work in manufacture, and occupy a great deal of valuable space.

In the turnstile of the present invention, the unlocking function is performed electrically. The turnstile may be connected to a control circuit in such a manner as to allow passage in either direction upon receipt of a release current from a control circuit in response to a proper token. Thus, if installed in a station in a rapid transit system, for example, the turnstile may be controlled to require payment of fare either upon entry or upon exit. In addition, by including two token receiving receptacles, one on either side of the barrier, the turnstile may be set up to require payment upon entrance and, in addition, require payment upon exit. In many modern rapid transit systems, tickets are employed to release the barrier upon entrance and upon exit. A passenger may purchase a ticket for a specific journey, insert the ticket into a slot in a turnstile for electronic sensing, and if the ticket is satisfactory, an initiating switch is closed, releasing the barrier and allowing the passenger to enter the system through the turnstile. Upon reaching his destination, the passenger inserts the same ticket into a slot in an exit turnstile wherein fare data on the ticket will be sensed and the validity of the ticket for exit at that station is determined. Upon collection of proper fare payment at the exit station, the turnstile is released, enabling the passenger to exit. Depending upon the auxiliary equipment provided, the actuating token employed to open the turnstile may be a ticket as discussed hereinabove, a coin, or a coin-like object such as is frequently employed by transit systems.



The turnstile of the present invention has a cushioned positive lock, provided by locking pawl assemblies and a cushioned hub mount. The positive locking pawl assemblies securely lock the main control plate at the end of each cycle. However, the hub carrying the barrier arms is secured to the main shaft and through it to the main control plate at three cushioned points, allowing the hub to rotate somewhat with respect to the main shaft. The force necessary to rotate the hub with respect to the shaft increases with the rotation, providing a cushioning effect. The cushioned effect is supplied by resilient bushings between the hub post and the main shaft attaching lobe.

Means are also provided to prevent release of the barrier arms if excessive force is exerted upon the barrier arm in barrier position. Accidents have occurred in prior art turnstiles when a patron was exerting a force upon the arm, as by leaning on it, at the time the barrier arm is released. In such a case, the barrier rotates with excessive speed and may strike the patron in the back. Such accidents cannot occur in connection with the turnstile of the present invention. Even if the barrier release signal has been received from the token receiving apparatus, the barrier will not release as long as excess pressure is being exerted upon it. However, upon removal of the excess pressure, the barrier will be released, enabling the passenger to pass through the turnstile. The above advantages are achieved with a turnstile basically comprising a base plate, a roller plate journaled for rotation on the base plate, a hub carrying a plurality of barrier arms mounted for rotation with the roller plate, a plurality of rollers each coinciding with a barrier arm mounted on the roller plate, locking means mounted on the base plate cooperating with the rollers to lock the roller plate and the hub with one of the barrier arms in a barrier position, and electromagnetic means for releasing the locking means to enable rotation of the roller plate and the hub.

### *Objects*

It is, therefore, an object of this invention to provide an electrically controlled, turnstile type barrier.

Another object of this invention is to provide a bi-directional, electrically controlled turnstile barrier.

Another object of this invention is to provide a turnstile having a cushioned, positive lock.

Another object of this invention is to provide an electrically controlled turnstile which is simple, reliable and inexpensive to manufacture.

These and other objects and advantages of the present invention will become apparent from the following specification and appended drawings, wherein:

FIGURE 1 is an external view of the turnstile of the present invention;

FIGURE 2 is a cross-sectional view of the mechanism of the turnstile taken along line 2—2 of FIGURE 1;

FIGURE 3 is a side view of the back of the turnstile mechanism of the present invention;

FIGURE 4 is a cross-section taken along line 4—4 of FIGURE 3;

FIGURE 5 is a cross-section taken along line 5—5 of FIGURE 3; and

FIGURE 6 is a cross-sectional view taken along line 6—6 of FIGURE 4, illustrating the positive locking pawl assemblies.

FIGURE 7 is a partial exploded view of the elements illustrated in FIGURE 3.

Referring now to the drawings, FIG. 1 illustrates the turnstile barrier of the present invention as it may be installed in an access controlling position. A passage is de-

fined by the case 11 of the turnstile and a fence-like barrier 12. A cup-shaped rotary hub 13 is journaled to rotate about an axis at an angle of 45° from the vertical. Three barrier arms 14, 15, and 16 are equidistantly mounted spaced 120° apart on the periphery of hub 13. Each barrier arm is mounted at an angle of 45° from the axis of rotation of the hub. A turnstile so constructed will always have one barrier arm at rest in a barrier position, obstructing the passageway.

The operating mechanism of the turnstile is secured to a base plate 17 which is fastened to the frame (not shown) of case 11. Hub 13 is resiliently fastened, by means to be further disclosed hereinbelow, to roller plate 21 through shaft 22. Shaft 22 is journaled in bearing 23, secured to base plate 17, as by machine screws 24. The resilient mounting of hub 13 to shaft 22 includes a shaft attaching lobe 25 secured to shaft 22, as by welding, having apertures, each containing a bushing, as bushing 26, fabricated of a suitable resilient material such as rubber. A threaded post 27 is screwed into a suitable tapped aperture in hub 13, and through rubber bushing 26. It will be apparent that the resilience of bushing 26 enables a small amount of cushioned relative movement between hub 13 and shaft 22. The resilient motion of hub 13 with respect to shaft 22 is restrained to rotary movement only by the provision of skid buttons 31 about the periphery of hub 13, riding on base plate 17.

Referring now to FIGURES 6 and 7, it will be noted that the turnstile is illustrated therein at home position, with one of the barrier arms in barrier-obstructing position. At the home, or rest position roller plate 21 which is connected to the shaft 22 is held in a locked position by a roller 32 and locking pawls 33 and 34, journaled for rotation on posts 35 and 36, respectively. Locking pawl 33 serves to prevent clockwise rotation and locking pawl 34 is provided to prevent counterclockwise rotation of the turnstile. In addition to roller 32, roller plate 21 is furnished with rollers 37 and 41, spaced 120° from each other and from roller 32 on periphery of roller plate 21. Each roller coincides with one of the barrier arms, locking its associated barrier arm in barrier position. The turnstile is released for clockwise rotation by energization of solenoid 42 and for counterclockwise rotation by energization of solenoid 43. Either or both of the solenoids are energized by a control circuit (not shown) in response to insertion of the proper token in the slot 44 in the turnstile case 11, or by manual switches under the control of personnel of the transportation system.

For a clockwise operation of the turnstile, solenoid 42 is energized, retracting solenoid plunger 45, FIGS. 6 and 7. Solenoid plunger 45 is furnished with a slot 46, FIG. 5, and a latching pin 47. As solenoid plunger 45 is retracted, latching pin 47 having one end thereof riding in a groove 48 (shown dotted in FIG. 6) in the base plate 17 is engaged by the upper shoulder 49 on latching lever 51. Latching lever 51 pivots about post 52 and is urged into latching position by spring 53 wherein the pin 47 abuts the lever with a notch 49'. Retraction of solenoid plunger 45 applies a rotating force, clockwise in FIG. 6, by means of spring 55, to release lever 54, pivoting about post 56. Rotation in a clockwise direction of release lever 54 causes an abutment 50 attached to the release lever to engage a pin 39 attached to the locking pawl 33 and rotate the pawl clockwise. As locking pawl 33 is rotated about post 35, roller 32 is freed from edge 90 of the pawl 33 and roller plate 21 is free to be rotated in a clockwise direction as a result of force applied on the blocking barrier arm. After roller plate 21 rotes through about 60 degrees, a portion of roller 32 on the side of the control plate 21 opposite that shown in FIG. 6 contacts reset lever 57. Reset lever 57 is rotatable about post 35 in a counterclockwise direction so that an arm portion 58 thereof bears against a pin 61 attached to the lever 51 rotating latching lever 51 in a clockwise direction about post 52 and causing the notch 49' to move out of engagement with the latching pin 47. The plunger 45 is released, allowing release lever 54 and pawl assembly 33 to be retracted counterclockwise to rest position under the influence of springs 63 and 62 respectively (FIGS. 5 and 3 respectively). Spring 62 is connected between a cylinder housing 68 and the pawl 33 while spring 63 is connected between the latching pin 47 and a latching pin 47' attached to a plunger 77 of solenoid 43.

As roller plate 21 rotates after release of roller 32, under the force applied by the passenger to the barrier arm, roller 41 travels in slot 63, FIG. 3, in damper assembly yoke 64. As most clearly illustrated in FIG. 2, yoke 64 is secured to a traveling hydraulic fluid filled cylinder 65, traveling along rod 66. Rod 66 is furnished with a fixed piston 67, having a diameter slightly less than the inside diameter of stepped portion 71 of cylinder 65. As roller plate 21 rotates, yoke 64 is moved, stretching springs 72 and 73 and moving cylinder 65 through portion 71. After control plate 21 has rotated slightly more than 60°, the energy stored in springs 72 and 73 will continue the rotation of the roller plate and of the barrier arm-hub sub-assembly attached thereto. However, damper piston 67, cooperating with cylinder 65 in portion 71, prevents forceful rotation of the barrier arms, providing its greatest damping force when the force applied by springs 72 and 73 is greatest, but providing relatively little damping force as springs 72 and 73 have nearly returned to their unstretched position, since cylinder 65 has moved so that piston 67 is in the relatively wide diameter area of the cylinder as shown in FIG. 2. The relatively little dampening force is provided during a first half of the cycle of rotation of the barrier arms when cylinder 65 is moving upwards as viewed in FIG. 2 so that dampening washer 95 is moved away from openings 96 in the piston 67 and against complession spring 97. Thus fluid is allowed to move around the piston and through the openings without meeting much resistance. The greatest dampening force is provided during the second half of the cycle of rotation of the barrier arms when cylinder 65 is moving downward as viewed in FIG. 2 so that dampening washer 95 closes the opening 96. The fluid within the cylinder 65 is only able to move around the piston 67 which is relatively restricted. Thus a barrier arm rotating up behind a passenger passing through the turnstile will not move at an excessive speed so as to strike the passenger in the back and perhaps injure him.

When freed for rotation in a clockwise direction upon energization of solenoid 42, any attempt to reverse a barrier arm will cause serrations 74, FIG. 6, cooperating with ratchet 75 forming part of locking pawl 34, to prevent reverse rotation of the control plate. Ratchet 75 is retained against serrations 74 by spring 76, FIGS. 3 and 7, which also holds locking pawl 34 in locking position with respect to the rollers 32, 37, and 41.

Referring again to FIGS. 6 and 7, when it is desired to allow rotation of the turnstile in a counterclockwise direction, solenoid 43 is energized by the control circuitry and solenoid plunger 77 is retracted. Latching lever 81, operating similarly to latching lever 51, locks plunger 77 in the retracted position. Latching lever 81 also rotates about post 52. Spring 82 urges release lever 83 to rotate about post 84. Release lever 83 having abutment 85 rotates locking pawl 34 by bearing on pin 86. Locking pawl 34 is then rotated about post 36 to free roller 32 for counterclockwise rotation. The damper and yoke assembly operates as for clockwise rotation.

If, at the time that a passenger pays fare and a barrier release current is applied to the appropriate solenoid, the passenger is applying a great deal of force to the barrier arm, as by leaning against it, the barrier will not be released until the force on the arm is removed. It is apparent that a release of the barrier arm with a passenger leaning on it could result in injury to the passenger. Therefore, in the event of excessive pressure on either of locking pawls 33 or 34 by one of rollers 32, 37, or 41, spring

55 or 82 will be extended by solenoid plunger 45 or 77 respectively. The friction of the roller on locking lever 33 or 34 will result in a force too great to be overcome by the spring to retract release lever 54 or 83. It will be recalled that the release lever cooperates with a pin on its associated latching lever to rotate the latching lever out of locking position.

It is to be understood that the above-described embodiment is illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What we claim is:

1. A turnstile comprising:
a base plate;
a roller plate journaled for rotation on said base plate;
a hub carrying a plurality of barrier arms mounted for rotation with said roller plate;
a plurality of rollers, each coinciding with a barrier arm, mounted on said roller plate;
locking means mounted on said base plate cooperating with said roller to lock said roller plate and hub with one of said barrier arms in barrier position; and
electromagnetic means for releasing said locking means to enable rotation of said roller plate and hub.

2. In the turnstile of claim 1, said locking means including clockwise rotation locking means and counterclockwise rotation locking means.

3. In the turnstile of claim 2, said electromagnetic means including a clockwise release electromagnet connected to said clockwise rotation locking means and a counterclockwise release electromagnet connected to said counterclockwise rotation locking means.

4. In the turnstile of claim 1, means for preventing release of said roller plate upon application of excessive torque to said barrier arms.

5. In the turnstile of claim 1, damping means including:
a yoke moved linearly by said rollers;
resilient return means connected to said yoke; and
a damping piston and cylinder moving relative to one another with said yoke.

6. In the turnstile of claim 1, hub mounting means for resiliently fastening said hub to said roller plate.

7. In the turnstile of claim 2, said locking means including:
a release lever activated by said electromagnetic means;
a locking pawl rotated out of blocking relationship with one of said rollers by said release lever, thereby freeing said roller plate for rotation.



8. In the turnstile of claim 2, said electromagnetic means including:
a solenoid having a plunger retracted upon energization of said solenoid; and
a latching lever for retaining said plunger in retracted position after deenergization of said solenoid.

9. In the turnstile of claim 4, said means for preventing release of said roller plate upon application of excessive torque to said barrier arms including:
calibrated tension means connecting said plunger and said release pawl;
said locking lever having a linear section parallel to force exerted by said roller, said linear section in locking position being between said roller and pivot post on said base plate; and
pin means interconnecting said locking pawl and said release lever for moving said locking pawl from locking position to roller freeing position.

10. In the turnstile of claim 8, reset means including:
a reset lever pivoted by said roller; and
means interconnecting said reset lever and said latching lever for moving said latching lever to a solenoid plunger freeing position upon pivoting of said reset lever.

11. In the turnstile of claim 6, said hub mounting means including:
a lobe plate, having an aperture in each lobe, rigidly secured to rotate with said roller plate;
a resilient insert in each of said aperture; and fastening means passing through said resilient inserts and secured to said hub.

12. In the turnstile of claim 5, said damping means including:
a fixed piston secured to a rod fastened to said base plate;
a cylinder having end portions slidably mounted on said rod and having a central bore enclosing said piston; and
means securing said cylinder and said yoke to one another.


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