May 12, 1964 C. F. JACOBSON 3,133,168

DOOR LATCH AND SWITCH OPERATING MECHANISM

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FIG. 1

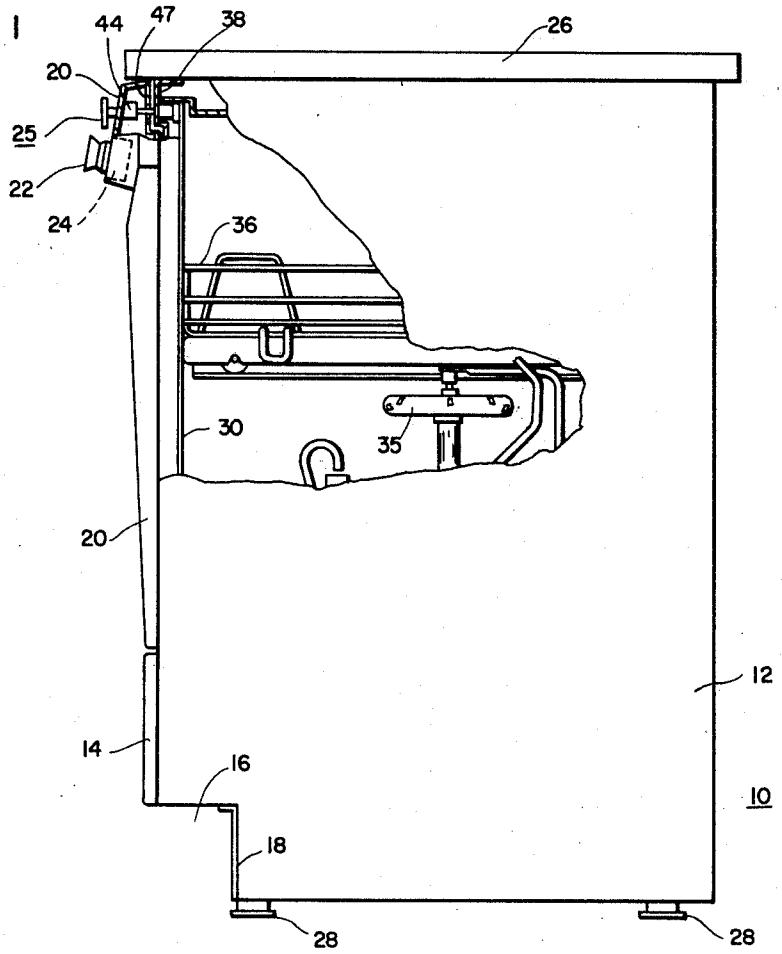

FIG. 2

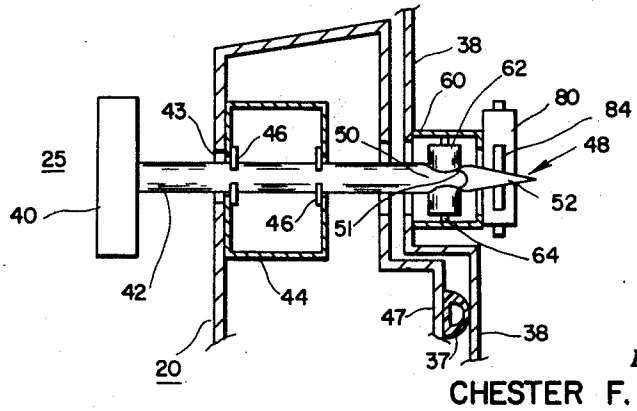

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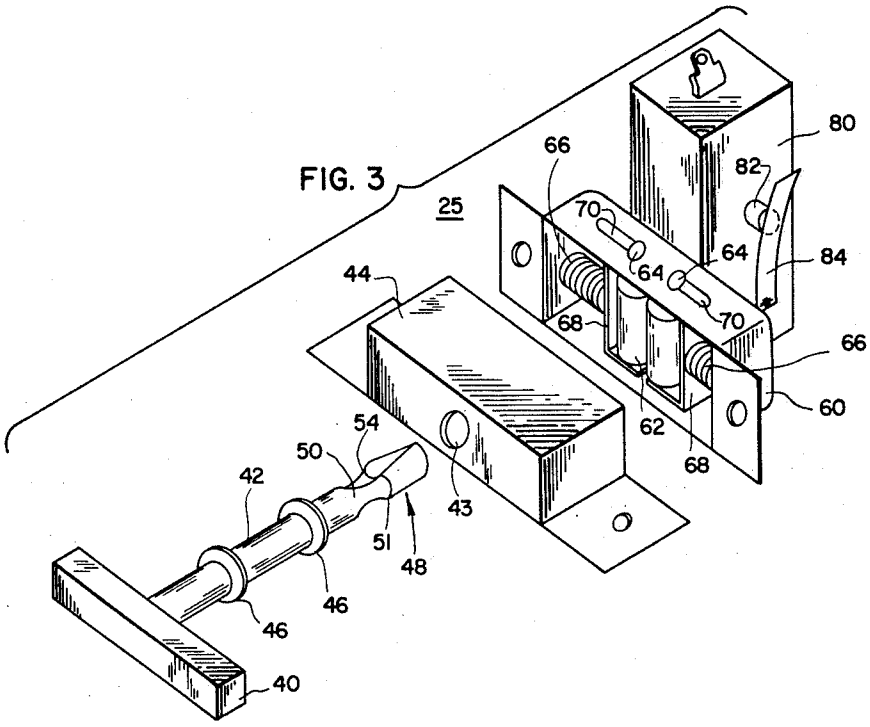
FIG. 3



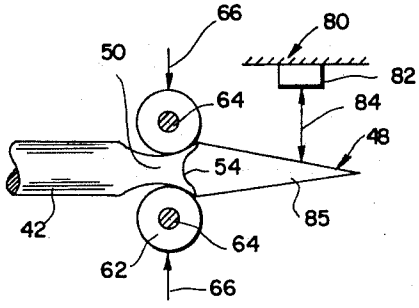


FIG. 4

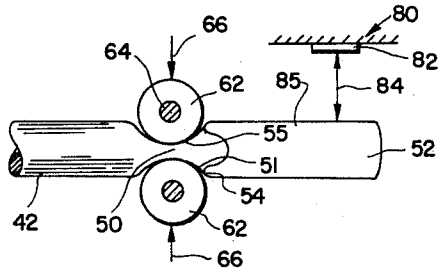


FIG. 5

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DOOR LATCH AND SWITCH OPERATING MECHANISM

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4 Claims. (Cl. 200—61.68)

The present invention relates to latching mechanisms and more particularly to those for use on appliance doors.

The mechanism as disclosed herein is particularly applicable to doors where a watertight seal must be formed by the door. A typical application for such a seal may be a dishwasher of the type in which the access door when closed forms one side wall of the water dispersion compartment or tub. In such devices, the door must be closed tightly and latched to the adjacent door jamb to retain the wash water within the tub or compartment. The door closing and latch mechanism also may serve as an interlock or door switch by which the drive and water fill circuits of the device are maintained in an inoperative condition for all door positions except the fully closed and latched position.

To perform these functions, the latch comprises a T handled plunger which is affixed to the appliance door adjacent the top thereof. The shaft of the plunger extends through the door, and the projecting end is formed with a neck portion and a wedge-shaped blade extending axially therefrom. The shaft is rotatable on its axis, but secured against axial displacement relative to the door. The appliance body has a detent structure including a pair of detent rollers between which the blade passes as the door is moved toward its closed position. Behind the rollers and affixed to the door jamb portion of the appliance body is a switch mechanism with a switch operating button or lever adjacent the extent of the plunger past the rollers. The oval neck section circumscribed in the plunger shaft is designed to rest between the rollers in a first door-closing position. The neck flares into the blade-like end of the plunger. This blade end is shaped much like the wedge-shaped blade of a screwdriver.

The plunger is constructed to have arcuate camming shoulders at the distal end of the neck portion, that is to say, at the commencement of the blade portion. When the blade is passed between the rollers during the closing movement of the door, curved wall surfaces of the neck portion provide seats for the rollers and yieldably secure the door in a first closed position. Rotation of the plunger handle through 90° will draw the cam shoulders against the rollers. This movement extends the plunger further past the rollers because of the projection of the camming surfaces into the neck area, and as a result the plunger draws the appliance door into a more tightly closed position. During this plunger rotation, a wall surface of the blade depresses the switch operating button or lever to close a line circuit in the machine operating network. Thus, the latch mechanism insures that the door is closed to its ultimate position before the line switch is closed, and during an unlatching operation, opens the switch before the door can be opened.

It is therefore an object of the invention to provide an improved appliance door latching device which insures that the door is fully latched shut before the line switch to the appliance operating mechanism is closed.

It is a further object of the invention to provide in conjunction with the side access door of an appliance a plunger latching mechanism which holds the door in a closed position and which may be manipulated to a latched position locking the door shut and actuating a line switch in the appliance.

It is a still further object to provide on a door a door handle with a plunger extending therefrom into a mating receiver on the adjacent door jamb wherein the plunger includes a neck for holding the door in a first closed position against the door jamb, and cam surfaces responsive to manipulation of the handle for latching the door to the door jamb in a second, more tightly closed position.

Other objects, features and advantages of the invention will be apparent from the detailed description of a presently preferred embodiment thereof, read in connection with the accompanying drawings in which:

FIG. 1 is a side sectional elevation of a dishwasher, partially broken away to show the invention as applied thereto;

FIG. 2 is a detailed view of the broken away portion of FIG. 1, the dishwasher door and the latch being in fully home position;

FIG. 3 is an exploded view of the latch mechanism of FIG. 2 showing the orientation of the latch blade in door-open position;

FIG. 4 is a schematic plan view of the latch blade after passage between the detent rollers; and

FIG. 5 is a schematic plan view of the blade after 90° rotation from FIG. 4, as required to complete the closure of the door and actuate a switch mechanism.

Now turning to the drawings in greater detail, FIG. 1 shows in general a conventional dishwasher **10**. The dishwasher includes an outer appearance cabinet **12** covering both sides and the rear of the appliance. At the front, the lower portion of the dishwasher is covered by a horizontal cover plate **14** extending above a conventional toe space **16** the inner extent of which is defined by a kick plate **18** secured to the machine side walls to complete the outer appearance housing. Above the cover plate **14** is a bottom hinged door **20** which opens outwardly to expose the interior of the machine for access. Near the upper edge of the door are suitable knob or knobs **22** governing the action of a conventional time controller mechanism shown respesentatively as rectangle **24**. Above the knob is the latch mechanism **25** which forms the core of the invention. The machine top surface is covered by a conventional permanently affixed cover **26** which may be fabricated of wood or suitable synthetic resin to match the surface of adjacent counter tops. To complete the general outer appearance structure, the dishwasher may be mounted on individually adjustable legs **28** of generally known configuration and construction.

The structure includes interiorly thereof a substantially imperforate tub structure **30** into which wash water is fed by the water distribution head **35** and other conventional outlets (not shown). One or more dish-bearing open-work trays **36** are aligned within the tub and spaced to permit circulation of water throughout the dishes to be washed.

Since the front door **20** forms a necessary side wall of the water retentive structure, the door is fitted with sealing gaskets **37** about its periphery and must be closed fully to the adjacent door jamb **38** before water is allowed through the inlet heads. It is to insure such a tight closure that the latch mechanism of the present invention is directed.

The latch mechanism **25** as shown in detail in FIGS. 2 and 3 includes a T-handled plunger having an operating handle **40** from which a plunger shaft **42** extends perpendicularly. The plunger shaft is secured within circular openings **43** in a boxlike frame **44** mounted firmly within the door structure. The plunger is secured to the frame by the use of snap rings **46** which allow rotational movement of the plunger and handle about the plunger shaft axis but which allow no axial movement of the plunger shaft with respect to the frame and the door to which the frame is secured. The plunger extends through

an aperture in the inside wall 47 of the door 20, and at its forward end terminates in a blade 48 similar to a conventional screwdriver blade. Intermediate the blade and the plunger shaft 42 is a neck portion 50, preferably elliptical in cross section. The neck curves outwardly, along surfaces 51, into the tapering opposed blade faces 52. In a plane transverse to the faces 52, the blade is formed with arcuate camming shoulders 54, there being two such shoulders. These shoulders blend into the neck portion 50 by means of a downwardly and forwardly curving wall 55 (FIG. 5) which has a radius substantially that of the detent rollers, next described.

The receiving structure of the latch mechanism is affixed to the door jamb adjacent the upper door edge. This structure includes a rectangular box frame 60 open to the plunger shaft. Within this frame I provide detent means, which may advantageously be cylindrical rollers 62. These rollers are mounted on vertical axes, as represented by the individual shafts 64. By the use of suitable compression springs 66 acting on the respective roller housings 68, the rollers are biased toward one another. From FIG. 3 it can be seen that shafts 64 extend through slots 70 which are formed in the upper and lower walls of the box frame 60. Thus, the rollers are capable of limited lateral movement on the interposition of an object between the rollers, and will assume an ultimate position according to the width of the object. The rear surface of the roller frame is apertured to allow the neck portion and blade to extend therethrough without interference. Mounted to this rear surface adjacent this aperture is a switch 80 with an actuating button 82. An actuating lever 84 may comprise a leaf spring appropriately secured to the switch casing, to overlie the button. Said spring has an inherent outward bias to permit outward movement of button 82 to assume a desired operating condition of the switch. The lever arm on depression drives the button inwardly; as well understood in the art, this movement of the button may close or open an internal switch circuit as desired. In a dishwasher, the switch would be in series with the main control circuit of the appliance so as to exercise master control over the control mechanism 24 and the water distribution system 35; the switch would be of the normally open type. The switch mechanism, of course, is mounted in an area shielded from the water being circulated through the tub for washing dishes in the dishracks.

Now turning to the operation of the device, it can be understood that door 20 must be fully closed and latched shut before a circulation of wash water is permitted within the tub, one side of which includes the door itself. Also, the water distribution system should be substantially inactivated before the door can be opened. Therefore a satisfactory door latch mechanism should firmly hold the door in a tightly closed latched position and should open the electrical energy circuit before any movement of the door from a closed position.

As mentioned, the plunger shaft is secured to the door and is rotatable about its shaft axis. Thus to close and latch the door, the plunger blade 48 is positioned as in FIG. 3, with the blade faces 52 forming the vertical sides of the blade. As the door is nearing its closed position the blade passes between the rollers. The rollers are moved outwardly against the bias imposed by springs 66 to allow the blade to pass through. The rollers 62 will come to rest on the curved surfaces 51. In this closure relationship, the door is closed to the extent of blocking any substantial escape of water from the tub, but probably not to the extent of sealing the door opening against the forceful action of water during a washing operation. In this position, the camming shoulders 54 are in the FIG. 4 relationship to the rollers, and the major axis of the elliptical neck 50 is normal to the shafts 64. In this position, a face 52 of the blade is in engagement with the switch actuation lever 84. With the elliptical major axis of the neck in the plane of the paper, the rollers are relatively widely separated and exert only a moderate detent action against the surfaces 51.

To latch the door in its second or ultimate closed position, the handle 40 and its associated plunger are rotated through 90° of arc. This action draws cam shoulders 54 into contact with the rollers. The arcuate cam shoulders 54 will assume a tangent-circle relationship with the detent rollers. The cam shoulder surfaces 55 have substantially the same radius as the rollers, as seen in FIG. 5, whereupon the rollers seat more deeply into the neck 50 and exert a more positive detent or latching action. The major axis of the ellipse is parallel to the shafts 64. The door is drawn inwardly an amount represented by the curvature of the cam shoulders 54. The door is held quite securely in this closed position.

When the latch blade is being rotated toward the latched position, the top wall 85 of the blade (as viewed in FIG. 4) will depress the switch lever 84, actuating the switch button 82. This action is shown in FIGS. 4 and 5, in which the lever 84 is represented as a line of constant length. The electrical circuit necessary for operation of the dishwasher will thus be closed at switch 80, and the time control mechanism 24 made available for its control function as well understood in the art.

When the door is to be opened, the blade is rotated through 90° of arc, restoring to the FIG. 4 position, the relationship of the blade to the switch lever, and restoring the switch to open circuit position. It will be noted that the door remains in its first closed position, which is sufficient to prevent leakage of water from the tub during the interval before the water distribution system comes to a stop. With the comparatively narrow blade faces 52 extending vertically, and the large-radius surfaces 51 again engaging the rollers, the rollers offer only nominal resistance to the opening of the door.

While there has been described what is at present thought to be a preferred embodiment of the invention, it will be understood that modifications may be made therein and it is my intention to cover in the appended claims all such modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. A mechanism for latching a door to an adjacent door jamb, comprising:
- a plunger shaft extending through and secured to the door for rotation about the axis of said shaft,
- a plunger receiving structure affixed to the door jamb adjacent said plunger shaft,
- detent means in such structure,
- means for resiliently biasing said detent means to a position normally obstructing said shaft as the door is moved toward said jamb,
- means on said shaft engageable with said detent means and effective in opposition to the biasing means thereof to displace said detent means to permit passage of said shaft thereby during said door movement,
- a reduced-diameter neck portion on said shaft configurated for engagement by said detent means to hold the door as said door is moved to a first closed position,
- and a plurality of cam surfaces on said plunger shaft, said cam surfaces positioned to maintain engagement with said detent means while effective upon rotation of said shaft relative to said detent means to draw said door to a second closed position.

2. In an appliance having a cabinet, a door affording access thereto, and a switch device mounted on a door jamb portion of said cabinet; mechanism for latching said door in either a first or second closed position while operating said switch means from one to another circuit condition only when latching said door in its second closed position, comprising:
- a shaft member extending through said door,
- means on said door for mounting said shaft for rota-

tion about its axis while precluding axial displacement thereof,

said shaft member having a curved neck portion outwardly of the inner wall of said door, said neck portion providing a demarcation between said shaft portion and a blade-like structure extending axially therebeyond,

detent structure fixed on said cabinet door jamb portion adjacent said switch device,

a pair of cylindrical detent members rotatably mounted in said structure, said detent members being disposed to accommodate the passage of said blade-like structure therebetween as the door is moved toward its closed position,

arcuate wall means on said neck portion engageable with said detent members rearwardly thereof to secure said door in its first closed position,

cam shoulders on said neck portion engageable with said detent members to urge said door to its second closed position upon rotation of said shaft member,

an actuator for said switch device,

and structure on said blade-like member for operating said actuator only during said shaft member rotation.

3. In an appliance having a cabinet, a door affording access thereto, and a switch device mounted on a door jamb portion of said cabinet; mechanism for latching said door in either a first or second closed position while operating said switch means from one to another circuit condition only when latching said door in its second closed position, comprising:

a shaft member extending through said door,

means on said door for mounting said shaft for rotation about its axis while precluding axial displacement thereof,

said shaft member having a neck portion outwardly of the inner wall surface of said door, said neck portion being elliptical in cross section and providing diametrically opposed arcuate wall surfaces delineating between said shaft portion and a wedge-like member extending axially therebeyond,

detent structure fixed on said cabinet door jamb portion adjacent said switch device,

a pair of cylindrical detent members rotatably mounted in said structure to accommodate the passage of said wedge-like member therebetween as the door is

moved toward its closed position, said detent members being of less radius than the radius of the said arcuate wall surfaces of said neck portion, said wall surfaces being engageable with said detent members rearwardly thereof to secure said door in its first closed position,

cam shoulders on said neck portion engageable with said detent members to urge said door to its second closed position upon rotation of said shaft member through a predetermined arc,

an actuator for said switch device,

and a wall on said wedge-like members for operating said actuator only during said shaft member rotation.

4. A mechanism for latching a door to an adjacent door jamb, comprising:

a plunger shaft extending through and secured to said door for rotation about the axis of said shaft, said shaft having a reduced-diameter neck portion of substantially oval cross section and a wedge portion extending therefrom to form the terminus of said shaft,

a shaft-receiving structure affixed to the door jamb in the path of movement of said shaft as the door is swung toward said jamb,

a pair of detent devices in said receiving structure,

means for mounting said detent devices for guided movement toward or away from said shaft,

spring means for biasing said detent devices into mutual contact at a location relative to said shaft whereby upon appropriate movement of said door the wedge portion of said shaft will pass between said detent devices and the devices will thereafter react to engage with the neck portion of said shaft to establish said door in a first closed position,

and cam means on said shaft engaging with said detent devices to draw the door to a second closed position upon rotation of said shaft about its axis.

References Cited in the file of this patent

UNITED STATES PATENTS

2,275,740	Deorlow	Mar. 10, 1942
2,486,003	Christensen	Oct. 25, 1949
2,735,707	Sylvan	Feb. 21, 1956
2,970,718	Jennings	Feb. 7, 1961