A latch assembly of a fire door lock comprises a latch base with a bottom, a latch bolt, a stopper, a resilient member and a link member. The latch bolt is retractably pivotable within the latch base and having a blocking surface. The stopper is pivotable within
(57) Abrégé(suite)/Abstract(continued):
the latch base and having a blocking protrusion. The resilient member is disposed between the bottom of the latch base and the stopper and contacts against the stopper. The blocking protrusion of the stopper is capable of engaging with the blocking surface of the latch bolt. The link member is disposed within the latch base and pivotally connected with the latch bolt.
ABSTRACT

A latch assembly of a fire door lock comprises a latch base with a bottom, a latch bolt, a stopper, a resilient member and a link member. The latch bolt is retractably pivotable within the latch base and having a blocking surface. The stopper is pivotable within the latch base and having a blocking protrusion. The resilient member is disposed between the bottom of the latch base and the stopper and contacts against the stopper. The blocking protrusion of the stopper is capable of engaging with the blocking surface of the latch bolt. The link member is disposed within the latch base and pivotally connected with the latch bolt.
LATCH ASSEMBLY OF A FIRE DOOR LOCK

FIELD OF THE INVENTION

The present invention is generally relating to a latch, more particularly to a latch assembly of a fire door lock, which applies a stopper for controlling retraction of latch bolt and has self-locking function against high temperature.

BACKGROUND OF THE INVENTION

In general, vertical latch of known fire door lock is pivotally mounted vertically on fire door and can be latch-released via an operation of main lock body. For example, R.O.C. Patent Publication No. 149199 entitled “vertical-type latch structure of fire door lock” is disclosed, which is to release latched state via impelling a plate to drive a vertical driving sheet allowing an engaging member to retract into cylinder body. However, it needs relatively large force that the vertical latch mentioned above applies the vertical driving sheet to drive the engaging member so unable to quickly release latched state for emergency. In addition, when a fire is going for the fire door, the vertical latch mentioned above is subject to failure due to high temperature of fire, which makes the fire door become unlatched state unable to block spread of fire.

SUMMARY

A primary object of the present invention is to provide a latch assembly of a fire door lock comprising a latch base with a bottom, a latch bolt, a stopper, a resilient member and a link member. The latch bolt having a blocking surface is retractably pivotable within the latch base. The stopper that is pivotable within the latch base has a blocking protrusion capable of engaging with the blocking surface of the latch bolt. The resilient member is disposed between the bottom
of the latch base and the stopper and contacts the stopper. The link member is disposed within the latch base and pivotally connected with the latch bolt. When a fire door is opened via main lock body of a fire door lock, a connection rod is driven to move upward and further drives the link member to pull the latch bolt downward into the latch base for releasing latched state. Accordingly, the present invention can widely reduce latch-releasing force of the latch assembly for rapid latch-releasing movement.

A secondary object of the present invention is to provide a latch assembly of the fire door lock further comprising a self-locking member and at least one hot-melt member. The hot-melt member is applied for limiting the self-locking member. When the hot-melt member melts due to high temperature of fire, the self-locking member will act to enable the latch bolt not to retract into the latch base to release latched state, so the self-locking member can allow the latch bolt to retain a latched state all the time as to effectively prevent fire door from being opened and block spread of fire.

DESCRIPTION OF THE DRAWINGS

Fig.1 is a perspective exploded view illustrating a latch assembly of a fire door lock in accordance with a first preferred embodiment of the present invention.

Fig.2 is a perspective assembly view illustrating the latch assembly of the fire door lock in accordance with the first preferred embodiment of the present invention.

Fig.3A-3C is an action view illustrating the latch assembly of the fire door lock in accordance with the first preferred embodiment of the present invention.

Fig.4 is a disposition view of a hot-melt member in accordance with an
embodiment of the present invention.

Fig.5A-5B is an action view of self-locking member and hot-melt member in accordance with the first preferred embodiment of the present invention.

Fig.6 is a perspective exploded view illustrating a latch assembly of the fire door lock in accordance with a second preferred embodiment of the present invention.

Fig.7 is a perspective assembly view illustrating the latch assembly of the fire door lock in accordance with the second preferred embodiment of the present invention.

Fig.8 is a view illustrating a latch assembly in which latch bolt has step portion in accordance with another embodiment of the present invention.

Fig.9 is a sectional view illustrating the latch assembly of the fire door lock in accordance with the second preferred embodiment of the present invention.

Fig.10 is a disposition view of a hot-melt member in accordance with one more embodiment of the present invention.

Fig.11 is a view illustrating a latch assembly in which a stopper engages with step portion in accordance with further one more embodiment of the present invention.

Fig.12A-12B is an action view of self-locking member and hot-melt member in accordance with the second preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

With reference to Fig.1 and 2, a latch assembly 10 of a fire door lock in accordance with a first preferred embodiment of the present invention comprises a latch base 11, a latch bolt 12, a stopper 13, a resilient member 14, a link member 15 and a connection rod 16. The latch base 11 has a top 11a, a bottom 11b, a
first lateral member 112 and a second lateral member 113 opposite to the first lateral member 112, and wherein the first lateral member 112, the second lateral member 113 and the bottom 111 define a space 114 between them. The bottom 111 comprises an inside wall 111a and a recessed region 111b recessing from the inside wall 111a. The first lateral member 112 and the second lateral member 113 comprise a bias runner 112a, 113a formed thereon respectively, and wherein the bias runners 112a, 113a correspond with each other communicate with the space 114 and have a position hole 112b, 113b respectively. Also, the first lateral member 112 and the second lateral member 113 have a longitudinal runner 112c, 113c formed thereon respectively, and wherein the longitudinal runners 112c, 113c correspond with each other and communicate with the space 114. The latch bolt 12 is retractably pivotable within the latch base 11 and has a blocking surface 121 and an arcuate surface 122 adjacent to the blocking surface 121 in this embodiment. The stopper 13 is pivotable within the latch base 11 and comprises a first surface 13a, a second surface 13b opposite to the first surface 13a, a first end 131 pivotable within the latch base 11, a second end 132 opposite to the first end 131 and a blocking protrusion 13c positioned between the first end 131 and the second end 132. The stopper 13 has at least one attachment portion 133 formed at the first end 131 in this embodiment, preferably, the stopper 13 comprises two attachment portions 133 projecting from the first surface 13a respectively. Besides, the attachment portion 133 of the stopper 13 is attached to the latch base 11 by means of an attachment pin 134 penetrating the attachment portion 133 to allow the first end 131 to be pivotable within the latch base 11. The second end 132 projects from the top 11a of the latch base 11, the blocking protrusion 13c of the stopper 13 contacts the arcuate surface 122 of the latch bolt.
12, in this embodiment, the blocking protrusion 13c projects from the first surface 13a but preferably without projecting from the top 11a of the latch base 11.

With reference to Fig.1, 2 and 3A, the resilient member 14, disposed between the bottom 111 of the latch base 11 and the stopper 13, contacts the second surface 13b of the stopper 13 and is a compressible spring in this embodiment. One end of the resilient member 14 can be disposed within the recessed region 111b of the bottom 111 of the latch base 11 and the other end contacts the stopper 13. The link member 15 is disposed within the latch base 11 and pivotally connected with the latch bolt 12, which comprises an upper rod 151 pivotally connected with the latch bolt 12, a lower rod 153 and a middle rod 152 pivotally connected with the upper rod 151 and the lower rod 153. Two ends of the connection rod 16 are connected with the lower rod 153 of the link member 15 and a main lock body (not shown in the drawings) of fire door lock respectively. In this embodiment, the latch assembly 10 further comprises a joint pin 17 slideably disposed within the longitudinal runners 112c, 113c of the first lateral member 112 and the second lateral member 113, wherein the joint pin 17 connects the lower rod 153 of the link member 15 and the connection rod 16.

With reference again to Fig.1, 2 and 3A, the latch assembly 10 further comprises a self-locking member 18 and a pair of hot-melt members 19 in order to farther enhance fire ability. The self-locking member 18 is disposed within the bias runners 112a, 113a of the first lateral member 112 and the second lateral member 113. The hot-melt members 19 are attached to the bias runner 112a of the first lateral member 112 and the bias runner 113a of the second lateral member 113 respectively, and wherein the hot-melt members 19 block the self-locking member 18 as to prevent the self-locking member 18 from downward sliding into
each of the position holes 112b, 113b. In this embodiment, each of the hot-melt members 19 has a melting temperature and will melt when heated to reach the melting temperature. Otherwise, with reference to Fig.4, the latch assembly 10 in another embodiment may also apply only one hot-melt member 19 which is inserted into and attached to the bias runners 112a, 113a of the first and second lateral members 112, 113, and wherein the hot-melt member 19 blocks the self-locking member 18.

Operation of the latch assembly 10 of fire door lock will be described in detail below by referring to Fig.3A-3C. Initially, with reference to Fig.2 and 3A, which illustrate disposition of each parts of the latch assembly 10 in latched state, the latch bolt 12 projects from the top 11a of the latch base 11 and the resilient member 14 contacts the second surface 13b of the stopper 13 to allow the blocking protrusion 13c of the stopper 13 to press the arcuate surface 122 of the latch bolt 12. With reference to Fig.3B, when a fire door is opened via the main lock body (not shown in the drawings) of fire door lock, the connection rod 16 is driven to move upward and meantime drives the lower rod 153 to move upward that makes the middle rod 152 rotate in counterclockwise to drive the upper rod 151 to pull the latch bolt 12 downward, so that the latch bolt 12 retracts into the latch base 11 to release latched state. In order to keep retaining unlatched state after opening the fire door, the resilient member 14 contacts the stopper 13 to make the blocking protrusion 13c of the stopper 13 engage with the blocking surface 121 of the latch bolt 12 capable of limiting the latch bolt 12 within the latch base 11. With reference to Fig.3C, when the fire door is closed, the stopper 13 is pushed toward the bottom 111 of the latch base 11 and presses the resilient member 14 that makes the blocking surface 121 of the latch bolt 12 depart from
the limitation of the blocking protrusion 13c of the stopper 13. Meantime, the 
latch bolt 12 will restore to project from the top 11a of the latch base 11 to back to 
latched state.

In addition, operation of the self-locking member 18 and each of the hot-melt 
members 19 will be described in detail below by referring to Fig.5A-5B. First, 
with reference to Fig.1 and 5A, when fire is going for the fire door, the 
temperature of latch assembly 10 of the fire door lock will rise and when reaching 
the melting temperature, each of the hot-melt members 19 will melt. Meantime, 
the self-locking member 18, which is disposed into the bias runners 112a, 113a of 
the first lateral member 112 and the second lateral member 113, will slide to each 
of the position holes 112b, 113b. With reference to Fig.1 and 5B, when the 
self-locking member 18 slides into each of the position holes 112b, 113b, it can 
block the middle rod 152 of the link member 15 to prevent the middle rod 152 
from rotating in counterclockwise and enable the latch bolt 12 not to retract into 
the latch base 11 to release latched state. Accordingly, the fire ability of the 
latch assembly 10 of fire door lock is widely improved capable of preventing the 
fire door from being opened and blocking spread of fire.

With reference to Fig.6 and 7, a latch assembly 20 of fire door lock in 
accordance with a second preferred embodiment of the present invention 
comprises a latch base 21, a latch bolt 22, a stopper 23, a resilient member 24, a 
link member 25 and a connection rod 26. The latch base 21 has a top 21a, a 
bottom 211, a first lateral member 212 and a second lateral member 213 opposite 
to the first lateral member 212, and the first lateral member 212, the second lateral 
member 213 and the bottom 211 define a space 214 between them. The first and 
the second lateral members 212, 213 have a longitudinal runner 212a, 213a
formed thereon respectively, and wherein the longitudinal runners 212a, 213a correspond with each other and communicate with the space 214. The latch bolt 22 is retractably pivotable at the top 21a of the latch base 21 and has a blocking surface 221 and an arcuate surface 222 adjacent to the blocking surface 221 in this embodiment. Otherwise, with reference to Fig.8, the latch bolt 22 in accordance with another embodiment may further comprises a step portion 223 formed at the blocking surface 221 and positioned adjacent to the arcuate surface 222. With reference again to Fig.6 and 7, the stopper 23 comprise a first surface 23a, a second surface 23b opposite to the first surface 23a, a first end 231 pivotable within the latch base 21, a second end 232 opposite to the first end 231 and a blocking protrusion 23c positioned between the first end 231 and the second end 232. The stopper 23 comprises at least one attachment portion 233 formed at the first end 231 in this embodiment, preferably, the stopper 23 has two attachment portions 233 projecting from the second surface 23b respectively. Besides, the attachment portion 233 of the stopper 23 is attached to the latch base 21 by means of an attachment pin 234 penetrating the attachment portion 233 to allow the first end 231 to be pivotable within the latch base 21. The second end 232 projects from the top 21a of the latch base 21, the blocking protrusion 23c contacts and presses the arcuate surface 222 of the latch bolt 22, in this embodiment, the blocking protrusion 23c projects from the first surface 23a but preferably without projecting from the top 21a of the latch base 21. In addition, the latch assembly further comprises a latch return spring 224 pivotally disposed at one end of the latch bolt 22 and one end of the latch return spring 224 contacts the latch bolt 22.

With reference to Fig.6, 7 and 9, the resilient member 24 is disposed between the bottom 211 of the latch base 21 and the stopper 23 and pushes the second
surface 23b of the stopper 23. In this embodiment, the resilient member 24 is a torsion spring and comprises a contact end 24a contacting the bottom 211 of the latch base 21 and a support end 24b contacting the second surface 23b of the stopper 23. Otherwise, the contact end 24a can be attached to the bottom 211 of the latch base 21 in another embodiment. With reference again to Fig.6, 7 and 9, the link member 25 is pivotally connected with the latch bolt 22 and comprises an upper rod 251 pivotally connected with the latch bolt 22, a lower rod 253 and a middle rod 252 pivotally connected with the upper rod 251 and the lower rod 253. Two ends of the connection rod 26 are connected with the lower rod 253 of the link member 25 and a main lock body (not shown in the drawings) of fire door lock respectively, wherein the main lock body of fire door lock drives the connection rod 26. In this embodiment, the latch assembly 20 may further comprise a joint pin 27 slideably disposed into the longitudinal runners 212a, 213a of the first lateral member 212 and the second lateral member 213, wherein the joint pin 27 connects the lower rod 253 of the link member 25 and the connection rod 26.

With reference again to Fig.6, 7 and 9, the latch assembly 20 may further comprise a self-locking member 28 and a hot-melt member 29 in order to farther enhance fire ability. The self-locking member 28 is pivotally disposed at one side of the middle rod 252 of the link member 25 and comprises a limit end 28a. The hot-melt member 29 having a melting temperature is inserted into and attached to the latch base 21 and penetrates the self-locking member 28 to limit the self-locking member 28 not to rotate in this embodiment. Otherwise, with reference to Fig.10, the hot-melt member 29 is directly disposed at the limit end 28a without penetrating the self-locking member 28 in another embodiment to
limit the self-locking member 28 not to rotate because the limit end 28a contacts the hot-melt member 29.

Operation of the latch assembly 20 of fire door lock in this embodiment similar to that of the first preferred embodiment will be described in detail below. With reference to Fig.9 or 10, when the fire door is opened via the main lock body (not shown in the drawings) of fire door lock, the connection rod 26 is driven to move upward and meantime drives the lower rod 253 to move upward that makes the middle rod 252 rotate in counterclockwise to drive the upper rod 251 to pull the latch bolt 22 downward, so that the latch bolt 22 retracts into the latch base 21 to release latched state. In order to keep retaining unlatched state after opening the fire door, the resilient member 24 contacts the stopper23 to allow the blocking protrusion 23c of the stopper 23 to engage with the blocking surface 221 of the latch bolt 22 capable of limiting the latch bolt 22 within the latch base 21. Otherwise, with reference to Fig.8 and 11, the blocking protrusion 23c of the stopper 23 is capable of engaging with the step portion 223 of the latch bolt 22 in another embodiment. With reference again to Fig.9 or 10, when the fire door is closed, the stopper 23 is pushed toward the bottom 211 of the latch base 21 and compresses the resilient member 24 that makes the blocking surface 221 of the latch bolt 22 depart from the limitation of the blocking protrusion 23c of the stopper 23. Meantime, the latch return spring 224 will push the latch bolt 22 to restore that the latch bolt 22 projects from the top 21a of the latch base 21 to back to latched state. In addition, operation of the self-locking member 28 and the hot-melt member 29 will be described in detail below by referring Fig.12A-12B. First, with reference to Fig.7 and 12A, when fire is going for the fire door, temperature of latch assembly 20 will rise and when reaching the melting
temperature, the hot-melt member 29 will melt. Meantime, the self-locking member 28 will rotate downward because the limitation of the hot-melt member 29 should no more exist and the limit end 28a of the self-locking member 28 is corresponding to the joint pin 27. With reference to Fig. 7 and 12B, when the limit end 28a of the self-locking member 28 corresponds to the joint pin 27, the joint pin 27 is blocked by the limit end 28a of the self-locking member 28 and unable to move, the connection rod 26 is directly limited to be unmovable upward as well as the middle rod 252 is indirectly limited not to rotate in counterclockwise, so that the latch bolt 22 cannot retract into the latch base 21 to release latched state. Accordingly, fire ability of the latch assembly 20 of fire door lock is widely improved capable of preventing the fire door from being opened and blocking spread of fire.

While this invention has been particularly illustrated and described in detail with respect to the preferred embodiments thereof, it will be clearly understood by those skilled in the art that is not limited to the specific features shown and described and various modified and changed in form and details may be made without departing from the spirit and scope of this invention.
What is claimed is:

1. A latch assembly of a fire door lock comprising:
   a latch base having a bottom;
   a latch bolt retractably pivotable within the latch base and having a blocking surface;
   a stopper pivotable within the latch base and having a blocking protrusion;
   a resilient member disposed between the bottom of the latch base and the stopper and contacting the stopper, wherein the blocking protrusion of the stopper is capable of engaging with the blocking surface of the latch bolt; and
   a link member disposed within the latch base pivotally connected with the latch bolt.

2. The latch assembly of a fire door lock in accordance with claim 1, wherein the stopper comprises a first surface and a second surface opposite to the first surface, wherein the resilient member contacts the second surface, and wherein the blocking protrusion projects from the first surface.

3. The latch assembly of a fire door lock in accordance with claim 2, wherein the latch bolt further comprises an arcuate surface adjacent to the blocking surface and the blocking protrusion of the stopper is capable of contacting the arcuate surface of the latch bolt.

4. The latch assembly of a fire door lock in accordance with claim 3, wherein the latch bolt further comprises a step portion formed at the blocking surface and positioned adjacent to the arcuate surface, and wherein the blocking protrusion of the stopper is capable of engaging with the step portion.

5. The latch assembly of a fire door lock in accordance with claim 2, wherein the stopper comprises a first end pivotable within the latch base and a second end opposite to the first end, and wherein the blocked protrusion is positioned between the first end and the second end.
6. The latch assembly of a fire door lock in accordance with claim 5, wherein the stopper comprises at least one attachment portion formed at the first end of the stopper.

7. The latch assembly of a fire door lock in accordance with claim 6, wherein the stopper comprises two attachment portions and wherein each of the attachment portions projects from the first surface of the stopper.

8. The latch assembly of a fire door lock in accordance with claim 6, wherein the stopper comprises two attachment portions and wherein each of the attachment portions projects from the second surface of the stopper.

9. The latch assembly of a fire door lock in accordance with claim 5, further comprising an attachment pin penetrating the attachment portion of the stopper for attaching the attachment portion to the latch base.

10. The latch assembly of a fire door lock in accordance with claim 2, wherein the resilient member comprises a support end contacting the second surface of the stopper.

11. The latch assembly of a fire door lock in accordance with claim 1, wherein the bottom of the latch base comprises a recessed region, wherein one end of the resilient member is disposed within the recessed region of the bottom of the latch base and the other end contacts the stopper.

12. The latch assembly of a fire door lock in accordance with claim 1, wherein the resilient member comprises a contact end contacting the bottom of the latch base.

13. The latch assembly of a fire door lock in accordance with claim 1, wherein the resilient member comprises a contact end capable of attachment to the bottom of the latch base.

14. The latch assembly of a fire door lock in accordance with claim 1, wherein the latch base further comprises a first lateral member and a second lateral member.
opposite to the first lateral member, and wherein the first lateral member, the
second lateral member and the bottom define a space between them.
15. The latch assembly of a fire door lock in accordance with claim 14, wherein the
first and second lateral members comprise a bias runner formed thereon
respectively, and wherein the bias runners correspond with each other and
communicate with the space.
16. The latch assembly of a fire door lock in accordance with claim 15, further
comprising at least one self-locking member disposed within the bias runners
of the first lateral member and the second lateral member.
17. The latch assembly of a fire door lock in accordance with claim 16, further
comprising a pair of hot-melt members that are attached at each of the bias
runners of the first and second lateral members respectively and wherein the
hot-melt members block the self-locking member.
18. The latch assembly of a fire door lock in accordance with claim 16, further
comprising a hot-melt member which is inserted into and attached at each of
the bias runners of the first and second lateral members and wherein the
hot-melt member blocks the self-locking member.
19. The latch assembly of a fire door lock in accordance with claim 16, wherein
each of the bias runners comprises a position hole, and wherein the self-locking
member is capable of sliding into each of the position holes and blocking the
link member.
20. The latch assembly of a fire door lock in accordance with claim 19, wherein the
link member at least comprises a middle rod, and wherein the self-locking
member is capable of blocking the middle rod of the link member.
21. The latch assembly of a fire door lock in accordance with claim 14, further
comprising at least one self-locking member, the link member at least
comprising a middle rod and a lower rod, wherein the self-locking member is
pivotally disposed at one side of the middle rod.

22. The latch assembly of a fire door lock in accordance with claim 21, further comprising a hot-melt member that is inserted into and fixed at the latch base, and wherein the self-locking member comprises a limit end contacting the hot-melt member.

23. The latch assembly of a fire door lock in accordance with claim 21, wherein the first and second lateral members comprise a longitudinal runner formed thereon respectively, and wherein the longitudinal runners correspond with each other.

24. The latch assembly of a fire door lock in accordance with claim 23, further comprising a joint pin slideably disposed within the longitudinal runners of the first and second lateral members and a connection rod, wherein the joint pin connects the lower rod of the link member and the connection rod.

25. The latch assembly of a fire door lock in accordance with claim 24, wherein the self-locking member is capable of blocking the joint pin.

26. The latch assembly of a fire door lock in accordance with claim 25, wherein the self-locking member comprises a limit end capable of blocking the joint pin.

27. The latch assembly of a fire door lock in accordance with claim 1, further comprising a latch return spring which is pivotally disposed at one end of the latch bolt and wherein one end of the latch return spring contacts the latch bolt.
FIG. 2