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(54) Electro-mechanical controls for ventilators and methods employing same.

(57) An electro-mechanical ventilator control mechanism comprises a rotary actuator (19) operable to move a control arm (1) to open and close the ventilator *via* a force transmitting member (10) formed in two sections (4, 5), normally retained telescoped one within the other by an electromagnetic device (2, 3) mounted on the section (4) and an electromagnetic keeper plate (4) mounted on the section (5), spring means (7) being provided pulling on the end of the member (10) and tending to open the ventilator. De-energisation of the electromagnetic device (2, 3) e.g. under the control of an automatic fire ventilating system, releases the keeper plate (4) and allows the ventilator to open under the action of the spring (7). Subsequent operation of the rotary actuator (19) and re-energisation of the electromagnetic device (2, 3) re-sets the ventilator for automatic operation. Instead of a rotary actuator (19) a linear actuator (20) (see Figure 2) may be used.

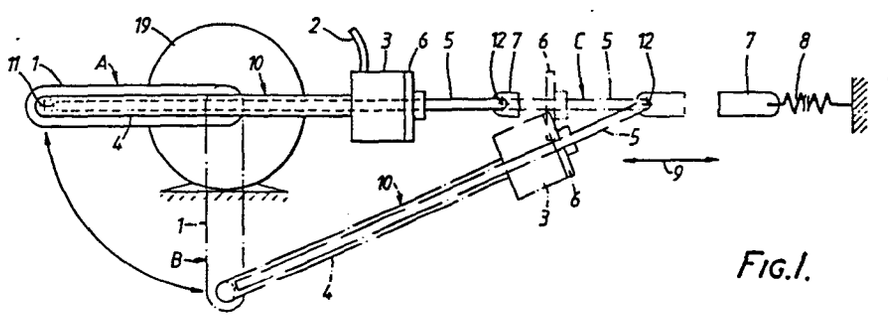

FIG. 1.

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ELECTRO-MECHANICAL CONTROLS FOR VENTILATORS AND METHODS EMPLOYING SAME

The present invention relates to ventilators and concerns electro-mechanical controls for ventilators and methods of employing same.

There are ventilating applications requiring the impartation of a movement to a member upon the operation of two different control systems to open or close a ventilator or a series of ventilators. Typically a ventilator may be required to be opened or closed under the control both of say a day-to-day ventilation management system and opened or fully opened or closed under the control of say an emergency fire ventilation system. A requirement in respect of emergency systems is that they can readily be tested and reinstated.

According to the present invention a ventilator has an electro-mechanical control mechanism comprising actuating means operable to open and close the ventilator via a force transmitting member formed in two sections which are normally retained telescoped one with respect to the other by an electromagnetic device mounted on one of the sections and an electro-magnetic keeper plate mounted on the other of the sections, energising means being provided pulling or

pushing on the distal end of the force transmitting member in the direction to extend the member.

Typically, a rotary actuator may be driven to swing a control arm through a predetermined angle about an axis of rotation to impart a predetermined movement to the distal end of a connecting rod pivoted to the arm, thereby to perform the opening and closing movement of the ventilator.

With this arrangement according to the invention, when the electromagnetic device is de-energised under the control of a first control system, the connecting rod is extended by the pushing or pulling means to perform the opening or closing movement. The same function may be performed under the control of a second control system by rotating the control arm. Furthermore, operation of the rotary actuator following upon extension of the connecting rod rotates the control arm to re-unite the electromagnetic device and the keeper plate so that upon re-energisation of the electromagnetic device and reverse rotation of the control arm by the rotary actuator the ventilator is re-set to its original condition.

In another arrangement according to the present invention a linear actuator is operable to impart a

predetermined movement to a rod, for example, a piston rod of the actuator, the distal end of which is connected to perform the opening and closing movement of the ventilator.

With the last described arrangement, the ventilator responds to de-energisation of the electromagnetic device and is re-set by operation of the linear actuator in the same manner as the first described arrangement in accordance with the invention.

The present invention has been developed for the control of a ventilator to provide for both ordinary day-to-day ventilation and for emergency fire ventilation purposes. The electromagnetic device may be de-energised automatically in response to a fire condition detected for example by a smoke or pressure detector of a fire ventilation system to fully open the ventilator. Operation of the rotary or the linear actuator using the day-to-day management system then reinstates the automatic fire ventilation system or permits it to be installed upon energisation of the electromagnetic device.

Specific embodiments of the present invention will now be described by way of example, and not by way of limitation, with reference to the accompanying drawings in which :-

FIG. 1 shows a ventilator control comprising a rotary actuator in three different settings indicated A in full line and B and C respectively in broken line; and

FIG. 2 shows a ventilator control comprising a linear actuator.

With reference now to the accompanying drawings, and first to Figure 1, a control arm 1 is rotatable by a reversible electric motor 19 for controlling day-to-day opening and closing of a louvred ventilator (not shown) the louvres of which are hingeably connected to a control bar 7 of the ventilator which is bodily movable in opposite directions 9 respectively to open and close the ventilator louvres in unison and in the direction to open the louvres by means of a spring 8. Louvred ventilators are commonly controlled by means of such a control bar and biased for spring opening and the control bar 7 is the member to be moved by the ventilator control now being described. The control arm 1 operates a connecting rod 10 which is pivoted as at 11 to the arm. The distal end 12 of the connecting rod is pivoted to the control bar of the ventilator. The connecting rod 10 is in two sections 4 and 5. Section 4 is formed as a tube and section 5

as a rod. The rod 5 slides in the tube 4. The rod 5 is normally retained telescoped within the tube 4 by an energised electromagnetic device 3 mounted on the tube 4 and an electromagnetic keeper plate 6 mounted on the rod 5. An electrical lead 2 connects with the electromagnetic device, the lead 2 being connected in with an automatic fire ventilation energising opening system. The control arm 1 is rotatable by the electric motor under the control of the day-to-day ventilation management system from its position in which the control is in the setting A shown in full line and the ventilator louvres are in a closed position to its position in which the control is in the setting B shown in broken line, to allow the ventilator louvres to be opened under the action of spring force tending to open the ventilator louvres. Conversely, the control arm 1 is rotatable by the electric motor from its B setting to its A setting under the control of the day-to-day management system to close the ventilator louvres against the action of the opening spring.

When the electromagnetic device is de-energised for test purposes, under the control of the automatic fire ventilation system, e.g. while the control is in the setting A, the keeper plate 6 is released and the

rod 5 and keeper plate 6 travel to the setting C shown in broken line under the action of the spring force tending to open the ventilator louvres and at the same time permitting the ventilator louvres to open. Following this, rotation of the arm 1 from its A setting to its B setting under the control of the day-to-day system re-engages the electromagnetic device 3 with the keeper plate 6 in the B setting position so that upon re-energisation of the electromagnetic device under the control of the fire ventilation system the automatic fire-response of the control is re-set.

It will be clear that de-energisation of the electromagnetic device in any setting of the control will cause the ventilator louvres to be moved to their fully open position if they are not already in that position.

In the A setting of the control arm 1, the arm is in a "dead centre" position with respect to the connecting rod 10 and the spring forces tending to open the ventilator are not operable to rotate the motor. The system is, therefore, locked when the ventilator is in its closed condition.

In Fig. 2 parts corresponding with parts already described are indicated by the same reference

numeral as used in Fig. 1. A pneumatic cylinder 20 has its piston rod 21 formed in two sections corresponding to the sections 4 and 5 mounting the parts 3 and 6. Operation of the pneumatic cylinder is under the control of the day-to-day management system to open and close the ventilator. De-energisation of the device 3 under the control of the automatic fire ventilation system permits the ventilator to open fully if it is not already fully open. The keeper plate 6 then assumes its chain dotted position shown in Fig. 2. Operation of the pneumatic cylinder 20 and re-energisation of the device 3 re-sets the automatic fire ventilation system.

The pneumatic cylinder may be double acting or single acting, air under pressure being supplied to the cylinder at least to close the ventilator.

The invention is not restricted to louvred ventilators but may be applied to the opening and closing; testing and re-setting of ventilators and ventilating systems particularly fire ventilating systems employing any kind of openable and closable ventilators. The ventilators may be ducted ventilators in the form of dampers and may be required to close rather than to open in response to a fire condition being detected.

CLAIMS:

1. A ventilator having an electro-mechanical control mechanism comprising actuating means (19 or 20) operable to open and close the ventilator via a force transmitting member (10 or 21) formed in two sections (4, 5) which are normally retained telescoped one with respect to the other by an electromagnetic device (2, 3, 6) mounted on one of the sections and an electromagnetic keeper plate (6) mounted on the other of the sections, energising means being provided pulling or pushing on the distal end of the force transmitting member in the direction to extend the member.

2. A ventilator as claimed in claim 1 in which the actuator is a rotary actuator (19) operable to swing a control arm (1) through a predetermined angle about an axis of rotation to impart a predetermined displacement to the distal end of said force transmitting member (10), the force transmitting member being pivoted to said arm.

3. A ventilator as claimed in claim 1 in which the actuator is a linear actuator (20) operable to impart a predetermined displacement to the distal end of said force transmitting member (21).

4. A ventilator as claimed in claim 3 in which the force transmitting member is a piston rod of said actuator.

5. A ventilator as claimed in any preceding claim in which the energising means is a spring (7).

6. A ventilator as claimed in any preceding claim including means for de-energising said electromagentic device (2, 3, 6) in response to a fire condition being detected.

7. A method of controlling a ventilator as claimed in claim 6 including operating said actuator to open the ventilator for day-to-day ventilation purposes while said electromagnetic means remains energised.

8. A method of re-setting a fire ventilator as claimed in claim 6 following opening or closing of the ventilator in response to a fire condition being detected, including operating said actuator and then re-energising said electromechanical device.

9. A method of testing a fire ventilator as claimed in claim 6 including de-energising said electromagnetic means (2, 3, 6) to test operate the ventilator by opening or closing the ventilator, then operating said actuator (10 or 20), then re-energising said electromagnetic device (2, 3, 6) and again

operating said actuator (10 or 20) to close the ventilator.

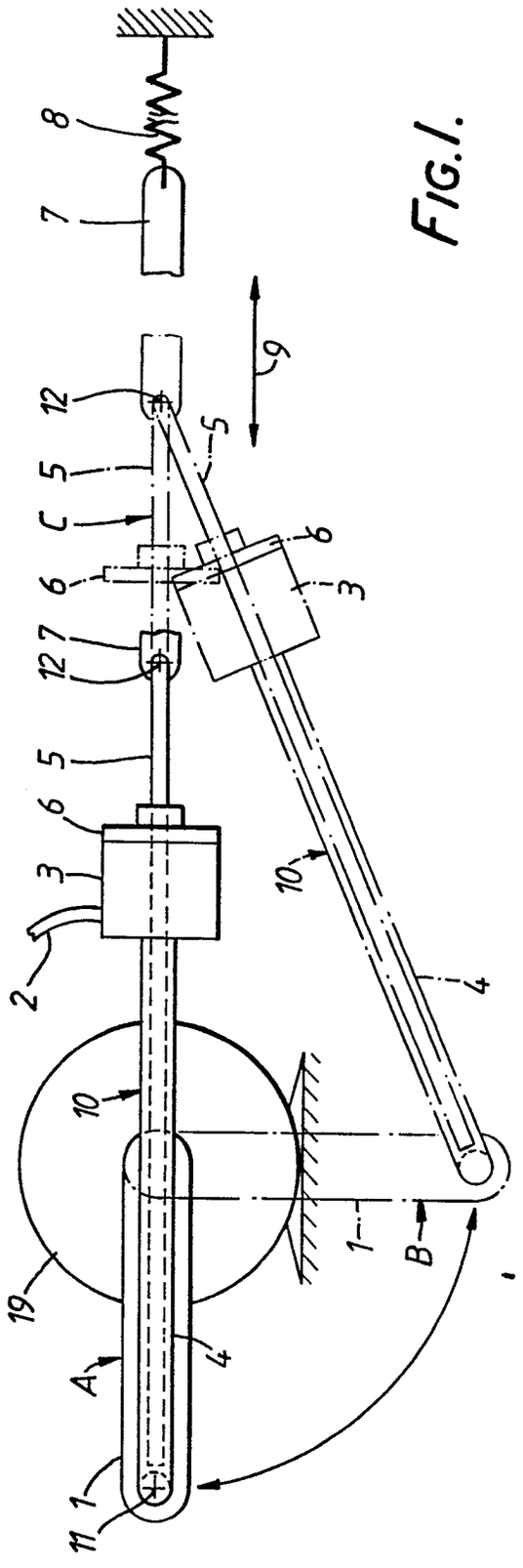
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FIG.1.

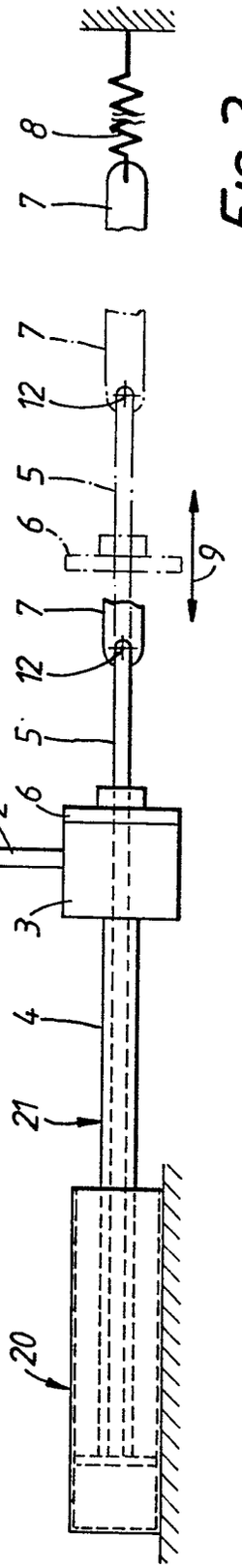
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FIG.2.