Aug. 6, 1929. T. OHNO 1,723,487

SHUTTER

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FIG. 1.

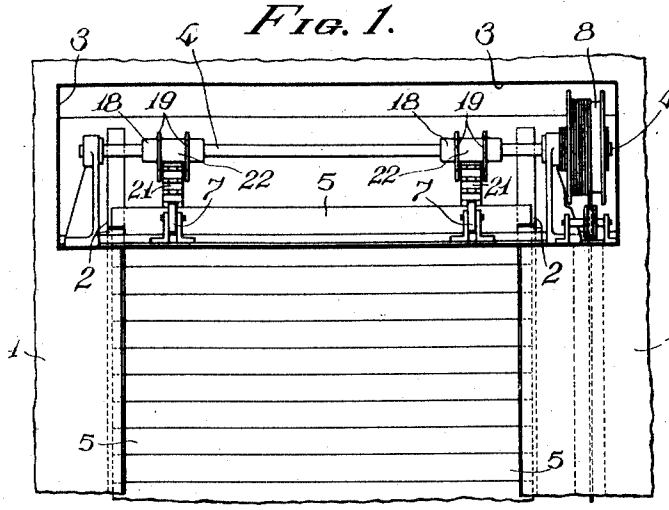
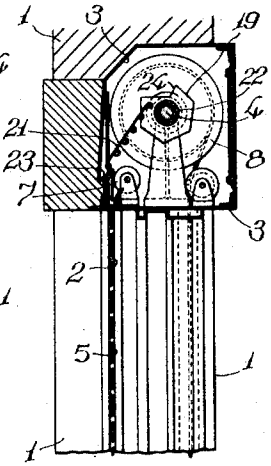
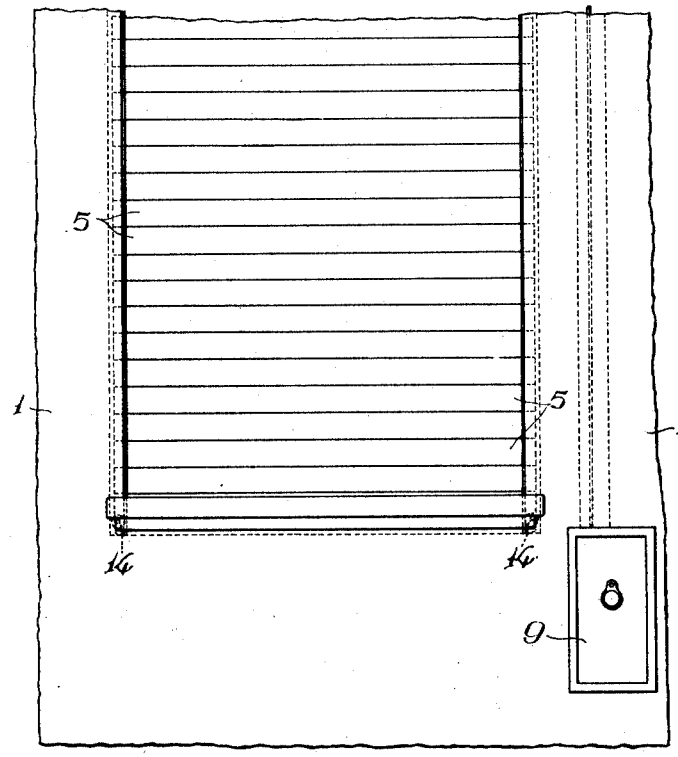
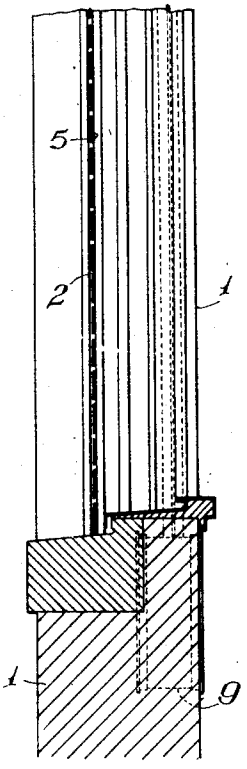


FIG. 2.







T. Ohno
Inventor

By: Marks & Clark
Attys

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Fig. 3.

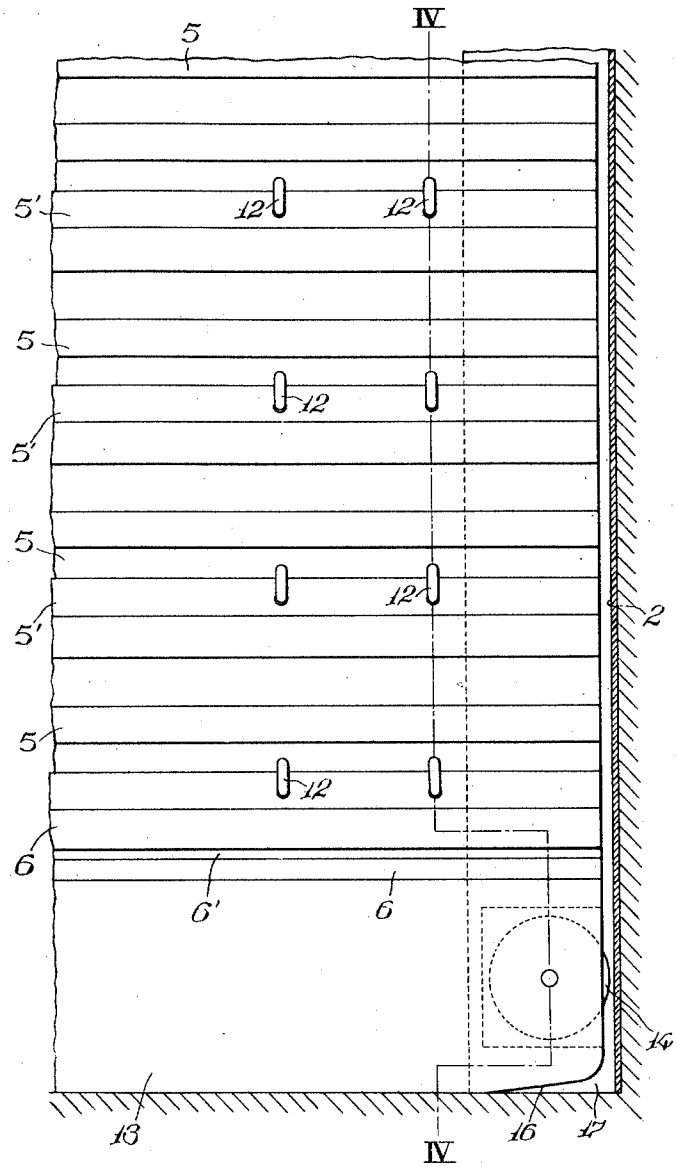
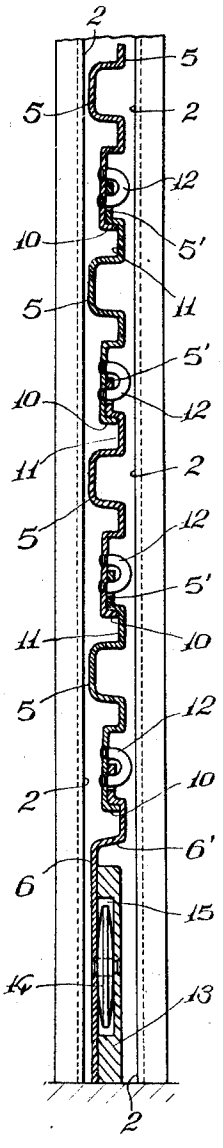


Fig. 4.



T. Ohno
Inventor
By: Marks & Clark
Attys

Aug. 6, 1929. T. OHNO 1,723,487

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Fig. 5.

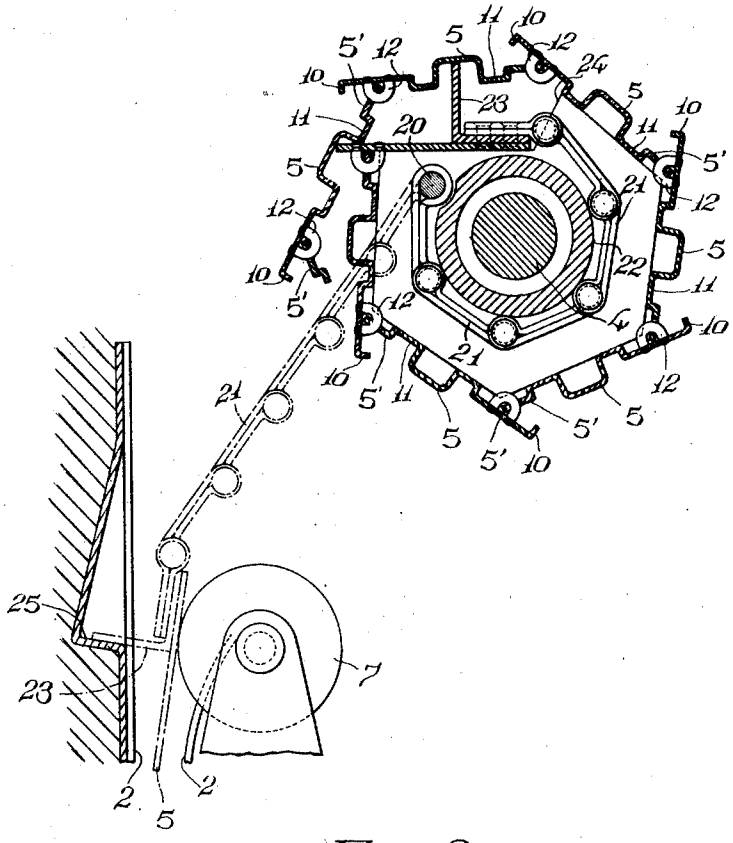
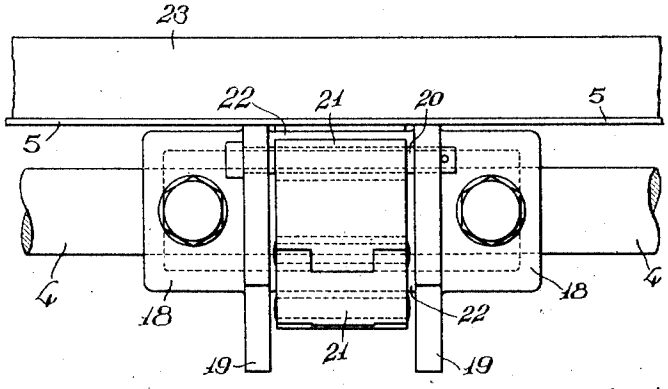


Fig. 6.



T. Ohno
inventor
By: Marks & Clerk
Attys.

Patented Aug. 6, 1929. 1,723,487

UNITED STATES PATENT OFFICE.

TADASHI OHNO, OF TOKYO, JAPAN.

SHUTTER.

Application filed September 13, 1926. Serial No. 135,229.

My invention relates to improvements in a shutter of the type provided with slats successively fastened together to be rolled on a shaft when opened.

The principal object of the invention is to provide a flexible door in which the joints of the slats are kept in close contact with each other and smoke is effectively prevented from passing through even when the door becomes deformed by heat, and further the construction of the door is rendered durable and strong. Another object of the invention is to render the operation of opening and shutting the door smooth by the provision of an end slat provided with guide rollers. Another object of the invention is to prevent the intrusion of smoke by provision of a smoke arrester which comes in close contact with the inner side of the shutter box when the door is shut. Another object of the invention is to roll the door concentrically on the shaft by provision of barrels whereby the movement of the door may be rendered even and smooth. Further objects of the invention will appear in the course of the specification.

Accompanying drawing shows an embodiment of the invention in which—

Fig. 1 is an inside elevation of the improved shutter, partly in section showing the construction of the shutter box.

Fig. 2 is a longitudinal sectional side elevation of Fig. 1.

Fig. 3 is an inside elevation of a part of the flexible door showing the slats successively fastened together.

Fig. 4 is a longitudinal sectional side elevation on the line (IV) (IV) of Fig. 3.

Fig. 5 is an elevation, in an enlarged scale, of a part of the shaft provided with a barrel on it.

Fig. 6 is a cross sectional view of Fig. 5 showing the rolling of the slats on the barrel.

Referring firstly to Figs. 1 and 2, (1) represents the entrance or window on which the shutter is provided. (2) (2) are channels arranged at both sides of the entrance or window (1). (3) is a shutter box arranged at the upper end of the channels (2) (2), inside the entrance or window (1), and within which box the shaft (4) for rolling the flexible door is provided. (5) are narrow steel slats constituting the flexible door. (6) is an end slat arranged at the lower end of the door. (7) are guide rollers or fenders arranged inside the shutter box (3). (8) is a drum fixed at an end of the shaft (4). (9) is a box provided with the mechanism for mechanically or manually operating the shutter.

The door is constructed of numbers of narrow steel slats (5) successively fastened together to be rolled on the shaft (4) when the door is to be opened. As shown in Figs. 3 and 4 one side (the lower side) of each slat (5) is bent substantially at a right angle to form a projecting edge (10) while at the other side (the upper side) of the slat is formed a groove (11) located slightly inward of the edge of the slat. Said projecting edge (10) is fitted in turn into the groove (11) of an adjacent slot so that the inner side of the projecting edge (10) is kept in close contact with the upper side of the groove (11) when the door is shut and subjected to the force of gravity. To fasten the slats to each other U-shaped rivets (12) are passed freely through the top edges of the slats and fixed to the bottom portions of adjacent slats whereby the latter are hinged together. The upper part (5′) of each slat may preferably be made thicker for strengthening the hinged part. The door may also be strengthened by corrugating the surface of the slat.

It is an important feature of the present invention that the joints of the slats forming the door are always kept in close contact with each other, even when the rivets have become loosened by the engagement of the projecting edges in the corresponding grooves. Furthermore the rivets are protected by the back-side of the groove (11) which projects at the inner side of the door, and the door may be contained within the channel at both sides.

The door is provided at its lowermost end with an end slat (6) which is made broader than the other slats (5) and is bent at its upper part (6′) for attaching at its inner side a thick slat (13) for adding a weight to the door, as shown in Figs. 3 and 4. The bend (6′) of the end slat (6) is such that when the upper side of said slat is fastened to the adjoining slat (5) the surface of the former slat (6) is disposed parallel to the channels (2). The end slat (6) is provided at both ends with rollers (14) slightly projecting at the sides of the slat for insuring freedom of movement of the door in the channels (2), as shown in Fig. 3. The weight slat (13) is

provided at both ends with recesses (15) in which the rollers (14) are arranged, as shown in Fig. 4. The end slat (6) as well as the weight slat (13) are cut aslant at (16) (16) at both ends of the lower side to provide gaps (17) (17) for the purpose of insuring full closure of the door even when dust lies at the bottom of the channels (2).

The upper part of the end slat is bent so as to hang vertically or parallel to the channels 2 when the weight slat (13) is attached at its inner side, whereby the movement of the door is rendered smooth. Furthermore in the shutter hitherto in use, when the channels or other parts of the frame have become distorted by earthquake or other accident or the door become deformed by the heat of fire the door becomes difficult to be shut instantly and the function of the shutter is entirely lost. According to the present invention the end slat of the door is provided at its sides with the rollers whereby the movement of the door may be easily effected in case of the accident.

The slats (5) forming the door are rolled on the shaft (4) provided within the shutter box (3) while the door is open. The slats are of equal width and the diameter of the roll increases as the slats are rolled on it. Therefore, in case the uppermost slat of the door is directly attached on the shaft and is rolled immediately on it the shape of the roll becomes inevitably eccentric according to the width of the slats so that the operation of opening and shutting the door is rendered unsmooth. It is desirable that the slats may be rolled concentrically on the shaft. The present invention provides for said purpose barrels (18) (18) fixed on the shaft (4) at the same relative position, as shown in Figs. 1 and 2. The barrel is provided with polygonal flanges (19) (19), each side of which polygon corresponds to the width of the door slat (5) as shown in Figs. 5 and 6. A pin (20) is passed through the flanges (19 (19) and one end of the chain or rope (21) to be wound on the drum (22) formed between the flanges (19) (19). At the other end of each chain (21) is connected a smoke arrester (23) made of an angle iron with its lower side projecting outward, as shown in Fig. (5). The lengths of said smoke arrester is equal to the door slat, and at the inner side of said smoke arrester the uppermost or the first slat (5) of the door is attached. Each flange (19) of the barrel (18) is recessed at (24) so as to correspond to the smoke arrester (23) when the latter is rolled on the shaft, as shown in Figs. 2 and 6.

When the shaft (4) is rotated to open the door, each chain (21) is first wound on the drum (22) of the barrel (18), and at the end of the chain the smoke arrester (23) fits in the recess (24) of the flange (19), whereby the flanges (19) in connection with the smoke arrester present an equilateral polygonal form. When the shaft (4) is further turned the second, third and other slats are successively rolled substantially concentrically on the flanges (19) as one side of each flange is made just equal to the widths of the slats. Thus the energy required for rolling and unrolling the door is rendered uniform and the movement of the door is rendered therefore smooth. When the door is to be shut the shaft (4) is rotated and the door hangs vertically down. When the lower side of the end slat (6) has moved in close contact with the lower side of the window or the entrance (1), as shown in Figs. 1 and 2, the smoke arrester (23) is also unrolled from the shaft (4) and being pressed forward by the guide rollers or fenders (7) arranged within the shutter box (3) the side of the smoke arrester (23) projecting forward comes in close contact with the upper side of the recess (25) formed inside the shutter box (3), so that the clearance space between the door and the shutter box is closed and the smoke is prevented from entering the box at the time of the fire.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed I declare that what I claim is:—

1. An improved shutter including a shaft, slats successively fastened together to be rolled on the shaft when opened, one side of each slat being bent substantially at a right angle to form a projecting edge fitted into a groove formed a little distant from the side of an adjacent slat, said projecting edge being brought in close contact with said groove by action of the gravity, U-shaped rivets passed freely through the lapped part of the slats and fixed to an adjacent slat whereby the slats are successively fastened to form a flexible door; substantially as described.

2. An improved shutter including a shaft, slats successively fastened together to be rolled on the shaft when opened, one side of the slat being bent substantially at a right angle to form a projecting edge fitted into a groove formed a little distant from the side of an adjacent slat, said projecting edge being brought in close contact with the groove by the action of gravity, U-shaped rivets passed freely through the lapped part of one slat and fixed to an adjacent slat whereby the slats are successively fastened together to form a flexible door, said U-shaped rivets lying within the grooves in the slats, said slats being corrugated.

3. An improved shutter including a shaft, guide channels, slats successively fastened together to be moved in said channels and rolled on the shaft when opened, one side of each slat being bent substantially at a right angle to form a protecting edge fitted into a

groove formed a little distant from the other side of an adjacent slat, said projecting edge being brought in close contact with said groove by the action of gravity, U-shaped rivets freely passed through the lapped part of the adjacent slat and fixed to an adjacent slat whereby the slats are successively fastened together to form a flexible door, a weight slat, the lowermost or the end slat being made broader than the other slats and the upper part thereof being bent and attached at one side with said weight slat, the bend of said end slat being such that when fastened to the lower side of the adjacent slat the surfaces of said end slat and the weight slat hang parallel to the guide channel.

4. An improved shutter including a shaft, slats successively fastened together to be rolled on the shaft when opened, one side of each slat being bent at a right angle to form a projecting edge fitted into a groove formed a little distant from the side of an adjacent slat, rivets connecting the slats, an L shaped smoke arrester attached at the upper end of said shutter and having its side projecting outward, barrels fixed at the same relative position on the shaft and having polygonal flanges and bosses, flexible elements wound on said bosses, said flanges being recessed corresponding to said smoke arrester to permit of concentric winding of the slats thereon.

5. An improved shutter including a shaft, a door frame having channels and a shutter box, a flexible door including corrugated slats one side of each being bent at a right angle to form a projecting edge fitted into a groove formed in an adjacent slat, means connecting the slats, a broader end slat at the end of the door bent at its upper end, a weight slat attached to the last mentioned slat, rollers at the sides of the door and further said last mentioned broader slats being cut away at both ends, a smoke arrester attached at the upper end of said flexible door, a shaft arranged in the shutter box and barrels fixed on said shaft having chains and polygonal flanges recessed corresponding to the position of the said smoke arrester; substantially as described and shown in the accompanying drawing.

In testimony whereof I have affixed my signature.

TADASHI OHNO.