

PATENT SPECIFICATION

(11)

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(21) Application No. 40605/74 (22) Filed 18 Sept. 1974

(19)

(23) Complete Specification filed 16 Sept. 1975

(44) Complete Specification published 30 March 1978

(51) INT. CL.³ E05F 15/00

(52) Index at acceptance

E2A D5U

E2M 11E2 16 26

F2K 4B4

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(54) DRIVING AND LOCKING MECHANISMS

(71) We, WESTINGHOUSE BRAKE AND SIGNAL COMPANY LIMITED, a Company incorporated under the Laws of Great Britain, of 3, John Street, London, WC1N 2ES, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to driving and locking mechanisms and relates especially but not exclusively to such mechanisms for use with sliding doors for rail vehicles.

In the field of railway vehicle doors which open and close by sliding sideways along or within the vehicle body, it is desirable (and sometimes required by official regulations) that the door operating mechanism will, when the door is closed, maintain the door held in the closed position even in the event of a failure of the door mechanism controls or power supply. In prior art arrangements utilising long stroke linear actuators (such as a piston and long cylinder supplied with pressurised air or hydraulic oil), a latch has been employed for locking the door in the closed position. Such a latch requires separate unlatching actuation to permit the door to open, and moreover is an extra mechanism which adds to the problems of cost, maintenance, reliability and safety. The present invention provides a simple and reliable mechanism which, as applied to a sliding door, obviates the need for a separate latching mechanism by being self-latching in the door-closed position. An optional extra may additionally provide for limited opening of the door with the mechanism in the door-closed position so as to allow for freeing of anything trapped by closure of the door. (The mechanism of the present invention can also be utilised for other purposes which may be unrelated to railway vehicle doors.)

According to the present invention there is provided a driving and locking mechanism including a driven member, a first link coupled by a first pivot to the

driven member, a driving member, a second link coupled by a second pivot to the driving member, said first and second links being mutually pivotally coupled by a third pivot so as to pivotally link the driving and driven members, said first and second links being constrained to remain in a predetermined relative position or positions over a range of movement of the driving and driven members, and wherein at a point beyond said range the constraint is removed whereby to allow pivotal movement of the links away from said predetermined relative position or positions so that the first link swings into a position in which the line joining the first and third pivots thereon takes up a vertical or over-vertical position in relation to an abutment surface thereby to oppose movement of the driving means by forces from the driven means.

The abutment may be a resiliently movable abutment permitting a predetermined deflection of the drive means via the linkage by movement of the driven means.

Preferably the third pivot, between and coupling the mutually pivoted links, is constrained to move over said range of movement by means of a guide track.

The drive means may comprise a sliding door actuator and the driven means may comprise a sliding door hanger.

In order that the invention may be more clearly understood and readily carried into effect, the same will be further described by way of example with reference to the accompanying drawings of which,

Fig. 1 illustrates a driving and locking mechanism in accordance with one embodiment of the invention,

Fig. 2 illustrates the driving and locking mechanism of Fig. 1 in an alternative condition,

Fig. 3 illustrates an end view of the mechanism of Fig. 1 or Fig. 2, and

Fig. 4 illustrates an alternative form of locking mechanism with a resilient abutment.

Referring to the drawing and considering

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first Fig. 1, this shows a sliding door track in a form of a tubular member 1. The circular form of the member 1 is shown more clearly in Fig. 3 from which it is seen that a sliding door 2 is suspended via a hanger 3 extending through a slot 4 into the member 1 which carries internal rollers (not shown) to which the hanger 3 is connected. Attached to the hanger 3 is a bracket 5 which has a triangular flange, the apex of which is pivotally connected at a first pivot 8 to a first link 6. The other end of the link 6 is pivotally connected at a pivot 7 (the "third" pivot of claim 1) to one end of a further and shorter second link 9. The other end of the link 9 is pivotally connected by a pivot 12 (the "second" pivot of claim 1) via a bracket 10 to a driving member in the form of an actuator rod 11 of a door actuator (not shown). The pivot 7 between the two links 6 and 9, and the pivot 12 between the link 9 and the driving member, are provided with respective rollers 13 and 14 each of which is rollingly engageable between the upper and lower surfaces 15 and 16 respectively of a guide track 17. It will be seen moreover that the lower surface 16 of the guide track 17 terminates at a point displaced to the left from the right-hand end of the track 17 and is provided with a downwardly extending abutment denoted by reference 18 against the surface of which the roller 14 abuts when the apparatus is in the position shown in Fig. 1. The abutment 18 moreover is such that in the position shown in Fig. 1, which in the present instance is the closed position of the door 2, the line joining the pivots 7 and 8 on the link 6 is over-vertical or at least vertical with respect to the surface of the abutment 18 such that any effort exerted via the bracket 5 on the mechanism is reacted by the abutment 18 and therefore no motion is possible as a result of such a force. Thus, once the door 2 is placed in the closed position by the driving mechanism, the driving mechanism automatically locks the door 2 in the closed position so that the door 2 cannot be forced open by a passenger in the vehicle which carries the door 2. Moreover the door 2 will remain locked in the closed position even in the event of failure of the controls or power supply of the driving mechanism.

Considering now the operation of the apparatus, the position of the apparatus as shown in Fig. 1 is, as aforesaid, the door-closed position, and by reason of the vertical or over-vertical position of the link 6 in relation to the surface of the abutment 18, the mechanism is thereby locked. However, upon energisation of the actuator rod 11 tending to move the rod 11 towards the left, to tend to move the mechanism away from the door-closed position, the roller

13 is guided between the upper and lower surfaces 15 and 16 of the guide track 17 and the pivot 7 with its roller 14 is lifted upwards towards the previously remote surface 15 of the guide track 17 until a point is reached in which the roller 14 comes into contact with the surface 15, whereupon the leftward motion of the drive member 10 is transmitted directly through the two links 6 and 9 and the bracket 5 to the door hanger 3. In this state of affairs, the motion of the links 6 and 9 is constrained by the location of the rollers 13 and 14 within the surfaces 15 and 16 of the guide track 17 such that the first, second, and third pivots (8, 12, and 7 respectively) are constrained to a mutually substantially collinear disposition. Under these conditions, the door actuator can actuate the movement of the door 2 in a forward or a reverse direction towards or away from the closed position, the links 6 and 9 being relatively positioned with regards to one another as shown in Fig. 2. However, on return to a state of affairs where the roller 14 passes the end of the lower surface 16 of the guide track 17, the pivot 7 and its roller 14 move downward and the roller 14 again engages the surface of the abutment 18 to re-establish the door-locking condition of the mechanism.

Referring to Fig. 4, in certain applications of door driving and locking mechanisms, it is required to permit a certain amount of movement of a closed or nearly-closed door in order to enable trapped limbs or possessions to be withdrawn. This is especially desirable in rail vehicle doors where supervision of the closing of individual doors is not provided for. In order to satisfy this requirement, the arrangement described above with reference to Figs. 1, 2, and 3 may be modified, as shown in Fig. 4, by providing for the abutment 18 to be a resilient abutment which permits a degree of movement. Such a resilient abutment is provided by the sliding plunger 19 of Fig. 4, which is mounted beneath the lower surface 16 of the guide track 17 by means of a pair of horizontally slideable rods 20 and 21 carrying springs 22 and 23 respectively. The rods 20 and 21 are carried by and slideable through a suitably apertured guide block 25.

In order moreover to provide the locking mechanism with an anti-rattle capability, it may be arranged that the surface of the abutment 18 is so angled or radiused that it has a surface which at lower contact points is nearer to the pivot 8 than at upper contact points. The roller 14 thereby tends to jam against the abutment surface 18 when rolling down it. However it will be appreciated that whilst this provides an anti-rattle facility, it is inherently

such that when sufficient effort is applied to the linkage 6 and 9 by actuation of the rod 11, the roller 14 tends to roll upwards along the abutment surface 18 until a perpendicular relationship between the link 6 and the surface 18 is returned to. The surface of the abutment 18 of Fig. 4 is shown curved to achieve this particular anti-rattle capability.

WHAT WE CLAIM IS:—

1. A driving and locking mechanism including a driven member, a first link coupled by a first pivot to the driven member, a driving member, a second link coupled by a second pivot to the driving member, said first and second links being mutually pivotally coupled by a third pivot so as to pivotally link the driving and driven members, said first and second links being constrained to remain in a predetermined relative position or positions over a range of movement of the driving and driven members, and wherein at a point beyond said range the constraint is removed whereby to allow pivotal movement of the links away from said predetermined relative position or positions so that the first link swings into a position in which the line joining the first and third pivots thereon takes up a vertical or over-vertical position in relation to an abut-

ment surface thereby to oppose movement of the driving means by forces from the driven means.

2. A mechanism according to Claim 1, wherein the predetermined relative position is such that there is a mutually substantially collinear disposition of the first, second, and third pivots.

3. A mechanism according to Claim 1 or Claim 2, wherein the constraint upon the links is provided by a guide track which guides the links or parts attached thereto during movement within said range of movement.

4. A mechanism according to any preceding claim, wherein the abutment is resiliently movable whereby to permit a predetermined deflection of the drive means via the linkage by movement of the driven means.

5. A mechanism according to any preceding claim, wherein the drive means comprises a sliding door actuator, and the driven means comprises a sliding door hanger.

6. A driving and locking mechanism substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1978.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained



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