

EJECTION OUTLET ACTUATOR FOR AUTOMATIC FIRE EXTINGUISHER

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an actuator for automatically actuating an ejection outlet of an automatic fire extinguisher so as to eject a fire extinguishant, and more particularly to an ejection outlet actuator for an automatic fire extinguisher having a simple gear engagement structure for transmitting power of a motor, which is effectively actuated and has a long expected life span due to reduced load applied to the motor and other parts of the actuator.

Description of the Related Art

Generally, an automatic fire extinguishing device is installed in the kitchen or other commercial and residential places provided with electric or gas stoves (for example, a gas range) so as to detect a fire and then automatically extinguish the fire safely and quickly.

The aforementioned conventional automatic fire extinguishing device comprises a fire extinguisher, a nozzle of the fire extinguisher secured to a range hood above a gas range, and a fuse blink (low temperature melting lead) fused by

transmitted heat. An operating lever of the fire extinguisher is elastically supported downward by a spring and connected to the fuse blink via a wire so that the operating lever is in an elevated position.

Under the elevated position of the operating lever, when the fuse blink is fused by the heat generated by the fire, the operating lever of the fire extinguisher is lowered by the elasticity of the spring, thereby actuating an ejection outlet of the fire extinguisher to eject a fire extinguishant to the fire.

However, since the operating lever of the fire extinguisher of the aforementioned conventional fire extinguishing device must be connected to the fuse blink by the wire in order to maintain the elevated position of the operating lever, the conventional fire extinguishing device is difficult to install. Further, in the aforementioned conventional fire extinguishing device, the change of the elasticity of the spring for elastically supporting the operating lever, more particularly the weakening of the elasticity of the spring, and the change of extension and contraction rate of the fuse blink cause malfunctions of the fire extinguisher.

Therefore, in order to solve the above problems of the aforementioned conventional fire extinguishing device, a plurality of other automatic fire extinguishing devices are

disclosed. Among them, in one automatic fire extinguishing device, first and second fire detectors for detecting a fire and a fire extinguishing nozzle are installed on a range hood above a gas range in the kitchen.

The fire extinguishing nozzle is connected to an ejection outlet of a fire extinguisher via an ejection pipe, an actuator is installed on the upper portion of the ejection outlet of the fire extinguisher, a gas-blast circuit breaker is installed on a gas pipe, and the first and second fire detectors, the actuator, and the gas-blast circuit breaker are connected to a controller. Therefore, in case a first fire is detected, the gas-blast circuit breaker is operated by the controller so as to block gas and in case a second fire is detected, the actuator is operated by the controller so as to automatically eject a fire extinguishant of the fire extinguisher, thereby quickly suppressing the fire.

Specifically, the actuator of the fire extinguisher comprises a motor driven by the controller, a plurality of reduction gears, and an eccentric cam for compressing an operating pin to open the ejection outlet of the fire extinguisher. Therefore, in the actuator of the fire extinguisher, the motor is driven by a fire-sensing signal inputted from the controller and the eccentric cam compresses the operating pin of the ejection outlet of the fire extinguisher by the rotary force of the motor through the

reduction gears, thereby discharging the fire extinguishant.

Since the plural reduction gears of the actuator are toothedly engaged with each other so as to transmit the rotary force of the motor, the actuator is very complex in its structure, thereby reducing assembling efficiency and productivity of the actuator. Further, in case only some reduction gears are damaged, the whole set of the engaged reduction gears must be replaced with a new set.

The toothedly engagement of the plural reduction gears generates a large quantity of load in transmitting the rotary force of the motor, thereby shortening its expected life span.

SUMMARY OF THE INVENTION

Embodiments of the present invention may provide an ejection outlet actuator for an automatic fire extinguisher with a simple power transmission structure that effectively transmits the rotary force of a motor, thereby maximizing the assembling efficiency, productivity, and reliability of the actuator.

Embodiments of the present invention may provide an ejection outlet actuator for an automatic fire extinguisher that minimizes load generated in the power transmission of the motor, thereby lengthening the expected life span of the actuator.

In accordance with an aspect of the present invention, there is provided an ejection outlet actuator for an automatic fire extinguisher in which a motor is driven by a controller upon sensing a fire and an operating pin protruded from the upper surface of an ejection outlet of a fire extinguisher is compressed by the rotary force of the motor so as to eject a fire extinguishant, wherein an interlocking gear installed on a side of a shaft provided with a feed screw portion formed in the crosswise direction is toothedly engaged with a driving gear installed on the axis of the motor so that the driving gear and the interlocking gear are sequentially operated, a feed nut toothedly engaged with the feed screw portion is installed on the feed screw portion of the shaft so that the feed nut moves forward and backward by the regular and reverse rotation of the shaft, and an operating link contacting a push rod installed on the upper surface of the operating pin of the ejection outlet is connected to the feed nut so that the operating link is rotated by the forward and backward movement of the feed nut, and then compresses the operating pin of the ejection outlet.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a fire extinguisher employing an ejection outlet actuator in accordance with the present invention;

Fig. 2 is a cross-sectional view of the fire extinguisher of Fig. 1;

Fig. 3 is an exploded perspective view of the ejection outlet actuator in accordance with a first embodiment of the present invention;

Fig. 4 is an assembled perspective view of the ejection outlet actuator in accordance with the first embodiment of the present invention;

Fig. 5 is a cross-sectional view showing the operation of the ejection outlet actuator in accordance with the first embodiment of the present invention;

Fig. 6 is a cross-sectional view of a fire extinguisher employing an ejection outlet actuator in accordance with a second embodiment of the present invention; and

Figs. 7a and 7b are cross-sectional views showing the operation of the ejection outlet actuator in accordance with the second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, preferred embodiments of the present invention will be described in detail with reference to the annexed drawings.

As shown in Figs. 1 to 4, in an ejection outlet actuator for the automatic fire extinguisher in which a motor (M) is driven by a controller (not shown) upon sensing a fire and an operating pin 5 protruded from the upper surface of an ejection outlet 3 of a fire extinguisher 2 is compressed by the rotary force of the motor so as to eject a fire extinguishant, an interlocking gear 21 installed on a side of a shaft 20 provided with a feed screw portion 22 formed in the crosswise direction is toothedly engaged with a driving gear 10 installed on the axis of the motor (M) so that the driving gear 10 and the interlocking gear 21 are sequentially operated.

A feed nut 30 toothedly engaged with the feed screw portion 22 is installed on the feed screw portion 22 of the shaft 20 so that the feed nut 30 moves forward and backward by the regular and reverse rotation of the shaft 20.

An operating link 40 contacting a push rod 58 installed on the upper surface of the operating pin 5 of the ejection outlet 3 is connected to the feed nut 30 so that the operating link 40 is rotated by the forward and backward movement of the feed nut 30, and then compresses the operating pin 5 of the

ejection outlet 3.

Herein, guide pins 32 are respectively protruded from both sides of the feed nut 30 and long holes 42 opened at their tops are formed on both sides of the upper portion of the operating link 40 so that the guide pins 32 of the feed nut 30 are guided and inserted into the corresponding long holes 42 of the operating link 40, thereby rotating the operating link 40 centering around an axial pin inserted into the center of the operating link 40 by the forward and backward movement of the feed nut 30.

As shown in drawings, a worm and a worm gear are preferably used as the driving gear 10 installed on the axis of the motor (M) and the interlocking gear 21 installed on the shaft 20, respectively.

Undescribed Reference number 25 represents supporting bushes for supporting both sides of the shaft 20. Undescribed reference numbers 50 and 51 represent upper and lower cases, respectively. Undescribed reference numbers 53 and 55 represent a bearing for receiving the shaft 20 and a bracket into which the axial pin 45 is inserted.

Hereinafter, the operation and function of the ejection outlet actuator for the automatic fire extinguisher in accordance with the present invention will be described in detail.

The motor (M) is driven by the control action of the

controller (not shown) upon sensing a fire. Then, the shaft 20 is rotated by the interlocking gear 21 (i.e., the worm gear) toothedly engaged with the driving gear 10 (i.e., the worm) on the axis of the motor (M).

The feed nut 30 screw-type engaged with the opened terminal end of the feed screw portion 22 moves along the feed screw portion 22 of the shaft 20 by the rotary motion of the shaft 20.

That is, the feed nut 30 rectilinearly moves according to the rotary motion of the shaft 20.

As described above, since the feed nut 30 moves forward along the feed screw portion 22 of the shaft 20, the guide pins 32 on the both sides of the feed nut 30 are guided to the corresponding long holes 42 of the operating link 40, thereby rotating the operating link 40 centering around the axial pin 45.

Herein, the change of the distance between the guide pins 32 of the feed nut 30 and the axial pin 45 of the operating link 40 is offset by guiding the guide pins 32 of the feed nut 30 to the corresponding long holes 42 of the operating link 40. Therefore, the operating link 40 is smoothly rotated.

As described above, when the operating link 40 is rotated centering around the axial pin 45, an inclined operation surface 41 of the lower portion of the operating link 40 compresses the operating pin 5 protruded from the upper surface

of the ejection outlet 3 of the fire extinguisher 2 by means of the push rod 58, thereby opening the ejection outlet 3 and allowing the ejection outlet 3 to eject the fire extinguishant from the fire extinguisher 2.

As a result, the ejection outlet actuator for the automatic fire extinguisher of the present invention has a simple gear engagement structure such that the rotary motion of the motor is transmitted to the shaft via the worm and the worm gear so as to rotate the shaft, the feed nut rectilinearly moves by the rotary motion of the shaft, and the operating link connected to the feed nut is rotated. Therefore, the simple gear engagement structure of the ejection outlet actuator for the automatic fire extinguisher of the present invention effectively transmits power of the motor to the shaft so as to compress the operating pin of the fire extinguisher without the conventional complex engagement of plural reduction gears.

Further, compared to the aforementioned first preferred embodiment of the present invention as shown in Fig. 2 to 5, in an ejection outlet actuator for the automatic fire extinguisher in accordance with a second preferred embodiment of the present invention as shown in Figs. 6 and 7, guide pins 32 are respectively protruded from both sides of the feed nut 30, long holes 42 opened at their tops for receiving the corresponding guide pins 32 of the feed nut 30 are formed on both sides of the upper portion of the operating link 40, and

cavities 43 having a larger diameter than that of the guide pin 32 are formed on the external side surfaces of the lower portions of the corresponding long holes 42 so that washers 47 are inserted to the protruded ends of the corresponding guide pins 32 inserted into the long holes 42 of the operating link 40, and then forcibly fitted into the corresponding cavities 43 so as to prevent the release of the guide pins 32 from the long holes 42 and rotatably support the guide pins 32.

A guide bar 44 formed on the lower surface of the operating link 40 is inserted into a guide hole 62 penetrating the diameter of a drum 60 rotating in the rotary direction of the operating link 40 so that the operating link 40 is rotated centering around the guide pins 32 of the feed nut 30 by the forward and backward movement of the feed nut 30.

Compared to the aforementioned first preferred embodiment, in the second preferred embodiment of the present invention, the guide bar 44 of the operating link 40 connected to the feed nut 30 moving forward along the feed screw portion 22 of the shaft 20 is guided to the guide hole 62 of the drum 60, thereby being rotated centering around the guide pins 32 of the feed nut 30.

Herein, the change of the distance between the guide pins 32 of the feed nut 30 and the drum 60 with the guide hole 62 for receiving the guide bar 44 of the operating link 40 is offset by guiding the guide bar 44 of the operating link 40 to

the guide hole 62 of the drum 60. Therefore, the operating link 40 is smoothly rotated.

As described above, when the operating link 40 is rotated centering around the guide pins 32, the inclined operation surface 41 of the lower portion of the operating link 40 compresses the operating pin 5 protruded from the upper surface of the ejection outlet 3 of the fire extinguisher 2 by means of the push rod 58, thereby opening the ejection outlet 3 and allowing the ejection outlet 3 to eject the fire extinguishant from the fire extinguisher 2.

That is, the same as the aforementioned first preferred embodiment, as the operating link 40 of the second preferred embodiment of the present invention is rotated by the rectilinear motion of the feed nut 30, the operating link 40 compresses the operating pin 5 protruded from the upper surface of the ejection outlet 3 of the fire extinguisher 2.

As apparent from the above description, the present invention provides an ejection outlet actuator for the automatic fire extinguisher with a simple power transmission structure that effectively transmits the rotary force of the motor to the shaft via the worm and the worm gear so as to rotate the shaft, the feed nut rectilinearly moves by the rotary motion of the shaft, and the operating link connected to the feed nut is rotated so as to compress the operating pin of the fire extinguisher, thereby effectively transmitting the

power of the motor to the shaft and maximizing assembling efficiency and productivity of the actuator.

Further, the present invention provides an ejection outlet actuator for the automatic fire extinguisher that does not require the conventional complex structure of engaging plural reduction gears, thereby minimizing load applied to the motor and other parts and lengthening the expected life span of the actuator.

Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

WHAT IS CLAIMED IS:

1. An ejection outlet actuator for an automatic fire extinguisher in which a motor is driven by a controller upon sensing a fire and an operating pin protruded from the upper surface of an ejection outlet of a fire extinguisher is compressed by the rotary force of the motor so as to eject a fire extinguishant,

) wherein an interlocking gear installed on a side of a shaft provided with a feed screw portion formed in the crosswise direction is toothedly engaged with a driving gear installed on the axis of the motor so that the driving gear and the interlocking gear are sequentially operated,

a feed nut toothedly engaged with the feed screw portion is installed on the feed screw portion of the shaft so that the feed nut moves forward and backward by the regular and reverse rotation of the shaft, and

an operating link contacting a push rod installed on the upper surface of the operating pin of the ejection outlet is connected to the feed nut so that the operating link is rotated by the forward and backward movement of the feed nut, and then compresses the operating pin of the ejection outlet.

2. The ejection outlet actuator for an automatic fire extinguisher as set forth in claim 1,

wherein guide pins are respectively protruded from both sides of the feed nut and long holes opened at their top are formed on both sides of the upper portion of the operating link so that the guide pins of the feed nut are guided and inserted into the corresponding long holes of the operating link, thereby rotating the operating link centering around an axial pin inserted into the center of the operating link by the forward and backward movement of the feed nut.

3. The ejection outlet actuator for an automatic fire extinguisher as set forth in claim 1,

wherein guide pins are respectively protruded from both sides of the feed nut, long holes opened at their tops for receiving the corresponding guide pins are formed on both sides of the upper portion of the operating link, and cavities having a larger diameter than that of the guide pin are formed on the external side surfaces of the lower portions of the corresponding long holes so that washers are inserted to the protruded ends of the corresponding guide pins inserted into the long holes of the operating link and then forcibly fitted into the corresponding cavities so as to prevent the release of the guide pins from the long holes and rotatably support the guide pins, and

a guide bar formed on the lower surface of the operating link is inserted into a guide hole penetrating the diameter of

a drum rotating in the rotary direction of the operating link so that the operating link is rotated centering around the guide pins of the feed nut by the forward and backward movement of the feed nut.

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ABSTRACT OF THE DISCLOSURE

Disclosed is an ejection outlet actuator for an automatic fire extinguisher that automatically actuates an ejection outlet of an automatic fire extinguisher so as to eject a fire extinguishant from the fire extinguisher in detecting a fire. In the ejection outlet actuator for the automatic fire extinguisher, an interlocking gear installed on a side of a shaft provided with a feed screw portion formed in the crosswise direction is toothedly engaged with a driving gear installed on the axis of the motor so that the driving gear and the interlocking gear are sequentially operated, a feed nut toothedly engaged with the feed screw portion is installed on the feed screw portion of the shaft so that the feed nut moves forward and backward by the regular and reverse rotation of the shaft, and an operating link contacting a push rod installed on the upper surface of the operating pin of the ejection outlet is connected to the feed nut so that the operating link is rotated by the forward and backward movement of the feed nut, and then compresses the operating pin of the ejection outlet, thereby effectively transmitting the power of the motor to the shaft, maximizing assembling efficiency and productivity of the actuator, minimizing load applied to the motor and other parts, and lengthening the expected life span of the actuator.

Figure 1