Dec. 31, 1963 J. D. WHEELER ETAL 3,115,685

DOOR CONTROL CLOSURE MECHANISM

Filed Sept. 20, 1960 2 Sheets-Sheet 1

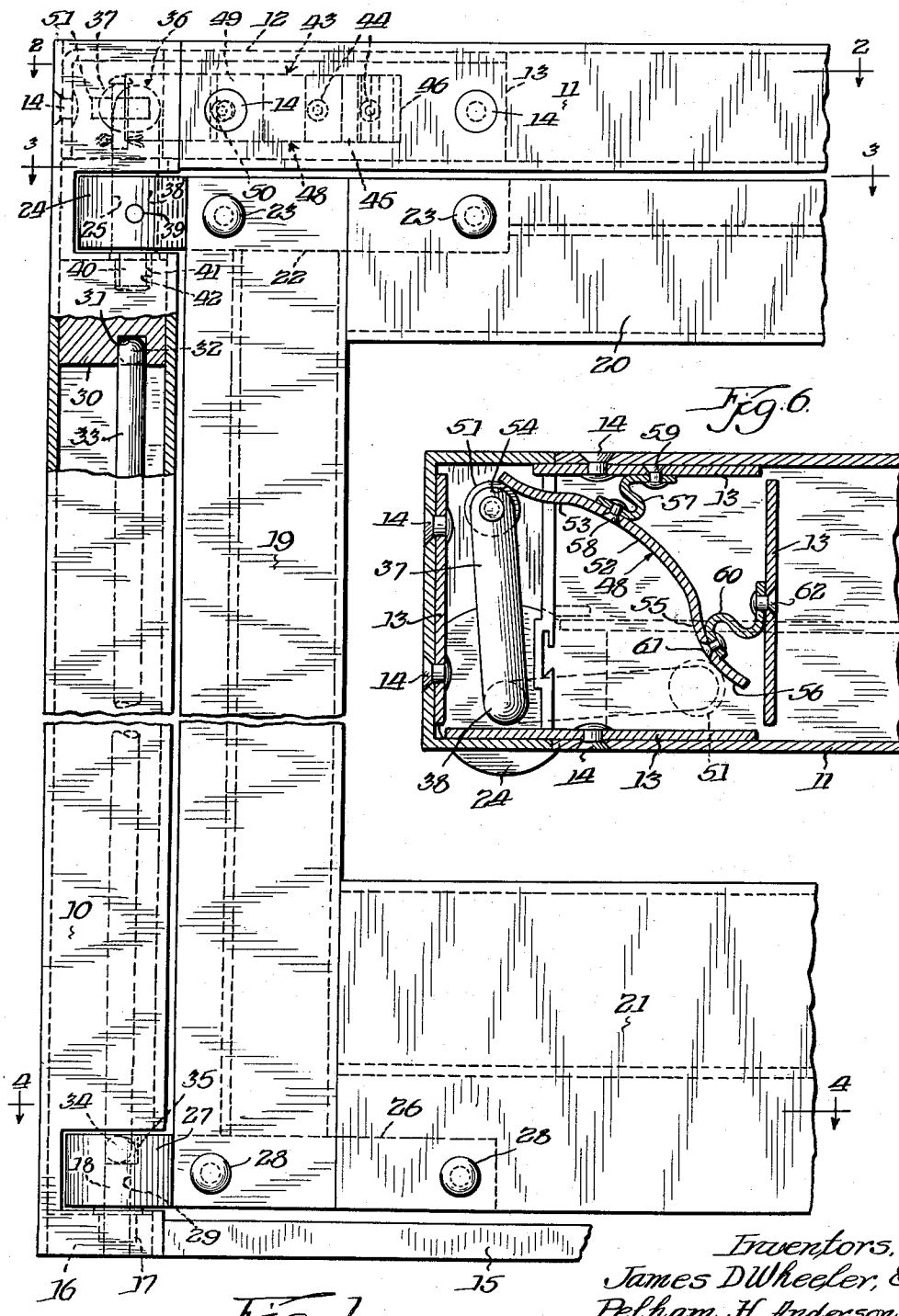


Fig. 1.

Fig. 6.

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Fig. 2.

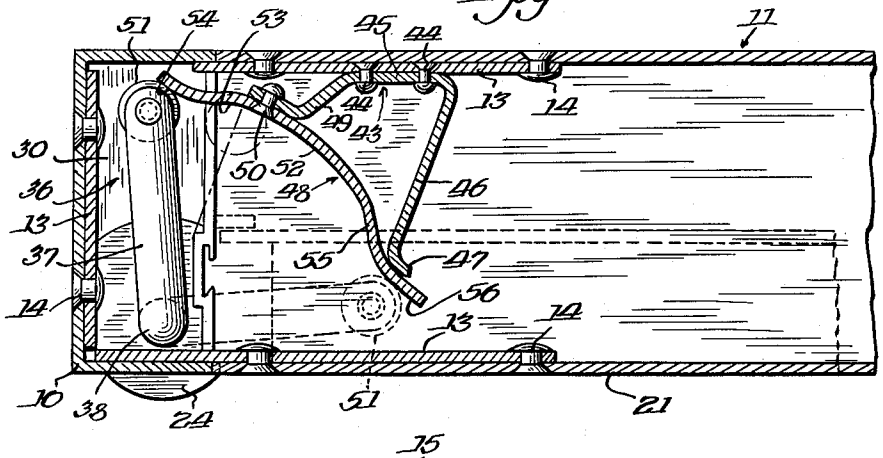


Fig. 3.

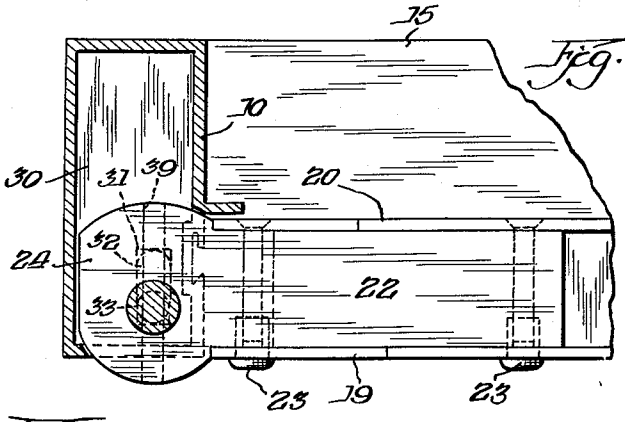


Fig. 5.

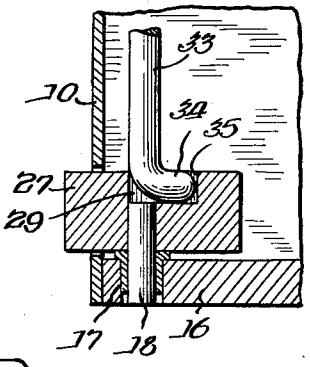
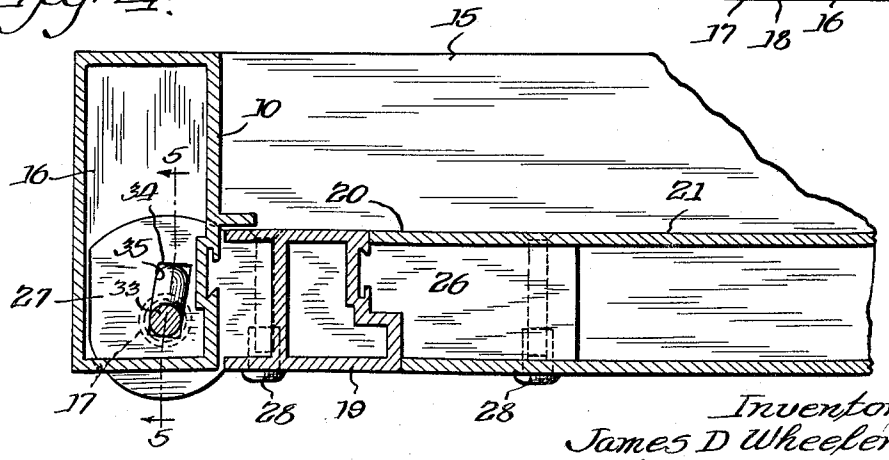


Fig. 4.



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DOOR CONTROL CLOSURE MECHANISM

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4 Claims. (Cl. 20—16)

Our invention relates to a door control closure mechanism and has particular reference to mechanisms for use in controlling the rate of closure of a power actuated door, and is adapted for use primarily in combination with a torsion bar closing mechanism mounted in such manner that the torsion force of a torsion bar is controlled as the loaded tension in the torsion bar closing mechanism moves the door from open to closed position with the torsion bar or other spring mechanism being placed under force by the opening of the door.

Another object of our invention is the provision of means in which a spring actuated door can be held in either open or closed position and in which its rate of closure can be controlled to prevent slamming of the door against the frame, or its rate of travel retarded in its closing movement to such a degree that it will not injure a person who accidentally might be struck by the door as it is being closed.

Another and further object of our invention is the provision of a door closing mechanism which is so designed that the rate of closure of the door is controlled and is retarded in the last stage of its closing movement to a point where the closing of the door is very gentle and will not injure anyone who might have their fingers or hands caught between the edge of the door and the door frame.

Another and further object of our invention is the provision of a control means which is easy and simple to apply and in which a smooth swinging movement of the door is secured without danger of breakage of the parts or of slamming the door, and in which a complete closure operation is secured under normal operating conditions.

These and other objects of our invention will be better and more fully understood by reference to the accompanying sheet of drawings and in which—

FIGURE 1 is an elevational view of a portion of a door frame and door embodying our invention;

FIGURE 2 is a detailed sectional view on lines 2—2 of FIGURE 1;

FIGURE 3 is a detailed sectional view on lines 3—3 of FIGURE 1;

FIGURE 4 is a detailed cross-sectional view through the door frame and hinge stile on lines 4—4 of FIGURE 1;

FIGURE 5 is a detailed sectional view of a portion of the door frame and operating parts on line 5—5 of FIGURE 1; and

FIGURE 6 is a modified form of mounting means for the shoe shown in FIGURE 1 of the drawings.

Referring now specifically to the drawings and in which like reference characters refer to like parts throughout, a portion of a door frame and door is shown, the frame comprising a vertical side frame member 10, a top frame member 11, both the side frame member and the top frame member being made of hollow rectangular metal sections now commonly used in metal doors, and having a bracket 12 having a top plate portion fitted against the under side of the top portion of the top frame member 11 and having depending portions 13, 13 integrally formed therewith and extending downward therefrom in face to face engagement with the inner face of the side frame 10 and the top frame member 11 and secured

to these members by rivets 14, 14 thus securing the frame member 10 and the top frame member 11 together at the upper end of the door frame. A threshold 15 is shown which spans the doorway at the bottom of the frame, only a portion of which door frame is shown. The top frame member 11 is connected to a vertical frame member (not shown) at its end opposite the member 10 thus forming the usual complete door frame. A bottom block 16 is mounted in the frame 10 and has a cored opening therein within which a bushing 17 is mounted with a hinge pin 18 extending into the bushing 17 which pin 18 forms a hinge pintle for the lower end of the door as hereinafter described.

The portion of the door shown comprises a hollow hinge stile 19, a top rail 20, a bottom rail 21, with a top hinge consisting of an arm portion 22 which extends through the hinge stile 19 and into the end of the top rail 20 and is secured thereto by means of rivets 23, 23, and at its opposite end extends into the side frame member 10 and has a hinge blade 24 formed on the inner end thereof with the blade 24 having an opening 25 cored therethrough for purposes hereinafter described.

A bottom hinge is provided consisting of an arm portion 26 and a hinge blade 27 integrally formed therewith, the arm portion of the bottom door hinge extending through the hinge stile 19 and into the end of the bottom rail 21 and is secured thereto by means of rivets 28, 28. The hinge blade 27 has a cored bore 29 therethrough into the lower part of which the hinge pin 18 is received forming a pintle for the hinged support of the door at its lower end. An upper block 30 is fixed to the frame member 10 adjacent the upper end of the member 10 forming a part of the door frame, and has an elongated recess 31 formed in its lower face which is adapted to receive the turned upper end 32 of a torsion bar 33 which is vertically mounted within the frame member 10 and extends longitudinally of the frame member 10 with its lower turned end 34 being mounted in an elongated recess 35 formed in the upper face of the hinge blade 27 outward from the bore 29. The ends 32 and 34 of the torsion rod 33 are turned at an angle of approximately 90° to the plane of the door in its closed position so that the opening of the door twists the torsion rod 33 on itself thereby placing the rod 33 under spring tension with its closing force being directed to the door through the hinge blade 27. The torsion bar 33 has its turned ends 32 and 34 extending in the same direction and substantially parallel with each other in the normal closed position of the door and therefore in static condition in the closed position of the door. The recess 35 is inclined about 5° towards the edge of the door so that when assembled the rod 33 has a very slight torsion to take up any back lash that may develop in the opening and closing of the door. As the door is opened the hinge block 27 rotates about the hinge pin 18 in a clockwise direction (FIGURE 4) to full open position about 90°. The torsion rod 33 is twisted upon itself as its upper end is held against rotation in the block 30. The door upon being released is returned by the recovery of the torsion rod 33 to its normal closed position.

An angle member designated as a whole as 36 and consists of an arm portion 37 and a pin portion 38 secured together is mounted at the upper end of the side frame member 10, the pin portion 38 of the angle member 36 extending through a cored opening 25 in the hinge blade 24 and is secured to the hinge blade 24 by a rivet 39 passing through the hinge blade 24 so the hinge blade 24 and pin 38 rotate as a unit. The lower end portion 40 of the pin 38 is reduced in size and extends into a bushing 41 mounted in a recess 42 formed in the upper face of the

fixed block 30 with the lower end 40 of the pin 38 forming a hinge pintle for the upper hinge as the door swings to open and closed position during its operation. The angle member 36 also rotates so that the arm 37 travels in an arcuate path during the opening and closing of the door.

A spring designated as a whole as 43 is secured by means of rivets 44, 44 passing through the base portion 45 of the spring 43 and through one of the depending portions 13 of the bracket 12 which member 43 has a spring arm 46 integrally formed therewith and extending outwardly therefrom and terminating in a curved end 47 in engagement with and supporting one end of a spring shoe 48. The base 45 has a shorter spring arm 49 integrally formed therewith which is secured at its end to the shoe 48 by means of a rivet 50 so that the shoe 48 is held in operative engagement with a roller 51 mounted in the end of the arm 37. The shoe 48 is saucer-shaped in contour and has an elongated curved concave face 52 thereon on a comparatively long and substantially uniform radii, with a curved surface 53 thereon adjacent one end on a shorter radius which merges into a reversely curved surface 54 at one end thereof which is the normal position occupied by the roller 51 in the closed position of the door. Towards the free or opposite end of the shoe 48 a curved surface 55 is provided somewhat longer in radius than is the curved surface 53 and which merges into a reversely curved surface 56 at the free end of the shoe 48 which is engaged by the roller 51 when the door is in open position. Because of the reverse curvature of the surface 56 the door is held in open position, until moved towards closed position when the torsion bar 33 takes over and completes the closing operation. Likewise when the roller 51 is in engagement with the surface 54 the door remains in closed position until the door is moved towards its open position by some form of force applied thereto.

It will be understood therefore that as shown in FIGURE 2 the arm 37 is in the closed position of the door, (as shown in full lines) while as the door is being opened the arm 37 rotates in a clockwise manner to its fully open position (shown in dotted line position) where the door will remain. When actuated in some manner towards its closed position either by manual or power operation the torsion bar 33 takes over and the roller 51 travels over the surface 52 of the shoe 48 where the closing movement is accelerated until the roller 51 meets the curved surface 53 on the member 48 at a point representing approximately eighty percent of the travel of the roller 51 over the surface of the shoe 48 and where because of the engagement of the roller 51 against the inturned end of the spring pressured shoe 48 the speed of the door is materially lessened, and its speed of closure decelerated to a point where the movement of the door from this point to its closed position is quite slow. When the roller 51 reaches a position shown in full lines of FIGURE 2 the door is held in closed position against ordinary movement but in position so that it can be opened manually or by some form of mechanical door operation mechanism.

In FIGURE 6, a modified form of a shoe mounting is shown wherein the shoe 48 is of the same type and character and surface contour as described hereinabove but which is secured to one of the depending portions 13 by means of an S-shaped spring 57 which is secured to the shoe 48 by a rivet 58 and to the depending portion 13 of the plate 12 by a rivet 59. The opposite end of the shoe 48 is secured to a second S-shaped spring 60 by a rivet 61 and to one of the transverse depending portions 13 forming a part of the bracket 12 by means of a rivet 62. In operation the shoe 48 functions in precisely the same manner as that heretofore described with the exception that both ends of the shoe 48 are fixed to springs while in the modified form shown in FIGURE 6 only one end of the shoe 48 is fixed to the spring 49 while it is free at its opposite end and is supported by the spring 46. This modified form is adapted to be used in heavier doors where more friction may be necessary to brake the closing

movement of the door than desired in the preferred form.

The operation of the device is exceedingly simple in that when the door is opened by either a pressure or pulling force applied thereto, and in the form shown in the drawings, the door opens outward and turns in a clockwise direction upon the hinge pin 18 at the bottom of the door, with the pin 38 rotating in the bushing 41 which is mounted in the fixed block 30 towards the upper end of the side member 10 of the door frame. As the door begins to open, the arm 37 is moved in a clockwise direction so that the roller 51 passes over the surface 53 in a comparatively slow movement until it reaches the surface 52 and the relation of the spring shoe to the roller 51 is such that when very slight pressure is exerted on the roller the opening movement of the door can be fairly rapid until it reaches the surface 55. At this point the door is in the final stages of the opening movement and is retarded as the roller 51 runs upon the surface 55 and onto the reverse surface 56. The door is now in full open position and will remain so until an external force is applied to the door towards the closing position which moves the roller 51 off the surface 56 towards the surface 55 on the shoe 48. During the opening of the door the turned over lower end 34 of the torsion bar 33, mounted in the recess 35 in the hinge plate 27, is also moved in a clockwise direction as the torsion bar 33 is placed under tension. When the door is opened to a full 90° the torsion bar 33 has been rotated approximately this same amount, but due to the position of the roller 51 on the shoe 48 the door is held in open position until given an initial movement by the application of force to a closing position when the torsion rod 33 takes over and continues the closing of the door. As the roller 51 moves down the surface 55 and over the surface 52 of the shoe 48, the speed of the door is accelerated and continues its rather rapid movement until the roller 51 reaches the surface 53 where the movement of the door is materially decreased. Thereafter the closing operation is continued at an exceedingly slow rate until the final closing of the door by the passage of the roller 51 from the surface 53 onto the reverse curved portion 54 where the door is held in closed position. The location of the shoe relative to the arm 37 must be considered carefully so that a proper pressure is applied to the roller 51 at all times depending upon the desired conditions and needs of the door operation in each particular instance. The closing movement of the door can be performed rapidly if desired, or can be performed at an extremely slow rate of speed so that no possible injury or damage can result to persons passing through the door as it is being opened or closed.

While I have described more or less precisely the details of construction, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form, the proportion of parts and the substitution of equivalents as circumstances may suggest or render expedient without departing from the spirit or scope of the invention.

What is claimed:

1. A door assembly comprising in combination a door frame having a hollow side member, a hollow top member secured to the upper end of the side member, a threshold at the lower end of the door frame, a door mounted in the frame and upper and lower hinges secured to the said door, each of said hinges having blade portions thereon extending into the said hollow side door frame member, each of said blade portions having hinge pin openings therein, the blade portion of the lower hinge having a torsion rod receiving recess therein, a support block in the said hollow side member at its lower end, a lower hinge pin in the hinge block extending into the opening in the lower hinge blade, a fixed block secured in said hollow door side member of the frame having an upper hinge pin recess in the upper end thereof and a torsion rod receiving recess in its lower end, a torsion rod in the said hollow side frame member with its upper end in the fixed block and its lower end in the recess in the lower hinge block,

and an upper hinge pin extending into and secured to the upper hinge block having an angular arm portion thereon and a spring mounted shoe in the hollow top member in engagement with the end of the angular arm portion of the upper hinge pin whereby a braking force is applied to the closing movement of the door.

2. A door assembly comprising in combination a door frame having a hollow side member, a hollow top member secured to the upper end of the side member, a threshold at the lower end of the door frame, a door mounted in the frame and upper and lower hinges secured to the said door extending into the said hollow side member, the lower hinge having a torsion rod receiving recess therein, a door support block in the lower end of the said hollow side frame member, a hinge pin in the said block extending into the lower hinge on the door, an upper hinge block in the said hollow side frame having an upper hinge pin receiving recess therein at one of its ends and a torsion rod receiving recess at its opposite end, a torsion rod secured in the lower hinge at one of its ends and mounted in the upper hinge block at its opposite end, an upper hinge pin extending through the said upper hinge and secured thereto seated in the recess in the upper hinge block, the said upper hinge pin having an arm thereon and a spring mounted angularly disposed brake shoe mounted in the hollow top frame member in braking engagement with the end of the arm of the upper hinge pin.

3. A door assembly comprising in combination a door frame having a hollow side frame member and a top hollow member connected with the said first-mentioned hollow frame member, a door having upper and lower hinges thereon extending into the said hollow side member, upper and lower fixed blocks in the said hollow side member supporting each of said hinges, a door hinge pin in the said lower hinge block extending into the lower hinge, a torsion bar within the said hollow side member and extending longitudinally thereof, the said torsion bar being mounted in the door hinge at its lower end and in the upper hinge block at its upper end, a hinge pin secured to the upper hinge extending into the upper hinge block at

one of its ends and into the hollow top frame member and having an angularly disposed arm at its upper end, and a spring mounted fixed brake shoe in the said hollow top frame member in engagement with the end of the said extension arm of the hinge pin.

4. A door assembly comprising in combination a door frame having a hollow side member, a hollow top member secured to the upper end of the side member, a door mounted in the frame and a threshold at the lower end of the door frame, upper and lower hinges secured to the said door, each of said hinges having blade portions thereon extending into the said hollow side door frame member, each of said blade portions having hinge pin openings therethrough, and the blade portion of the lower hinge having a torsion rod receiving recess therein, a hinge block in the said threshold, a lower hinge pin in the hinge block extending into the opening in the lower hinge blade, a fixed block secured in said hollow door side member of the frame having an upper hinge pin recess in the upper end thereof and a torsion rod receiving recess in its lower end, a torsion rod in the said hollow side frame member with its upper end in the fixed block and its lower end in the recess in the lower block, and an upper hinge pin extending into and secured to the upper hinge block having an angular arm portion thereon and a spring mounted shoe in the hollow top member in engagement with the end of the arm portion of the upper hinge pin whereby braking force is applied to the door against the torsion rod in the closing movement of the door.

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