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TURNSTILE INSTALLATION

The present invention relates to a turnstile installation, in particular a turnstile installation for checking or blocking the passage of persons.

A known turnstile installation comprises a barrier element which is rotatable about a rotational axis inclined to the horizontal through about 45° and blockable against rotation or releasable for rotation in at least one rotational direction by means of an unlatchable blocking device. The barrier element comprises a carrier plate and at least two barrier arms, which are spaced apart in circumferential direction and project from this plate at an angle to the rotational axis and which in consequence of rotation of the barrier element about its rotational axis are movable one after the other out of a substantially horizontal position blocking the passage of a person and into a position freeing the passage. The arms are pivoted to the carrier plate to be able to be tilted away about pivot axes extending transversely to the longitudinal axis of the respective arm and are each detented in a normal effective setting by means of a locking bar which is mounted to be pivotable at the carrier plate and retained in its locking position by spring force. The locking bars, each time a barrier arm is disposed in the blocking position, are actuatable by means of an unlocking device, which is loaded by spring force and held in biased position by an electromagnet, on cessation of the electromagnetic retaining force and thereby moved into their unlocking position freeing the respective barrier arm for tilting away about its pivot axis out of its blocking position and into a tilted-away position permitting the unhindered passage of persons.

Turnstiles installations of that kind are used in conjunction with barriers in order to enable a blockable entry and exit of persons. Passage through these barriers is freed by operating the turnstile in dependence on previously defined criteria which are checkable automatically. At the same time, it is necessary to ensure in such turnstiles that an unblocked and rapid passing of the barriers is possible in certain situations, for example in case of emergency.

A turnstile installation of that kind is described in, for example, German laid-open specification No. 28 25 787. In the case of current interruption or switching-off, an electromagnet becomes free of current

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in this turnstile and an unlatching device is no longer maintained in a biasing position. A slide of the unlatching device is then moved by spring force in such a manner that it pivots a locking bar holding a barrier arm so that the bar comes out of engagement with a bearing tongue connected with the arm. As a consequence, the barrier arm drops under gravitational force into a tilted-away position freeing the passage. In order to subsequently reset the turnstile, the barrier arm must be manually pivoted back into the horizontal position until the bearing tongue again detents with the locking bar. The slide must previously be moved into its operative setting by the electromagnet of the unlatching device against the spring force acting thereon.

This turnstile installation must be equipped with a strong electromagnet. The resetting by hand after a switching-off phase is quite awkward, particularly in the case of extensive operational areas.

The invention therefore has the object of creating a turnstile installation which has a reduced energy requirement and a simplified construction by comparison with known turnstiles of the same general kind. In addition, the turnstile installation shall be largely capable of automatically returning into the normal operative setting after a switching-off phase.

A turnstile installation comprises a barrier element, which is rotatable about a rotational axis inclined to the horizontal through about 45° and blockable against rotation or releasable for rotation in at least one rotational direction by means of an unlatchable blocking device and comprises a carrier plate and at least two barrier arms, which are spaced apart in circumferential direction and project from this at an angle to the rotational axis and which in consequence of rotation of the barrier element about its rotational axis are actuatable one after the other out of a substantially horizontal position blocking the passage of a person into a rotational setting freeing the passage, the arms each being pivoted at the carrier plate to be tiltable away about a pivot axis extending transversely to the longitudinal axis of the respective arm and being detented in a normal effective or operative setting by means of a locking bar which is pivotably mounted at the plate and retained in an unlocking position by spring force, wherein the locking bars each time the barrier arm stands in a blocking position are actuatable by means of an unlocking device, which is biased by biasing means and held in a

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biased position by an electromagnet, on cessation of the electromagnetic retaining force and thereby moved into an unlocking position freeing the respective barrier arm for tilting away about its pivot axis at the bearing plate out of its blocking position and into a tilted-away position permitting the unhindered passage of persons, characterised in that the locking bars comprise double-armed levers which are pivotable in dependence on the operative setting of the respective associated barrier arm by means of a bearing portion of the barrier arm, wherein one lever arm is provided with detent means bringable into engagement with the bearing portion and the other lever arm is provided with resetting means, which is actuatable by means of the bearing portion of the barrier arm swinging into the tilted-away position, for the unlocking device.

Due to the locking bars each being provided with respective resetting means, the unlocking device is moved back into its biased position without additional expenditure of energy, whilst the barrier arm swings into the tilted-away position. The electromagnet of the unlocking device thus has exclusively a holding function. It can correspondingly be constructed to be smaller, so that the holding current of the electromagnet can also be reduced.

The arresting of the barrier arm in its blocking position can be substantially simplified if a spring-force-loaded latching lug of the locking bar detents with a latching shoulder of a projection on the bearing portion of the arm.

According to a development, each locking bar on the side thereof facing the bearing portion of the respective barrier arm has a recess and a rising cam track, with which the projection of the associated bearing portion co-operates during tilting-away of the barrier arm. It is thus made certain that the projection can swing unhindered below the locking bar at the beginning of the tilting-away operation and at the end of the tilting-away again actuates the unlocking device by way the rising cam track. The functional reliability of the turnstile installation is thereby increased in the manner that the barrier arm falls down completely into a vertical tilted-away position when the electromagnet current is switched off. On restoration of current, the unlocking device is returned into its original biased position. The resetting of the turnstile installation is thus possible merely by onward rotation of the carrier plate, since the projection moving back along the recess again

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detents with the locking bar.

Preferably, the unlocking device of the turnstile installation can be brought into engagement each time only with the barrier arm disposed in the blocking position. Thus, only the barrier arm barring the free passage for persons is tilted away in the case of switching-off or failure of current. Consequently, only one barrier arm has to be detented again on the resetting of the turnstile installation.

A passive security system can be realised by providing for the tilting-away of the relevant barrier arm to be triggered automatically in the case of a current interruption or switching-off of the current. For this purpose, the unlocking device is fastened by a U-shaped retaining bracket to a bearing block, wherein the electromagnet and - at both sides of the electromagnet - longitudinally movable guide rods, which each pass through a lower limb of the bracket, are arranged at an upper limb of the bracket, which guide rods are connected together at their lower end by a trigger plate and on which - between the electromagnet and the lower limb of the bracket - a metallic retaining plate is received, which on the side facing the upper limb bears on spring rings received on the guide rods. A first helical spring is provided on each rod between the upper limb and the rings and in the case of triggering urges the triggering plate against a lug-like projection of the locking bar so that the bar is pivoted out of engagement with the bearing portion of the barrier arm. The triggering of the locking bar accordingly takes place purely mechanically. Thus, a high functional reliability of the triggering is ensured. This is a decisive advantage particularly in the case of an emergency switching-off. A respective second weaker helical spring, which is received on each guide rod, acts against the spring force of the associated first helical spring and thus prevents an undamped impinging of the trigger plate on the lug-like projection of the locking bar. This reduces wear and thus increases service life. The second helical springs also hold the metallic retaining plate in contact with the spring rings on rods.

Preferably, the trigger plate of the unlocking device has run-up ramps in its regions protruding laterally beyond the guide rods, whereby it is made certain that the projection of the bearing portion, which during the onward movement of the carrier plate turns through below the trigger plate held in the biased position, does not come into contact

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with the trigger plate. This increases the functional reliability particularly during the resetting of the turnstile installation by mere onward movement of the carrier plate.

An embodiment of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

- Fig. 1 is a schematic elevation, with viewing direction in passage direction, of a turnstile installation embodying the invention, with one of three barrier arms thereof disposed in a horizontal blocking position barring the passage of a person;
- Fig. 2 is a view of the turnstile installation in the direction of the arrow II in Fig. 1;
- Fig. 3 is a view similar to Fig. 1, but with the barrier arm, which in normal operation prevents the passage of a person, in a setting of non-use, thus tilted away downwardly and freeing the passage;
- Fig. 4 is a view of the turnstile installation with tilted-away barrier arm, in the direction of the arrow IV in Fig. 3;
- Fig. 5 is a detail view, partly in section and to enlarged scale, of a drive unit of the turnstile installation showing a barrier arm in blocking position;
- Fig. 6 is a view similar to Fig. 5, but with the barrier arm unlocked and ready to tilt down into a position freeing the passage of persons;
- Fig. 7 is a view similar to Fig. 6, but with the barrier arm moved into the tilted-away position;
- Fig. 8 is a view of an unlocking device in the turnstile installation in mirror image to its appearance in Figs. 5 to 7; and
- Fig. 9 is a cross-section of the locking device along the section line IX-IX in Fig. 8.

Referring now to the drawings, there is shown a turnstile installation 10 comprising a drive unit 12 with a turnstile 13, which comprises three barrier arms 14 displaced one relative to the other by 120° and is mounted to be rotatable about a rotational axis 15 inclined through about 45° relative to a notional horizontal line. The drive unit

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is mounted on a stand column 11. The barrier arms 14 are hinged to a bearing plate 16 of a bearing block 18, which is located in a housing 17 of the drive unit 12, to be pivotable about hinge axes extending at right angles to the rotational axis 15. The arms are pivotable out of their normal or effective settings, which are shown in particular in Figs. 1 and 2, into settings of non-use. The bearing plate 16, which is connected to a drive shaft 19 to be secure against rotation relative thereto, is disposed in direct driving connection by way of a chain drive 21 with a stepping motor 20. Furthermore, the drive shaft 19 is connected at its end remote from the bearing plate 16, rotationally securely to a cam disc 22, which has control dogs and with which pawls 24, which are hinged at a bearing plate 23 to be pivotable, co-operate in a manner not requiring further explanation for the purpose of the present invention.

The barrier arms 14 extend, in their normal settings, from the bearing plate 16 on the envelope of a notional cone which is open at its end away from the bearing plate. In normal operation, one of the three barrier arms 14 always stands in a horizontal blocking position projecting into a zone of passage for persons past the installation, whilst the two remaining barrier arms 14 are pivoted out of the passage into positions pointing obliquely downwards, as Figs. 1 and 2 show.

When a person wishes to pass the turnstile installation 10, the barrier arm 14 in the blocking position is moved out of that position by means of the stepping motor 20 through rotation of the bearing plate 16 and thereby of the turnstile 13 in consequence of triggering by the person. The passage for the person is thus freed. At the same time, the barrier arm 14 which follows in the direction of rotation moves into a position barring the passage for the next person.

In the case of the illustrated turnstile installation 10 with barrier arms 14 displaced by 120° , each cycle of the turnstile 13 corresponds to a stepping-on rotation through 120° and one barrier arm 14 in normal operation always stands in the position barring the passage. In that case, as will be explained more closely further below, the barrier arms 14, which are tiltable away about their hinge axes, are releasably detented in the normal operative settings evident in Figs. 1 and 2 and are retained in these detented positions, as also explained more closely below.

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The articulation of a barrier arm 14, which can be tilted out of the illustrated operative setting into a setting of non-use, at the bearing plate 16 of the drive unit 12 is illustrated in Figs. 5 to 7 with the omission of the remaining barrier arms 14. A respective bearing spigot 25, which extends at right angles to the rotational axis 15 of the turnstile 13, serves for the articulation. The bearing spigots 25 are mounted on the bearing plate 16, which in its turn is fastened, secure against relative rotation, to the drive shaft 19 drivably coupled with the stepping motor 20 by way of the chain drive 21. By contrast to the impression given in Fig. 5, the stepping motor 20 is actually arranged radially outside the rotational circle of rotatable, radially projecting bearing brackets 31 of the plate 16 with the locking bars 30 articulated thereto.

A respective bearing body 26, which is firmly arranged at the end of the barrier arm 14 concerned and thus forms a bearing portion of the arm, is pivotably mounted on each spigot 25. On its side remote from the respective barrier arm 14 each bearing body 26 has a radially projecting dog 27 with a latching shoulder 28, behind which is engaged a latching lug 29 of a locking bar 30 in the blocking position of the barrier arm 14 shown in Fig. 5. The locking bars 30 are mounted to be pivotable, in each case against the effect of a restoring spring 33, about bearing pins 32, which are arranged at the bearing brackets 31 and each parallel to the hinge axis of the respective barrier arm 14, i.e. parallel to the respective bearing spigot 25.

The locking bars 30 consist of two-armed levers, wherein the end of one lever arm 34 forms the latching lug 29 co-operable with the latching shoulder 28 of the associated barrier arm bearing body 26. The respective other lever arm 35 has a lug-like projection 36 at its side remote from the bearing spigot 25 of the respective barrier arm 14 and co-operates with an unlocking or unlatching device 40 in a manner to be described below. On the side facing the bearing body 26, each locking bar 30 has, in the region of the lever arm 35, a rising cam track 37, which adjoins a recess 38 concave towards the bearing body 26. On tilting-away of a barrier arm 14 out of the blocking position shown in Fig. 5 into the position shown in Fig. 7, the projecting dog 27 of the bearing body 26 co-operates with the cam track 37 and in that case pivots the respective locking bar 30 out of its unlatching position. The

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unlatching device 40 is thereby reset into a position of operational readiness, in a manner to be explained below.

The unlatching device 40 is arranged to be radially spaced, as seen in circumferential direction, from the rotational axis 15 and is mounted on the bearing plate 23 in the region corresponding to the blocking position of the barrier arms 14. The device 40 comprises a trigger plate 41, which on the side remote from the barrier arm 14 is disposed over the rotational locus of the lug-like projections 36 of the barrier arm lever arms 35 during the rotation of the bearing plate 16. The trigger plate 41 is shaped arcuately in correspondence with the rotational locus and, seen in circumferential direction, is provided at both ends with a respective run-up ramp 42. The trigger plate is fixedly connected with two guide rods 43 extending parallel each to the other and to the rotational axis 15. The guide rods 43 are received to be longitudinally movable in guide openings in mutually spaced limbs 44 of an U-shaped bracket 45 of the unlatching device 40.

For securing axial end positions of the rods, upper spring rings 46 are arranged on those ends of the rods 43 which project beyond the upper limb 44 of the bracket 45. Two helical springs 47 and 48 of different spring hardness, which are arranged co-axially and surround each guide rod 41 concentrically, are arranged within the bracket 45. The first helical springs 47 of greater spring hardness bear against the upper limb 44 of the bracket 45 and against lower spring rings 49, which are located in axially fixed positions on the guide rods 43. The second helical springs 48 of lesser spring hardness bear against the lower limb 44' of the bracket 45 and a metallic retaining plate 50, which is mounted on the rods 43 to be movable in longitudinal direction and is urged by means of the second springs 48 against the lower spring rings 49. Finally, the unlatching device 40 comprises an electromagnet 52, which is screw-connected by an iron body 53 thereof to the upper limb 44 and comprises a coil body 54 open towards the plate 50.

In the operative setting evident in Fig. 5, the electromagnet 52, which functions as a retaining magnet lies at voltage. Accordingly, the retaining plate 50 is attracted by the coil body 54 of the electromagnet 52 and the trigger plate 41 is retained against the action of the thereby biased helical springs 47 in a retracted position, in which the projections 36 of the lever arms 35 of the locking bars 30 run through

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below the trigger plate 41 during movement of the turnstile 13. If the loading by voltage of the electromagnet 52 is interrupted, whether due to an operational disturbance or to switching-off of the current supply, the electromagnetic retaining force disappears and, in view of the force acting in release direction and produced by the biased first helical springs 47, the trigger plate 41 connected with the guide rods 43 springs forward, impinges on the projection 36 of the locking bar 30 and pivots the latter about its bearing pin 32 into its unlatched setting against the action of the restoring spring 33. In that case, the latching lug 29 of the locking bar lever arm 32 comes out of engagement with the latching shoulder 28 of the bearing body 26 of the barrier arm 14 standing until then in blocking position below the unlatching device 40. Fig. 6 shows this. After the disengagement of the lug 29, the barrier arm 14 is pivoted under gravitational force about its bearing spigot 25 into a tilted-away position, which is evident from Figs. 3, 4 and 7 and permits an unhindered passage of persons.

During the tilting of a barrier arm 14 out of its blocking position, the dog 27, which projects radially from the bearing body 26 of this barrier arm 14, engages into the recess 38 of the associated locking bar 30, then impinges on the cam track 37 and pivots the locking bar back in the direction of its latching position. In that case, the unlatching device 40 is moved by the projection 36, which engages at the underside of the trigger plate 41, of the locking bar lever arm 35, into a position of readiness. In that position, the retaining plate 50, which is acted on at its underside by spring force produced by the second helical springs 48, comes to bear against the electromagnet 52, as shown in Fig. 7. On renewed application of voltage to the electromagnet 52, whether due to return of current after a disturbance or due to intentional switching-on of current, the coil body 54 of the electromagnet 52 attracts the retaining plate 50, whereby the operational state, which is shown in Fig. 5, of the unlatching device 40 is reached again.

After the disappearance of the event triggering the tilting-away of the barrier arm 14 standing in blocking position, the resetting of the turnstile installation 10 into its normal operational state takes place by the stepping motor 20 advancing the turnstile 13 in such a manner by rotation about the rotational axis 15 that the barrier arm 14, which has been tilted away into its setting of non-use, pivots about its bearing

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spigot 25 back into its normal operative setting under the influence of gravitational force during the rotation. In this return pivotation the dog 27 of the bearing body 26 of the barrier arm slides along the recess 38 of the locking bar 30 and, under the action of the resetting spring 33 engaging at the lever arm 34 of the locking bar 30, pivots the locking bar together with its latching lug 29 into the engagement position, which is shown in Fig. 5, with the latching shoulder 28 of the relevant bearing body 25 as soon as the barrier arm 14 is pivoted back into its normal setting. Thus, the previously tilted away barrier arm 14 is detented in its normal setting.

In the case of the turnstile installation 10, which is illustrated in the accompanying drawings and explained in the foregoing, with three barrier arms 14 arranged offset by 120° relative to one another, the resetting of a tilted away barrier arm 14 into its normal operational setting is achieved in particularly reliable manner when at the end of a situation triggering tilting away of a barrier arm 14, the turnstile 13 is stepped on by at least two steps, so that the hinge axis, which is defined by a bearing spigot 25, of the barrier arm 14 to be returned from its tilted away position into the normal position of use passes through the lower culminating point of its path of circulation.

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CLAIMS

1. A turnstile installation comprising a barrier element which is rotatable about an axis inclined relative to the horizontal and which comprises a carrier plate and at least two barrier arms which project from the plate at an angle to the axis and at a spacing apart in the circumferential direction of the plate and which are each connected to the plate by a bearing portion to be pivotable into and out of an effective setting about an axis extending transversely to the longitudinal axis of the respective arm, means to rotate the barrier element in at least one rotational direction so as to move the arms in turn between a position blocking passage past the installation and a position permitting such passage and to block the barrier element against rotation, a respective locking bar mounted on the carrier plate in association with each barrier arm and pivotable into and out of a locking position in which it locks the associated arm in the effective setting, resilient means urging each locking bar into the locking position, an unlocking member movable by biasing means out of a biased position to cause the locking bar associated with an arm disposed in the blocking position to pivot out of its locking position and consequently the arm to pivot out of its effective setting and into a setting permitting passage past the turnstile, and electromagnetic means to hold the unlocking member in its biased position, each of the locking bars comprising a double-armed lever provided at one lever arm thereof with detent means engageable with the bearing portion of the associated barrier arm to lock the arm in the effective position and at the other lever arm with resetting means co-operable with the bearing portion during pivotation of the arm out of its effective setting to cause the lever to reset the unlocking member.

2. A turnstile installation according to claim 1, wherein the axis of rotation of the barrier element is inclined at substantially 45° relative to the horizontal.

3. A turnstile installation according to claim 1 or claim 2, wherein the detent means of each lever comprises a lug provided at the free end of said one lever arm and engageable with a shoulder of a projection on the

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bearing portion of the associated barrier arm.

4. A turnstile installation according to claim 3, wherein the resetting means of each lever comprises a lug provided at the free end of said other lever arm and co-operable with the unlocking member and wherein the lever is provided at a side thereof towards the bearing portion of the associated barrier arm with a concave recess permitting free movement of the projection on the bearing portion and with a rising cam track adjoining the recess and co-operable with the projection.

5. A turnstile installation according to any one of the preceding claims, wherein the unlocking member is so arranged on a mounting member of the installation as to be movable into engagement with the locking bar associated with a barrier arm disposed in the blocking position.

6. A turnstile installation according to claim 5, wherein the unlocking member is mounted on the mounting member by means of a U-shaped bracket and comprises two guide rods which are slidably engaged in the upper and lower limbs of the bracket, a trigger plate connecting the rods together at lower ends thereof below the lower limb, a retaining plate mounted on the rods between the limbs and damping springs arranged on the rods and acting between the retaining plate and the lower limb, the biasing means comprising biasing springs arranged on the rods and acting between the retaining plate and the upper limb and the electromagnetic means comprising an electromagnet mounted on the upper limb and co-operable with the retaining plate.

7. A turnstile installation according to claim 6, comprising a spring ring fixed on each rod between the retaining plate and the associated biasing spring.

8. A turnstile installation according to claim 5 or claim 6, wherein the spring force of the biasing springs is greater than that of the damping springs.

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9. A turnstile installation according to any one of claims 6 to 8, wherein the trigger plate has a portion projecting beyond each rod in a direction away from the respective other rod and each such projecting portion of the trigger plate is shaped to form a run-up ramp.

10. A turnstile installation substantially as hereinbefore described with reference to the accompanying drawings.

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