March 19, 1929. R. A. WORKMAN 1,706,338

VENTILATING SHUTTER

Filed April 30, 1927

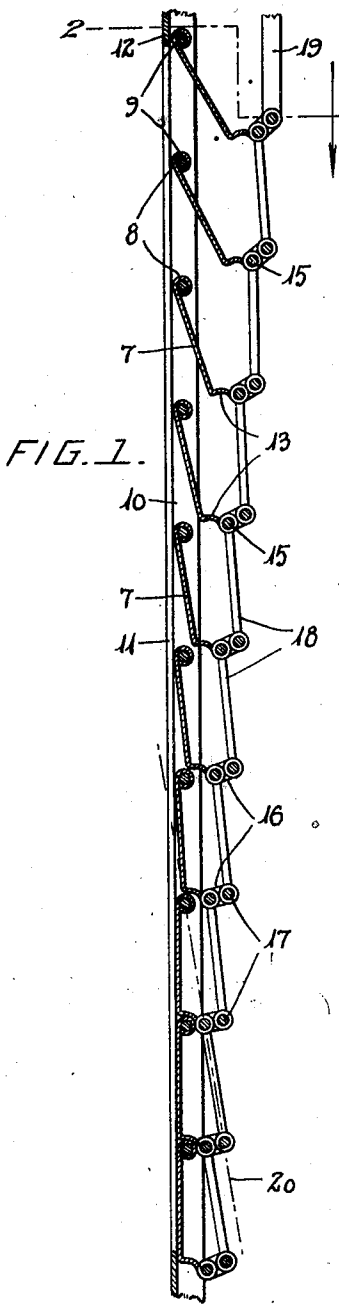

FIG. 1.

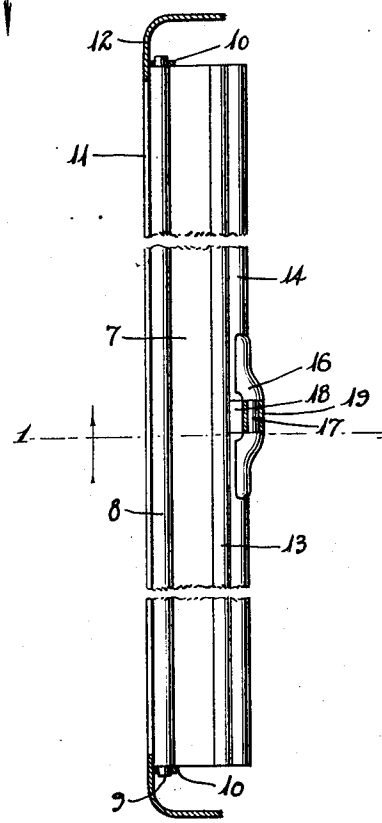

FIG. 2.

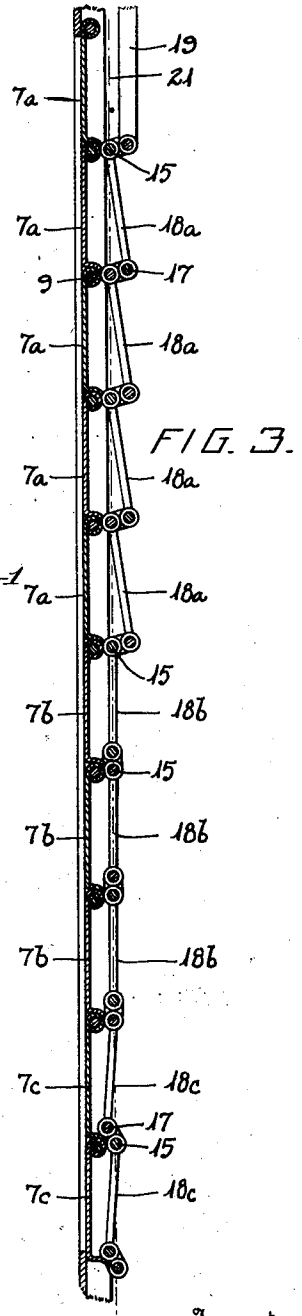

FIG. 3.

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VENTILATING SHUTTER.

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The present invention relates to ventilating shutters such as used on the radiators of the water cooling systems for automobile and airplane engines, and the like, and aims to provide novel means for connecting the shutters to control the opening movements thereof.

With the present improvements it is possible with a vertical series of shutters to open them in succession beginning with the upper shutter, which is especially advantageous for use in automobile and airship radiators, it being well known that the radiators will become hottest at the top and are most likely to freeze at the lower portions thereof. Therefore, by opening the shutters from the top downward in succession the air is first admitted through the upper portion of the radiator, where the cooling effect is most needed, and by opening the shutters further air is gradually admitted at lower points although in less amounts than higher up, the upper shutters opening further as the lower shutters are opened in succession so that the maximum flow of air is through the upper portion of the radiator, and only after the upper shutters are opened will the lower shutters be opened.

It is also possible to so arrange the connections between the shutters that two or more shutters in a group may be opened simultaneously, or that the shutters may be opened reversely, that is, from the bottom upward in succession, so that the present operative connections between the shutters lend themselves to a variety of arrangements for different circumstances to control the opening of the shutters as may be desired.

A further object of the invention is to accomplish the results above indicated by simple link connections between the shutters with compound toggle actions between the shutters and links.

With the foregoing and other objects in view, which will be apparent as the description proceeds, the invention resides in the construction and arrangement of parts, as hereinafter described and claimed, it being understood that changes can be made within the scope of what is claimed, without departing from the spirit of the invention.

The invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a vertical section of a ventilating shutter construction embodying the improvements, taken on the line 1—1 of Fig. 2.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a vertical section corresponding with Fig. 1 illustrating variations in the arrangements of the links.

The shutters 7 shown in Figs. 1 and 2 are of suitable sheet metal and are arranged in a vertical series, being disposed horizontally. The shutters are hingedly mounted to swing open rearwardly and upwardly, the upper edges of said shutters being bent around, as at 8, horizontal hinge rods 9 which have projecting terminals mounted for rotation in suitable vertical bearing bars 10. The shutters are arranged within or behind an opening 11 in a shell 12, which may be the radiator shell or a shell applied in front of the radiator, as well known. The lower portions of the shutters 7 are offset rearwardly, as at 13, to fit over the hinge portions 8 of the shutters immediately below, when the shutters are closed, as seen at the lower portion of Fig. 1, thereby enabling the shutters to move into a common plane in their closed position. The lower or free edges of the shutters are bent, as at 14, around rods 15 (see lowermost shutter in Fig. 1) which stiffen and reinforce the shutters together with the hinge rods 9. Each shutter has a yoke 16 suitably secured to the bead 14 and extending rearwardly, and the yokes have the horizontal hinge portions or rods 17 parallel with the rods 15 and disposed in rear thereof, as seen in Fig. 1.

The shutters are connected by links 18 which have their upper ends embracing the hinge rods 15 within the yokes 16 and which have their lower ends engaging the hinge portions 17 of said yokes. Thus, instead of having a single bar or link connected to all of the shutters, individual links connect the adjacent shutters.

A link or bar 19 is connected to the yoke 16 of the uppermost shutter and may be controlled by a thermostat or by a handle or other suitable means for opening and closing the shutters, the shutters operating the same for either automatic or manual control.

The arrangement of the yokes 16 and links 18 is such that when the shutters are closed, as seen at the lower portion of Fig. 1, each link 18 which extends downwardly from the corresponding shutter is substantially on a line (obliquely of the plane of the shutters in closed position) with the hinge rod or axis 9 of said shutter, as indicated at 20. Thus, the shutter and downwardly extending link thereof may be said to be in substantially

"dead center" or locking position, with the shutter and link "straightened out" with reference to the toggle action thereof. Now, when the bar or member 19 is raised for opening the shutter, the uppermost shutter is swung upwardly by said bar 19, and the uppermost or first shutter in swinging rearwardly will swing the upper end of the first link rearwardly, thereby "breaking" the toggle formed by the first shutter and first link, and said first link is then pulled upwardly with the first shutter. This will start the second shutter rearwardly and upwardly, and after it starts to swing rearwardly it pulls the second link upwardly, which in turn then starts the third shutter in its opening movement. With this arrangement it is necessary that each shutter open rearwardly slightly before the link extending downwardly therefrom is raised to start the rearward movement of the next lower shutter, and consequently the shutters open in succession from the uppermost shutter downwardly, as seen in Fig. 1. This will open the shutters from the top downward so that the air is first admitted through the upper portion of the shutter and is gradually admitted at points lower down as the opening movement of the shutters is continued. The shutters not only open in succession from the uppermost shutter downwardly but also swing open through greater angles or to greater extents from the uppermost shutter downwardly so that larger streams of air are admitted through the upper portion of the shutter than through portions lower down. When the bar 19 is moved downwardly to close the shutters the shutters close in succession from the lowermost shutter upwardly, just the reverse of the opening movements of said shutters.

By arranging the hinge portions 17 at different points with reference to the hinge rods 15 the opening movements of the shutters may be varied, and reference is had to Fig. 3 illustrating a variety of arrangements of the hinge portions 17 and links. The hinge rods 15 are disposed in the vertical plane or line 21 when the shutters are closed, as seen in Fig. 3, and the links 18^a of the first five shutters 17^a are arranged the same as shown in Fig. 1, so that the first five shutters will open in succession, it being noted that the upper ends of the links 18^a are disposed in the line or plane 21 while their lower ends are arranged rearwardly of said line. The links 18^b of the next three shutters 7^b are disposed vertically, with the shutters in closed position, so that said links 18^b are arranged in the line 21. With this arrangement of the links 18^b the shutters 7^b of this group will open simultaneously, inasmuch as the pull is transmitted through the links 18^b to the shutters 7^b alike so that they swing open as a unit. The links 18^c of the two lower shutters 7^c are inclined reversely to the links 18^a, with their lower ends spaced forwardly from the line 21. With the arrangement of the links 18^c the successive opening movements of the shutters is reversed, in that the shutters will start to open from the lower shutter upwardly, inasmuch as the movements of the shutters is increased from the upper shutter downwardly. For example, when the last shutter 7^b starts to open, the first link 18^c will swing the first shutter 7^c open to a slightly greater extent than the last shutter 7^b, and the movement of the second link 18^c will swing the second shutter 7^c open still more than the first shutter 7^b. Thus, by having the lower ends of the links hinged in rear of the vertical line 21 of the hinge rods 15, the shutters are opened in succession downwardly, whereas when the hinge axes of the lower ends of the links are located in front of the line 21 the shutters open in succession from the lower shutter upwardly, whereas when the hinge axes of the upper and lower ends of the links are in the same vertical line then the shutters will open simultaneously. All three conditions are shown in Fig. 3, inasmuch as the first five shutters 7^a will open in succession, and the next three shutters 7^b will open simultaneously with the fifth shutter 7^a, and when the shutters 7^b start to open the last two shutters 7^c will open in succession through greater amounts than the shutters 7^b. Various groupings of the shutters and links may thus be made to control the opening movements of the shutters accordingly, for different conditions and circumstances. The improvements may also be used with the shutters arranged in various positions, for example, with the shutter hinges arranged vertically.

Having thus described the invention, what is claimed as new is:—

1. A series of shutters, and links each having one end hingedly connected with a corresponding shutter, said ends of the links being disposed in a straight line when the shutters are closed, and the other ends of the links being hingedly connected with the shutters so that the links connect the shutters, the lastnamed ends of the links being arranged, in part at least, out of said line when the shutters are closed.

2. A series of shutters each having near its free edge parallel hinge portions with one of said hinge portions arranged in a straight line with the corresponding hinge portions of the other shutters when the shutters are in closed position, and the other hinge portions of at least some of the shutters being spaced from said line when the shutters are in closed position, and links connecting the firstnamed and secondnamed hinge portions of the shutters.

3. A series of shutters, means for operating one shutter thereof, and individual links hingedly connected with the shutters, the hinge axes of the links being disarranged

with respect to a straight line when the shutters are closed so that when said shutter is opened the successive shutters are opened by the successive links in a predetermined order.

4. A series of shutters, means for opening one shutter, and individual links hingedly connected with the shutters, part of the hinge axes of the links being arranged in a common straight line when the shutters are closed and the other hinge axes of the link being arranged out of said line when the shutters are closed so that when said shutter is opened the remaining shutters, in part at least, are opened in succession.

5. A series of shutters, and individual links hingedly connected with the shutters, the hinge axes of the links being so arranged with reference to one another and the shutters that each link forms with the corresponding shutter a toggle which is arranged to substantially straighten out in the closed position of the shutter.

6. A series of shutters, and links hingedly connected with the shutters, one hinge axis of each link being arranged in a common straight line when the shutters are closed, and the other hinge axes of said links being arranged, in part at least, out of said line when the shutters are closed, in order that the shutters will open in succession.

7. A series of shutters each having a hinged edge portion and having its opposite edge portion offset to fit over the hinged edge portion of the companion shutter with the shutters in a common plane in closed position, and links hingedly connected to said offset edge portions at spaced points.

8. A series of shutters each having a rod at one edge hingedly mounting the shutter and each having its opposite edge portion offset to fit over said rod of the companion shutter, said offset portions having rods to be disposed behind the firstnamed rods of the companion shutters, and links each having one end hingedly connected with the corresponding secondnamed rod, the other ends of the links being hingedly connected with said offset portions of the companion links parallel with the secondnamed rods.

In testimony whereof I hereunto affix my signature.

ROSS A. WORKMAN.