To all whom it may concern:

Be it known that we, Henry Penn Burke, and Henry M. Vetterlein, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Shutters or Doors, of which the following is a specification.

This invention relates to improvements in doors or shutters for closing openings in the walls of buildings, of that class wherein are employed a curtain comprising a plurality of connected metal plates which are slidable vertically relatively to each other and which is adapted to be raised from a lowered position in which the plates extend one below another and close an opening to an elevated position in which the curtain is raised from the opening and the plates thereof occupy positions back of one another, in combination with means to guide the plates of the curtain during the raising and lowering thereof and means operable to raise and lower the curtain.

An object of the invention is to provide a curtain of novel and efficient construction provided with improved means for connecting the plates thereof and for supporting them one upon another and for guiding them during their movements relatively to one another; another object is to provide a novel and efficient means for raising and lowering the curtain; and a further object is to provide the frame structure in which the curtain is raised and lowered with novel and advantageous means for guiding and stabilizing the plates of the curtain during the raising and lowering thereof and for holding it firmly in position when lowered, such means acting automatically to perform its functions during the raising and lowering of the curtain.

With the foregoing and related objects in view, the invention consists in the novel construction, combination and arrangement of parts hereinafter described and claimed.

In the accompanying drawings, illustrating our invention,

Figure 1 is an elevation of a structure having an opening therein and provided with a door embodying our invention for closing the opening, showing the door in the closed position.

Figure 2 is a vertical section thereof, on line 2—2 of Fig. 1.

Figure 3 is a view similar to Fig. 2, showing the door in the open position.

Figure 4 is a detail on a larger scale, showing the end portions of some of the plates of the curtain and adjacent parts.

Figure 5 is a side view of the portion of the curtain or door shown in Fig. 4.

Figure 6 is a horizontal section, on line 6—6 of Fig. 3 looking upwardly.

Figure 7 is a front view partly broken away of two plates of the curtain or door, showing their relative positions when the door is in the closed position.

Figure 8 is a view similar to Fig. 7, showing the lower plate raised a short distance relatively to the upper plate.

Figure 9 is a view of the two plates shown in Fig. 8.

Figure 10 is a view similar to Fig. 9, showing the lower plate of Fig. 9 raised to a higher position.

Referring to the drawings, 7 designates a wall which may form part of building and which forms part of the frame structure for supporting our improved door or shutter and its operating mechanism. The wall 7 is provided with an opening 8 which may constitute a door or window opening of the building.

A curtain or door 9 is arranged to be lowered from the position shown in Fig. 3 to the position shown in Figs. 1 and 2, to close the opening 8, and to be elevated from the position shown in Figs. 1 and 2 to open the door 9 or clear the opening 8.

The curtain or door 9 comprises a plurality of plates or sections 10 which are slidable vertically relatively to one another. In the lowered position of the curtain, as shown in Figs. 1 and 2, the plates 10 extend below one another and they are connected at their meeting upper and lower edge portions; and, in the elevated position of the curtain, as shown in Fig. 3, the plates 10 are nested together and located back of one another in a common horizontal plane.

When the lowermost plate 10, shown in Fig. 2 is raised from the position there shown to the position shown in Fig. 3, and thereafter lowered again to the position shown in Fig. 2 by mechanism hereinafter described, it will effect the raising and low-
ering of the entire curtain, the plates 10 sliding relatively to each other and being supported by each other as will be presently described.

The upper plate 10 shown in Figs. 1 and 2 or the foremost plate 10 shown in Fig. 3 is secured to the wall 7. The bottom edge portion of each plate 10 excepting the lowermost plate of the curtain, is bent to form a rearwardly and upwardly turned flange or hook 11, and the top edge portion of each plate 10, excepting the uppermost plate of the curtain, is bent to form a forwardly and downwardly turned flange or hook 12, for purposes presently appearing.

The end portions of each hook 11 are provided with rearwardly extending projections 13 which embrace the end edge portions of the plate next adjacent thereto and provide the means to slidably connect each plate to the next adjacent plate in a manner to permit them to be raised and lowered relatively to each other.

The hooks 12 do not extend to the ends of the plates 10 and the length thereof is less than the distance between the free ends of the projections 13 at the respective sides of the curtain, so that each hook 12 may occupy a position between the two projections 13 of the plate 10 directly in front of it when the curtain is in the elevated position shown in Fig. 3.

When the curtain is lowered from its elevated position shown in Fig. 3 to the position shown in Fig. 2, the plates 10 are held in working relation by the projections 13 through which the lateral edge portions of the plates slide, and the engagement of the hook 12 of each plate which is lowered with the hook 11 of the plate 10 rearwardly thereof limits the downward movement of the plate, so that in the lowered position of the curtain, the plates 10 extend below and hang upon one another, as clearly shown in the drawings.

When the curtain is raised to the elevated position shown in Fig. 3, the bottom hooks 11 on each movable plate 10 above the bottom plate engage the projections 13 of the plate 10 above or forwardly thereof and raise it to and support it in the position shown in Fig. 3; and an angle bar 14 is secured to the lower edge portion of the bottom or rearward plate 10 of the set and its bottom flange extends forwardly and is adapted to engage the bottom of the plate next adjacent thereto for the same purpose.

As an additional means to support the plates 10 one by the other, we provide each plate 10 between the top and bottom plates of the set with vertical bars or plates 15 spaced from the lateral edge portions thereof and having hooks 16 on the upper ends thereof which are engaged by the tops of the next adjacent plates below the hooks, as the plates are raised to the position shown in Fig. 3.

The curtain 9 is arranged between and protected by lateral guard plates 17 which extend vertically adjacent to the ends of the plates 10 the full length of the curtain when it is in the lowered position. These plates 17 are provided with longitudinal flanges 18 which are secured to the wall 7.

Arranged upon and secured to the guard plates 17 and to the wall 7 and top plate 10 are brackets 19 carrying bearings in which a horizontal shaft 20 is journaled. The shaft is arranged above the curtain 9 and extends parallel to the plates 10 thereof.

One end portion of the shaft 20 is provided with a worm wheel 21 which is engaged by a worm 22 on a shaft 23 extending transversely below the shaft 20 and arranged to turn in bearings on one of the brackets 19.

The outer end portion of the shaft 23 carries a grooved chain pulley 24 carrying a depending, endless chain 25 which is adapted to be operated by hand to turn the wheel 24 and thereby turn the shafts 23 and 20 through the bearings connecting them.

The shaft 20 is provided with two sheaves 26 carrying cables 27 which are adapted to be wound upon and unwound from the sheaves. The cables 27 extend from the sheaves 26 and are connected to the bottom or rearward plate 10 of the curtain whereby, when the chain 25 is operated by hand to turn the sheaves 26 in one direction, the cables 27 will be wound upon the sheaves 100 and the curtain 9 will be elevated from the position shown in Fig. 2 to the position shown in Fig. 3; and, when the chain 25 is operated by hand to turn the sheaves 26 in the reverse direction, the cables 27 will be unwound from the sheaves and the curtain 9 will be lowered from the position shown in Fig. 3 to the position shown in Fig. 2.

To take the supporting strain of the forward plates of the set thereof from the projections 13 and hooks 16 of the plates 10 near the rearward end of the set thereof, when the curtain is elevated to the position shown in Fig. 3, we provide one of the plates 10 at or near the central portion of the curtain with upwardly extending straps 28 having eyes on the free ends thereof through which the cables 27 extend, and we provide the cables 27 with collars 29 fixed thereon which are adapted to engage the straps 28 after a number of the plates 10 have been raised and thereafter to take the weight of the remaining plates above and forwardly of the plates provided with the straps 28.

The lateral edge portions of the plates of the curtain extend between forward and rearward guide bars 30 and 31, respectively. The forward guide bars 31 are secured to
the wall 7 at the sides of the opening 8, and the rearward guide bars 31 are located back of
the forward guide bars 30, and between the
curtain 9 and flanges 32 projecting from
the inner or rearward edge portions of the
lateral guard plates 17 hereinbefore re
ferred to.

The rearward guide bars 31 are movable
toward and from the forward guide bars 30.

10 The upper end portion of each guide bar 31
is held in place and guided in its movements
toward and from the adjacent forward guide
bar 30 by a rod 33 extending through a slot
in the bar 31, and also extending between
and supported by the wall 7 and the rear
ward portion of the bracket 19. The lower
end portion of each guide bar 31 is held in
place and guided in its movements, toward
and from the adjacent forward guide bar 30
by a stud bolt 34 projecting from the adja
cent guard plate 17 and through a slot in
the guide bar 31 and having a head on the
free end thereof between which and the
guard plate 17 the bar 31 is confined.

The upper end portion of each guide bar
31 is pressed yieldingly toward the curtain
in all positions of the plates 10 thereof by
a spring 35 encircling its rod 33 between
the bar 31 and the part of the bracket 19 to
which the rod 33 is connected; and the lower
end portion of each guide bar 31 is pressed
yieldingly toward the curtain in all positions
of the plates 10 thereof by a spring 36 act
ning between and against the bar 31 and the
flange 32 of the adjacent guard plate 17.

The spring 36 encircles and is held in place
by a rod or stem 37 projecting fixedly from
the lower end portion of the bar 31 and
through an opening in the flange 32.

When the curtain is raised and lowered,
as hereinbefore described, the side edges or
portions thereof are guided and clamped at
times by and between the forward and
rearward guide bars 30 and 31. The plates
10 of the curtain are thereby stabilized and
held firmly together and the parts thereof
are caused to come into proper registry in
all positions of the plates during the raising
and lowering of the curtain by the constant
yielding pressure of the rearward guide bars
31 throughout their entire lengths.

We claim as our invention—

1. The combination of a frame structure
having an opening therein and having for
ward guide bars at the sides of the opening,
rearward guide bars back of the forward
guide bars and movable toward and from
the same, a curtain having its lateral edge
portions extending between the forward and
rearward guide bars and comprising a plu
rality of plates slidable relatively to each
other and adapted to be raised from a low
ered position in which the plates extend one
below another closing said opening to an
elevated position in which the plates are
located back of one another in a common
horizontal plane, means operable to raise and
lower the curtain, and yielding means press
ing the rearward guide bars toward the for
ward guide bars and against the curtain.

2. The combination of a frame structure
having an opening therein and having for
ward guide bars at the sides of the opening,
rearward guide bars back of the forward
guide bars and movable toward and from
the same, a curtain having its lateral edge
portions extending between the forward and
rearward guide bars and comprising a plu
rality of plates slidable relatively to each
other and adapted to be raised from a low
ered position in which the plates extend one
below another closing said opening to an
elevated position in which the plates are
located back of one another in a common hori

horizontal plane, means operable to raise and lower the curtain, means to guide the upper ends of the rearward guide bars, means to guide the lower ends of the rearward guide bars and to limit the movement thereof away from the forward guide bars, springs pressing the upper ends of the rearward guide bars toward the forward guide bars, and springs pressing the lower ends of the rearward guide bars toward the forward guide bars.

3. The combination of a frame structure having an opening therein, a curtain comprising a plurality of plates slidably relatively to each other and adapted to be raised from a lowered position in which the plates extend below one another and close said opening to an elevated position in which the plates are located back of one another, and means for raising the curtain and comprising a cable attached to the lowermost plate when the curtain is down, means operable to raise the cable, a strap extending from a plate above said lowermost plate and having an eye through which the cable extends, and a part carried by the cable and adapted to engage the strap after the cable has raised said lowermost plate a predetermined distance.

6. A curtain comprising a plurality of plates slidably vertically relatively to each other and adapted to be raised from a lowered position in which the plates extend one below another to an elevated position in which the plates are located back of one another in a common horizontal plane, certain of said plates having forwardly and downwardly turned hooks on the upper portions thereof and rearwardly and upwardly turned hooks on the lower portions thereof and rearwardly turned hooks on the upper portions thereof, the forwardly and downwardly turned hooks being adapted to enter the rearwardly and upwardly turned hooks when the curtain is lowered, and the rearwardly turned hooks on the upper portions of the plates being adapted to engage the tops of plates next adjacent thereto and thereby support the plates from which they extend when the curtain is elevated.

7. A curtain comprising a plurality of plates slidable vertically relatively to each other to permit the curtain to be raised and lowered, certain plates of the curtain having longitudinally-extending, downwardly turned hooks on the upper portions thereof and longitudinally-extending, upwardly turned hooks on the lower portion thereof, the downwardly turned hooks being adapted to hook into the upwardly turned hooks of adjacent plates when the curtain is lowered, and the end portions of one hook of each of said certain plates having projections thereon which embrace a plate next adjacent thereto, which slidably connect the two plates, and which are arranged to enter and engage a hook of a plate and cause it to support a plate when the curtain is raised.

8. A curtain comprising a plurality of plates slidable vertically relatively to each other to permit the curtain to be raised and lowered, certain plates of the curtain having longitudinally-extending, downwardly turned hooks on the upper portions thereof and longitudinally-extending, upwardly turned hooks on the lower portion thereof, the downwardly turned hooks being adapted to hook into the upwardly turned hooks of adjacent plates when the curtain is lowered, the end portions of one hook of each of said certain plates having projections thereon which embrace a plate next adjacent thereto, which slidably connect the two plates, and which are arranged to enter and engage a hook of a plate and cause it to support a plate when the curtain is raised, and the length of one hook of each of said certain plates being less than the space between the free ends of the projections of a plate to enter said space during the raising of the curtain.

In testimony whereof we affix our signatures hereto.

HENRY PENN BURKE.
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