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LOCK FOR SLIDING DOORS

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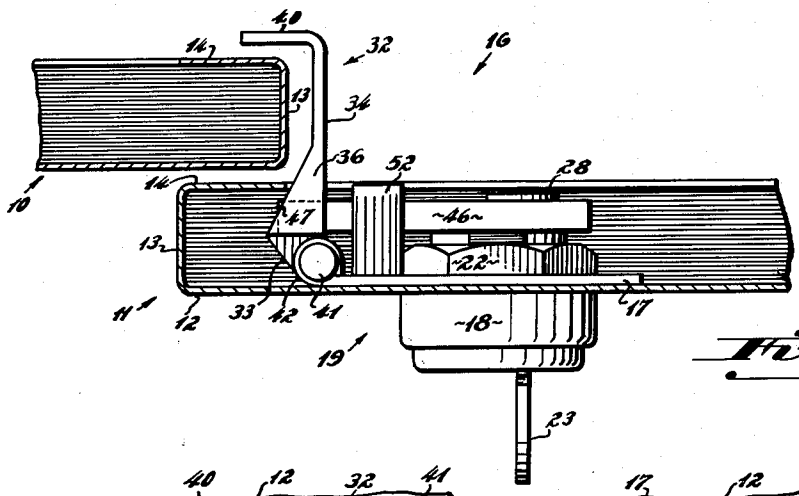

Fig. 1

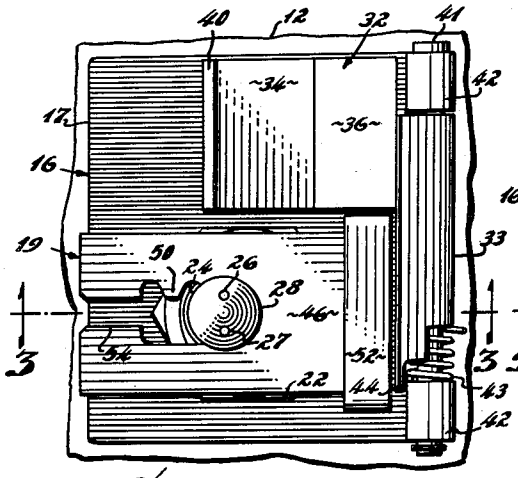

Fig. 2

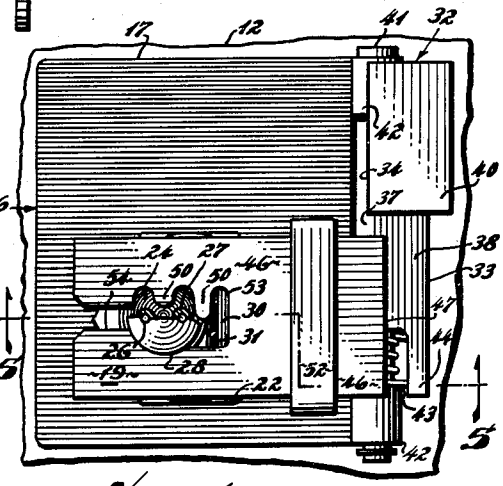

Fig. 4

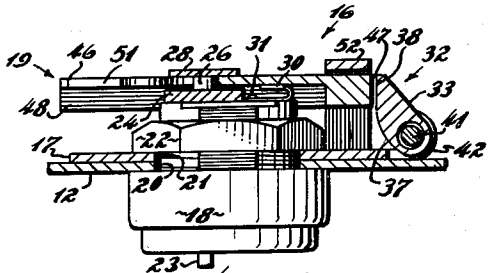

Fig. 3

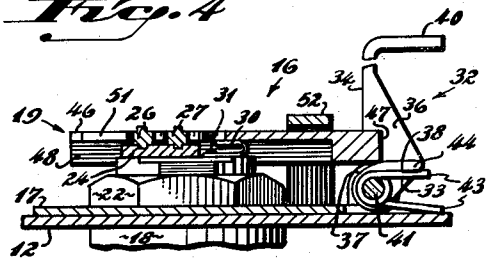

Fig. 5

INVENTOR.
Allen R. Bartlett
BY
Wood, Herron & Evans
ATTORNEYS

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LOCK FOR SLIDING DOORS

Allen R. Bartlett, Belmont, Calif., assignor to Mosler Harbor Metal Products Corporation, Belmont, Calif., a corporation of California

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This invention relates to a lock which is adapted to secure or lock sliding doors or panels against relative movement.

Conventional sliding doors are mounted in spaced parallel relationship at the entrance to a cabinet, room, closet or the like, and are translationally movable in longitudinal direction along upper and/or lower tracks. The doors can be moved or slid relative to each other along their respective tracks between the opposite sides of the entrance area, from closed position, in which the doors extend across the entire entrance area and overlap only along one edge, to open position, in which the doors substantially overlap each other. Such doors range in size from small cabinet doors to large doors several feet in height.

The present invention is directed to a lock for use with such doors, for securing them against relative longitudinal movement in a given direction. This lock is further characterized in that it does not impede free slidability of the doors past each other when it is in unlock position, but in locking position it positively secures the doors against transversely directed forces tending to spring them apart, as well as against relative sliding movement.

Past lock constructions of the general type to which this invention relates have typically included a large and unsightly barrel which has been necessary to provide the necessary throw, but which has usually protruded outwardly from the face of the door, especially if the door is relatively thin. Moreover, it has often been possible in the past to gain access surreptitiously to the space behind the locked doors without operating the lock, by springing the doors apart so that a gap is presented between the marginal areas along which they overlap; the doors are not damaged, particularly where they are large in surface dimension, and show no evidence of having been thus attacked.

The present lock overcomes these objections. It does not include a large, objectionably protruding barrel, and is small enough to be suitable for use on small or thin doors, yet by means of a novel mechanism provides sufficient throw to be equally suitable for use on large or thick doors. In unlock position, the lock elements do not project substantially inwardly from the door on which the lock is mounted, and thus do not impede free sliding movement of the other door of the pair. In lock position, however, the lock presents a bolt member which extends perpendicularly inwardly from the door in position to abut or arrest sliding movement of the other door past it and, moreover, secures the doors against relative transverse movement, so that they cannot be sprung apart to gain entrance to the locked area.

Simply put, a preferred embodiment of my invention comprises a key-operated lock mechanism of the type wherein insertion and rotation of a key in a cylinder effects longitudinal movement of a cylinder-driven bar or slider in a direction transverse or perpendicular to the axis of rotation of the cylinder. A bolt member, which in lock position is adapted to engage the leading edge of a sliding door, is mounted at one side of the lock mechanism for rotation about an axis which is transversely oriented with respect to the direction of movement of the bar. This bolt comprises a door-arresting arm portion having a flange at its outer end, and a cam portion connected to the arm portion for converting transverse off-axis force

applied by the bar into rotation of the bolt about its axis in such manner that the arm is swung from an unlock position against the surface of the door to a lock position in which the arm extends inwardly from the door in line to arrest the leading edge of the other door. The flange at the tip of the arm is arranged so that in lock position it hooks or projects behind the other door, thereby preventing the doors from being sprung apart.

One of the advantages of the lock I have invented is that the bolt rotating or camming means may comprise a conventional key-operated lock mechanism of which the part referred to herein as the bar or slider comprises the bolt. This lock mechanism is combined with the bolt of the present invention in such manner that the bar is aligned in camming relation with the cam portion of the bolt. As the key is turned in the lock mechanism, rotational movement of the cylinder is converted into linear movement of the bar, which is in turn converted by the cam surface into rotation of the bolt.

At the end of its travel the bar locks the cam against return movement, so that the arm is held in lock position. When the key is turned in the opposite direction to unlock the doors, the bar is drawn away from the cam shaft by the cylinder, and spring return means move the bolt arm to its original folded-away position against the door surface.

As will be apparent from the detailed description which follows, by combining this key-operated actuating mechanism with the cam shaft and bolt arm, I have provided a lock having the necessary bolt throw yet which is small and does not protrude objectionably from the door, and which positively secures the doors against being sprung apart.

The invention can best be further described in relation to the accompanying drawings, in which:

FIGURE 1 is a horizontal section through the overlapping marginal portions of two sliding doors in closed position, one of which is fitted with a lock in accordance with a preferred embodiment of the present invention, showing the bolt in lock position;

FIGURE 2 is a rear elevation of the lock shown in FIGURE 1 illustrating the positions of the various elements in unlock position;

FIGURE 3 is horizontal section taken on line 3—3 of FIGURE 2;

FIGURE 4 is a rear elevation similar to FIGURE 2 but shows the lock in lock position, the bar driving means being partly broken away to show the teeth formed in the bar; and

FIGURE 5 is a horizontal section taken on line 5—5 of FIGURE 4.

In FIGURE 1 a pair of generally conventional sliding doors are designated by **10** and **11** respectively. While the construction of the doors **10** and **11** themselves is not a part of the invention, the doors illustrated by way of example in the drawing are formed of sheet metal, and each comprise a flat panel **12** having an inwardly turned edge portion **13** and a flange **14** to rigidify the panels **12**. The door **11** shown at the right in FIGURE 1 is mounted in the entrance area forwardly of the door **10** shown to the left, the doors being slidable along spaced parallel tracks (not shown) as is conventional.

The right door **11** is fitted with a lock generally designated by **16** which embodies the principles of my invention. Lock **16** includes a substantially rectangular base plate **17** which may be made of metal, and which mounts the various elements of the lock as described in detail hereinafter. No fittings are mounted to door **10**.

The body **18** of a generally conventional key-operated lock mechanism **19** extends through openings **20** and **21** in door panel **12** and base plate **17** respectively (see FIGURE 3) and is secured therein by a nut **22**. The two

openings 20 and 21 are preferably non-circular and are keyed to body 18 so that the lock 16 cannot rotate relative to the door. Lock mechanism 19 is operated by a key 23 which is received in a cylinder or barrel 24 extending through body 18. Cylinder 24 can be rotated in either clockwise or counterclockwise direction by turning key 23. The internal key-receiving elements in body 18 may be conventional and are not shown.

The inner end of cylinder 24 is provided with two spaced diametrically aligned pins 26 and 27. The other ends of pins 26 and 27 are fastened to a circular plate or disk 28 which is spaced from cylinder 24. Together, cylinder 24, pins 26 and 27 and disk 28 comprise a simple gear, as will be explained. As is best shown in FIGURES 3 and 5, a spacer 30 is preferably provided adjacent this gear, the surface of spacer 30 being generally co-planar with the surface of cylinder 24. This spacer is attached to body 18 by screws 31 or in other suitable manner.

A bolt member generally designated by 32 is mounted by base plate 17 to the side of cylinder 24 for rotation about an axis which is vertical, i.e. which extends parallel to the edges of doors 10 and 11. Bolt 32 includes a cam shaft portion 33 and a door-engaging arm portion 34 which is connected to cam shaft 33 by a reinforcing section 36. The surface of cam shaft 33 is defined by a curved surface 37 and a substantially flat surface 38 tangenial thereto. The arm portion 34 of bolt 32 extends at substantially right angles to the plane of flat surface 38, as can best be seen in FIGURE 5.

At the outer end of arm 34 a flange 40 is provided. The length of arm 34, and the position of flange 40, is such that when the bolt 32 is in lock position, flange 40 will project behind flange 14 of left door 10, and thereby positively prevent the doors from being sprung apart.

The cam shaft portion 33 of bolt 32 is provided with a longitudinal bore through which an axle or pin 41 extends. The ends of axle 41 are received in concentrically bent tabs 42 of base plate 17. Torsion spring means 43 are disposed around axle 41, and one end of the spring abuts a finger 44 projecting from cam shaft portion 33. The other end of spring 43 bears against the door panel 12, thereby urging the bolt 32 about axle 41 toward unlock position.

From FIGURE 3 it can be seen that an off-axis force directed to the right against flat surface 38 of cam portion 33, of magnitude sufficient to overcome the force of spring 43, will rotate bolt 32 clockwise (as viewed in FIGURES 3 and 5) about axle 41, whereby the door arresting arm 34 will be moved from unlock position, toward lock position.

The force for effecting such cammed motion of arm 34 is provided in the preferred embodiment of my invention by a member 46 which is driven longitudinally by the rotation of cylinder 24 and which may conveniently comprise the bolt of the lock mechanism 19. This member 46 is a generally rectangular bar having a cam engaging surface 47 at one end and a recessed slot 48 which extends toward surface 47. A series of drive teeth 50 are formed in the web 51 defined by slot 48, as best shown in FIGURE 4. Web 51 is disposed between cylinder 24 and disk 28, the pins 26 and 27 co-acting with the teeth 50 of bar 46 in rack and pinion relationship. The cam engaging surface of bar 46 is supported and guided in drive relationship with cam surface 38 by a U-shaped guide 52 the legs of which are affixed to base plate 17, and by spacer 30, over which the inner surface of web 51 slides.

The operation of the lock may now be described. Assuming that the lock is in unlock position, as illustrated in FIGURES 2 and 3, insertion and rotation of the proper key 23 in lock mechanism 19 turns cylinder 24 and effects linear movement of bar 46 to the right, as the pins 26 and 27 alternately engage the teeth formed in bar 46 in rack and pinion relation. The motion of bar 46 to the right is constrained by cylinder 24 and disk 28 (between which web 51 is positioned), spacer 30, and guide 52 so that the surface 47 of bar 46 engages cam surface 38 and turns the bolt clockwise about axle 41 against the counteracting torque of spring 43. When arm 34 of a bolt 32 has been moved through an arc of approximately 90° to the position shown in FIGURE 5, surface 38 of cam portion 33 is substantially parallel to the direction of movement of bar 46. Further longitudinal movement of bar 46 produces no additional rotation of arm 34 since the bar then overtravels, that is, it slides over cam surface 38 and exerts no rotational force on it. However, movement of bar 46 beyond the position shown in FIGURE 5 to the position indicated by the dotted lines in FIGURE 1 positively holds bolt 32 against movement toward unlock position. Thus, in FIGURE 1, it can be seen that relative movement of door 10 to the right beyond the point at which the leading edge 13 of door 10 abuts arm 34 is prevented since bar 46 positively prevents rotation of the cam shaft 33 and arm 34. Force applied to arm 34 by attempting to force door 10 to the right is taken up by guide 52 to which such force is transmitted through cam shaft 33 and bar 46.

In the embodiment shown in the drawings, the left and right ends of the tooth cutout 53 in bar 46 function as stops for limiting the degree to which the bar can be moved by rotating key 23 and cylinder 24, rotation of the key through approximately 360° effecting full movement of the bar 46 from unlock to lock position.

While I prefer to employ the lock mechanism 19 shown in the drawing to effect rotation of bolt 32, it should be understood, however, that other means driven by the cylinder 24 which will provide a component of force transverse to cam 33 can be used to convert rotational movement of the cylinder into rotation of bolt 32 around axle 41, and are within the scope of the invention.

To unlock the lock, key 23 is turned in the reverse direction, bolt 32 being returned to unlock position by the force of spring 43 upon withdrawal of bar 46 from the cam surface 38. In unlock position, bolt arm 34 resides flat against base plate 17. Flange 40 on arm 34 does not extend outwardly therefrom a distance sufficient to impede free slidability of door 10 to the right past it.

To install the lock 16 a hole 20 is formed in door panel 12, and the body 18 of lock mechanism 19 is inserted through it and through the hole 21 in base plate 17, and locked in place with nut 22. With the cylinder 24 turned so that the pins are in the position shown in FIGURE 4, and with the bolt 32 manually held in lock position, bar 46 is engaged with the cylinder drive by sliding it through guide 52 above cam surface 38, until the pins 26 and 27 can be properly engaged with the teeth 50. No fitting is required on the other door 10.

While I have described the preferred embodiment of my invention, it will be appreciated that the invention is not limited thereto but includes such other embodiments as come within the spirit of the claims which follow.

What is claimed is:

1. A lock adapted to prevent relative longitudinal movement between a pair of sliding doors, said lock comprising, generally planar mounting means, an arm mounted by said mounting means for rotation about an axis parallel to the general plane of said mounting means, a cam shaft connected to said arm and rotatable therewith about said axis, said cam shaft presenting a cam surface which lies in a plane approximately perpendicular to said arm, a key-operated lock mechanism including a gear which is rotated upon operation of said mechanism, said mechanism being mounted by said mounting means at a position adjacent said arm, said gear having an axis of rotation which is normal to the general plane of said mounting means, a bar presenting a series of gear teeth, said teeth being engaged with said gear in rack and pinion relationship therewith, said bar being driven linearly in

a direction transverse to the axis of rotation of said gear, guide means presented by said mounting means for constraining said bar to move in a direction transverse to the axis of rotation of said arm, said bar engaging said cam shaft and camming said cam shaft about its axis as said mechanism is operated, and yieldable spring means urging said arm toward a plane generally parallel to the plane of said mounting means.

2. A lock for sliding doors, said lock comprising, a base, a key-operated lock mechanism of the type including an element which is rotated about an axis upon operation of said mechanism, said mechanism being mounted by said base so that said axis is normal to said base, gear means affixed to said element for rotation therewith about said axis, rack means engaged with said gear means for linear movement in a direction transverse to said axis when said mechanism is operated, guide means maintaining said rack means in engagement with said gear means and constraining the movement of said rack means to said linear movement, a cam shaft and an arm extending outwardly therefrom, said cam shaft being mounted by said base for rotation about an axis transverse to the axis of rotation of said element and also transverse to the direction of movement of said rack means, said cam shaft presenting a cam surface, said rack presenting a surface adapted to engage said cam surface as said rack means is moved linearly in response to rotation of said element and cause said cam shaft and arm to turn between an unlock position in which said arm is substantially parallel to said base and a lock position in which said arm extends outwardly from said base, said surface of

said rack means being parallel to said cam surface when said arm is in said lock position to positively prevent said arm from being moved toward said unlock position, said arm having a flange at its outer end for securing said doors against being sprung apart, and yieldable means urging said arm toward said unlock position.

3. A lock for sliding doors comprising,

a base,

a bolt mounted by said base for rotation about an axis parallel to said base,

a cam surface connected to said bolt for rotating said bolt about said axis in response to lineal camming movement applied to said cam surface in a direction transverse to said axis,

a key-operated lock mechanism including a member rotated by operation of said mechanism,

a bar moved lineally by rotation of said member,

said bar being aligned with said cam surface so that lineal movement of said bar applies camming movement to said cam surface,

said bar overtravelling said cam surface when said bolt is extended perpendicularly to said base and thereby deadlocking said bolt in locking position,

and yieldable means urging said bolt toward said base.

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