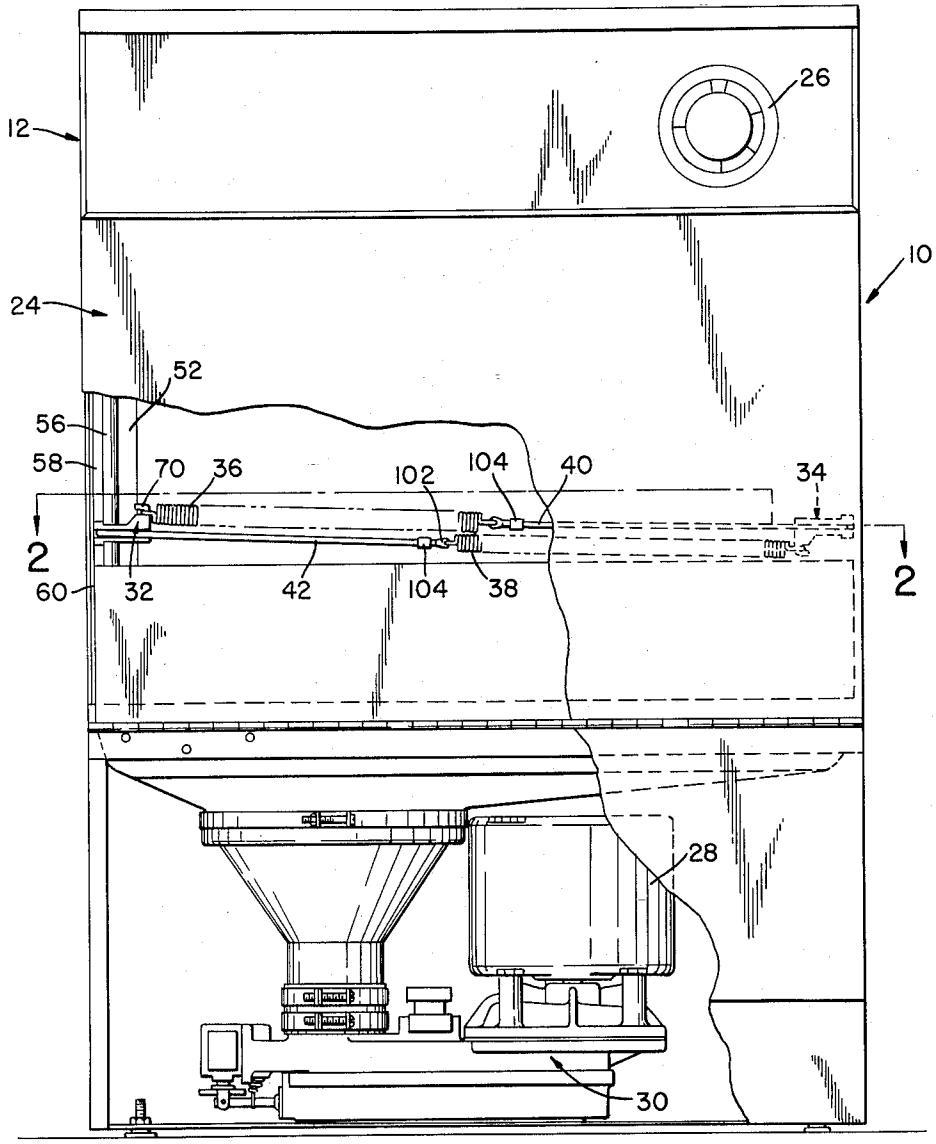
April 26, 1966 M. E. ULLMAN, JR., ET AL 3,248,161

DISHWASHER DOOR COUNTERBALANCING APPARATUS

Filed Dec. 11, 1963 3 Sheets-Sheet 1

FIG. 1



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DISHWASHER DOOR COUNTERBALANCING APPARATUS

Filed Dec. 11, 1963 3 Sheets-Sheet 2

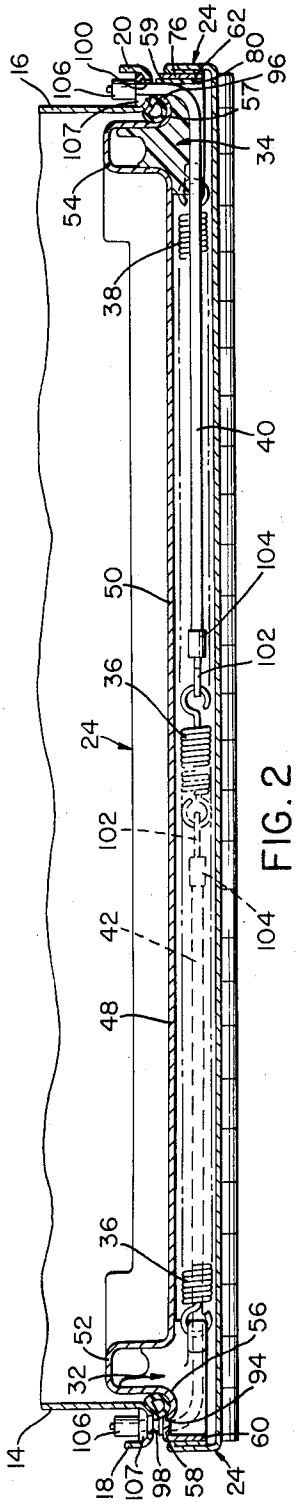


FIG. 2

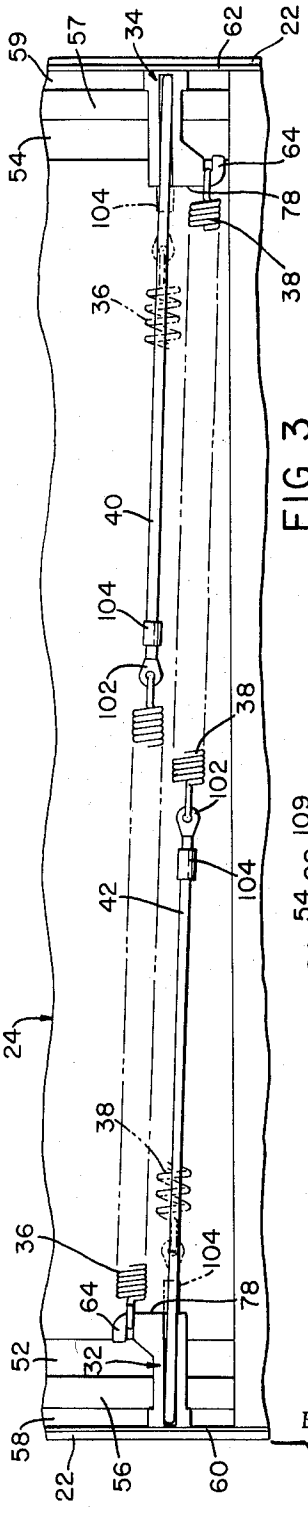


FIG. 3

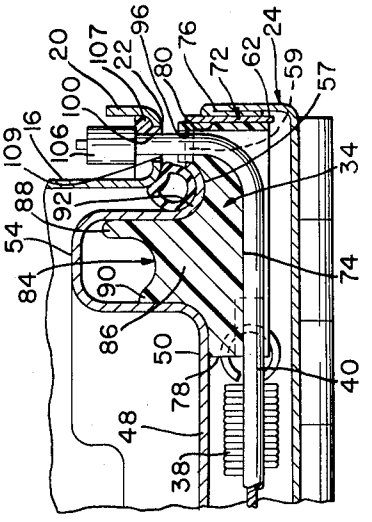


FIG. 4

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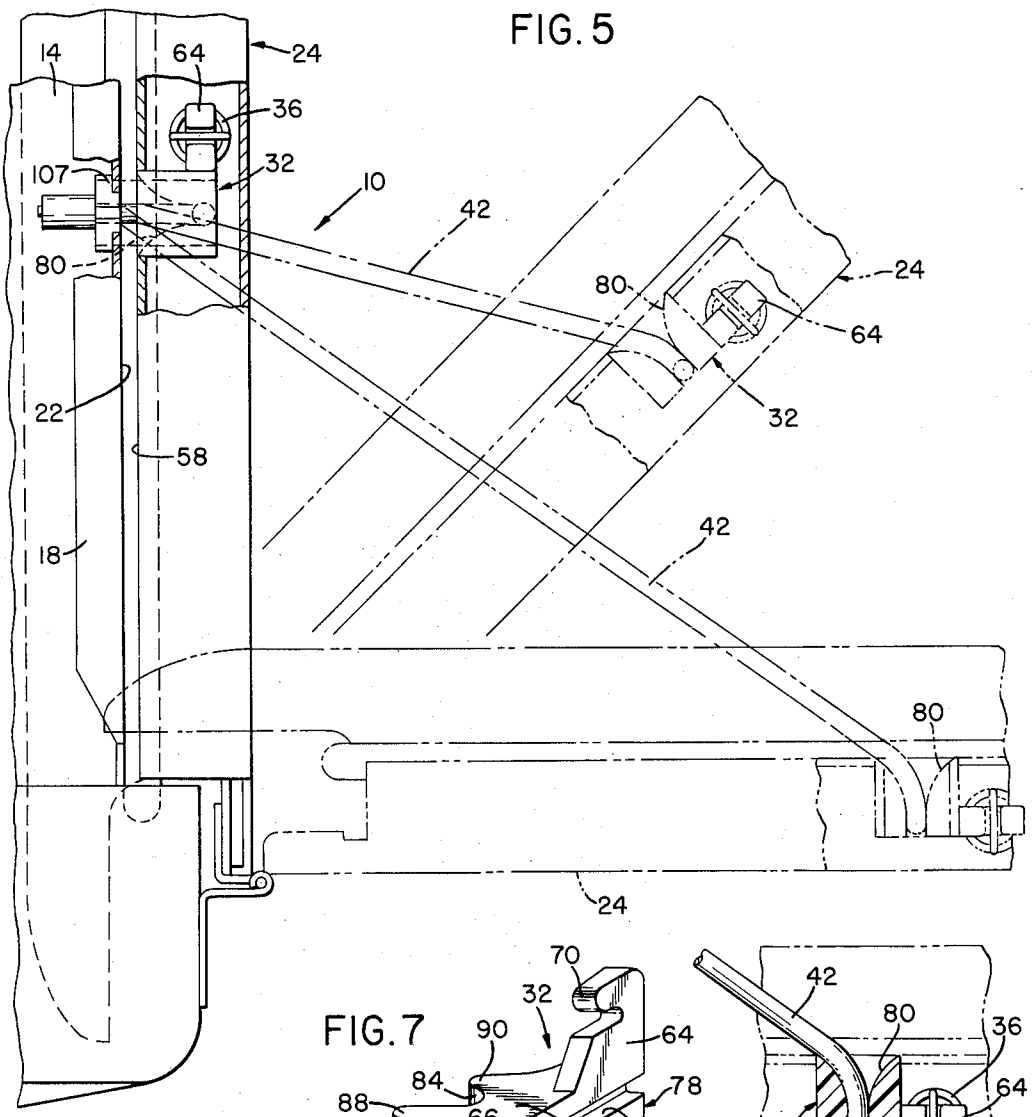
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DISHWASHER DOOR COUNTERBALANCING APPARATUS

Filed Dec. 11, 1963 3 Sheets-Sheet 3

FIG. 5



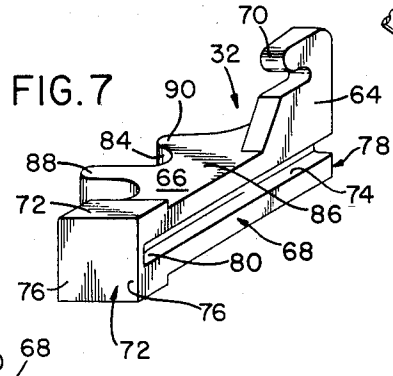


FIG. 7

FIG. 6

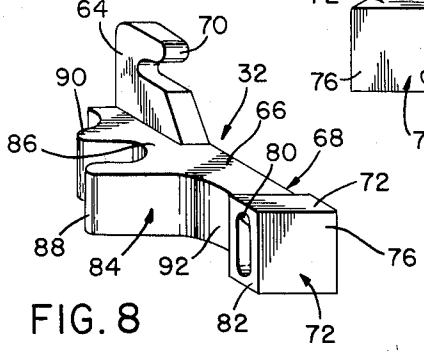


FIG. 8

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United States Patent Office 3,248,161 Patented Apr. 26, 1966

3,248,161

DISHWASHER DOOR COUNTERBALANCING APPARATUS

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Filed Dec. 11, 1963, Ser. No. 329,652
8 Claims. (Cl. 312—319)

The present invention concerns an improvement for a dishwashing machine and, more particularly, to an apparatus for counterbalancing the door of the machine.

In various types of domestic applicances such as ovens, and washing machines for example, access is gained to the working chamber by means of a pivotally mounted door which when closed forms one of the sides of the machine. Since these doors are often insulated and made of metal they are quite heavy, and are therefore, for the convenience of the user, usually counterbalanced so as to enable them to be more easily opened and closed.

However the various counterbalancing arrangements now in use for such doors leave something to be desired from such standpoints as economy of manufacture, simplicity of construction for purposes of installation and repair, and effectiveness of the counterbalancing achieved.

Therefore, foremost among the objects of this invention is that of providing a counterbalancing apparatus which constitutes a significant improvement over the prior apparatus from each of the standpoints noted above.

A particularly significant shortcoming in many of the counterbalancing arrangements employed at present is the inability of these arrangements to support the door in many of the open door positions which lie between the fully opened and closed positions. Thus, for example, in many counterbalancing constructions as the door approaches the closed position it will suddenly slam shut. This is a distinct disadvantage which this invention has as one of its further objects to overcome by providing a counterbalancing apparatus which will enable a door to be suspended in the infinite number of positions which lie between the fully opened and closed positions.

Briefly stated the present invention, which achieves the foregoing objects and others, comprises a pair of bearing blocks and attached coil springs which are mounted adjacent the opposite side edges on the front of the door to be suspended. Connected to each of the coil springs is a cable which extends toward and around the opposite bearing block and is secured to the side wall of the appliance. As the door is drawn open from the closed position the coil springs expand and the cables slide around and through the bearing blocks.

In view of the foregoing it is a still further object of this invention to provide an apparatus for counterbalancing doors in dishwashing machines and the like.

The novel features that are considered characteristic of the invention are set forth in the appended claims. However the invention itself, both as to its organization and operation, together with additional objects and advantages thereof, will best be understood from the following description of a specific embodiment when read in conjunction with the acompanying drawings in which:

FIG. 1 is a front elevational view of an automatic dishwasher with parts of the exterior housing broken away to illustrate the location of the counterbalancing apparatus of the invention therein;

FIG. 2 is a sectional view taken along the arrowed line 2—2 of FIG. 1;

FIG. 3 is a front elevational view of the apparatus shown in FIG. 2;

FIG. 4 is an enlarged view of the details shown on the right hand side of FIG. 2;

FIG. 5 is a side elevation of a portion of the dishwashing machine shown in FIG. 1, with parts broken away and with other parts shown in broken lines to illustrate the structural arrangement and operation of the invention when the door is in two of its opened positions and in its closed position;

FIG. 6 is a detailed view in section of the construction shown in the lower right hand corner of FIG. 5; and

FIGS. 7 and 8 are perspective views of the bearing block which forms a part of the apparatus of the present invention.

While the various features of this invention are hereinafter illustrated and described as being particularly adaptable to provide a counterbalancing means for a dishwasher or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide a counterbalancing means for other devices as desired.

Therefore, this invention is not to be limited to the only embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses for this invention.

Referring now to FIGS. 1, 2 and 5 of the drawings, the dishwasher is designated generally by the numeral **10** and consists of a housing **12** which includes opposite side walls **14** and **16** having flanges **18** and **20** respectively formed along their forward edge portions. The dishwasher **10** is provided at the front thereof with a doorway **22** through which the dishwasher may be loaded with dishes to be washed, rinsed and dried and through which it may be unloaded after these operations have been completed. The doorway **22** is closed by a door **24** when the dishwasher **10** is in operation, the door being hinged adjacent its lower edge for pivotal movement between an upper, generally vertical, closed position wherein it closes the doorway, and a lower, generally horizontal, open position.

The dishwasher **10** includes various electrical elements which cooperate to carry out the washing, rinsing and drying operations mentioned. Among these electrical elements is a timer (not shown) which is set for sequentially controlling the aforementioned operations by means of a control knob **26** and which in the course of its operation actuates a motor **28** which drives a pump **30** for pumping water into and out of the machine during the washing and rinsing operations.

With reference now to FIGS. 1–4, the counterbalancing apparatus of the present invention generally consists of a pair of bearing blocks **32, 34** mounted adjacent the side edges of door **24**, a pair of coil springs **36, 38** attached to bearing blocks **32, 34** respectively and extending across the front face of door **24**, and a pair of cables **40, 42** attached to coil springs **36, 38** respectively which bear against and around blocks **34, 32** and are secured at their opposite ends to flanges **20, 18.**

With reference now to the specific details of construction, the apparatus of the present invention is so constructed that it may be mounted in position on door **24** without using nuts, bolts, or other standard retaining devices. For the most part this is achieved by forming the side edges of the inner wall **48** of door **24** and bearing blocks **32** and **34** in such a manner that the blocks may be simply and quickly pressed into locked engagement with the inner wall of the door.

In order to accomplish this, inner door wall **48** which is generally flat in its central portion **50** is progressively provided, see FIGS. 2 and 3, from its central portion to its opposite side edges with rearwardly projecting channels **52, 54**, rounded shoulders **56, 57**, flat strips **58, 59** and forwardly projecting flanges **60, 62.**

The bearing blocks **32** and **34** which are formed along one side to be pressed into engagement with the un-

dulated front surface of wall **48**, are identical in form as shown in FIGS. 7 and 8 and are preferably made of a thermo plastic material having sufficient mechanical properties to withstand the stresses imposed during the operation of the counterbalancing structure of the present invention. Since bearing blocks **32**, **34** are identical in all respects, reference will be made only to block **32** in the course of describing the specific structural features and form of the blocks.

As best shown in FIG. 7, block **32** is provided with a hook portion **64** projecting upwardly from one corner of top surface **66** adjacent front surface **68** the hook finger **70** of which points toward opposite end portion **72** of the block. Front surface **68** which includes a side of hook portion **64** is provided with a longitudinal groove **74** spaced below hook portion **64** and extends the length of block **32** from end portion **78** up to end wall **76** of opposite end portion **72**. End portion **72** which has the general form of a rectangular box is provided with an aperture **80** which extends from its flat back surface **82** into the side groove **74** adjacent end wall **76**. Since aperture **80** and groove **74** are formed for the purpose of receiving either cable **40** or **42** in sliding engagement therewith, the opposite end walls adjacent aperture **80** are formed to flare outwardly at surface **82** (see FIG. 8), and to curve toward end **78** at groove **74** (see FIG. 4).

Referring now to FIGS. 4 and 8, rear surface **84** of block **32** is formed to fit into and engage the undulations provided adjacent the opposite side edges in the face of inner door wall **48**. In order to achieve this, rear surface **84** is formed with a central projecting portion **86** intermediate opposite end walls **72** and **78** which portion is provided on its opposite sides with a pair of rearwardly extending legs **88** and **90**.

Since the function of projecting portion **86** is to fit into either channel **52** or **54** and engage the side walls thereof for the purpose of securing bearing block **32** to inner door wall **48**, the width of portion **86** is slightly larger than the width of either channels **52** or **54** thereby assuring a tight forced fit engagement between portion **86** and the channel into which it is pressed.

Additional support is also provided block **32** in its mounted position on inner door wall **48** when curved rear surface shoulder **92**, flat back surface **82** and flat end **72** are nested within and against similarly formed inner wall surfaces presented by rounded shoulder **56** or **57**, flat strip **58** or **59**, and the inner wall of flanges **60** or **62**, respectively.

Since, as previously indicated, blocks **32** and **34** are of identical construction they will, as of necessity, be inverted with respect to one another when mounted in the manner indicated adjacent the opposite edges on inner wall **48** of door **24**. Thus, as is best shown in FIG. 3, the position of block **32** is such that its hook portion **64** is projecting upwardly whereas the hook portion **64** on block **34** which is mounted adjacent the opposite edge of door **24** is projecting downwardly. As is apparent from FIG. 2, this reversal of parts whereby hook portions **64** on mounted blocks **32** and **34** project in opposite directions achieves the result of enabling spring **36** and cable **40** to be mounted in spaced parallel relationship with adjacent spring **38** and cable **42**. In this manner the springs and cables are in non-interfering relationship during the opening and closing of door **24**.

In order to provide a continuous path for cables **40**, **42** through inner wall **48** of door **24** and flanges **18** and **20** of side walls **14** and **16** respectively, apertures **94** and **96** are provided in flat strips **58** and **59** respectively, and apertures **98** and **100** are provided in flanges **18** and **20** respectively, all of which apertures are in horizontal alignment with block apertures **80** when door **24** is in its closed position as shown in FIG. 2.

Cables **40** and **42**, as used in the illustrative embodiment of the present invention, are preferably formed with a steel cable core or other material that will not cold flow under tension. Furthermore, in order that cables **40** and **42** may slide smoothly along and through groove **74** and aperture **80** without causing any appreciable wear to either surface, the steel cable core is encased in a nylon coating or sleeve throughout its length. In order that cables **40** and **42** may be attached to coil springs **36** and **38** respectively, one end of each cable is provided with a hook eye **102** which may be crimped thereon. In addition, a cylindrical stop member **104** is attached as by crimping also to each of cables **40** and **42** adjacent hook eye **102**, the diameter of which member **104** is slightly greater than the width of grooves **74** in blocks **32** and **34** so as to prevent further movement of cables **40**, **42** through grooves **74** when member **104** engages side **78** of blocks **32** and **34**.

As best shown in FIG. 3, springs **36**, **38**, and cables **40**, **42** are mounted in position for providing counterbalancing support for door **24**, by hooking one end of springs **36** and **38** on to hook portion **64** of blocks **32** and **34** respectively and the opposite ends of springs **36**, **38** through eye portions **102** of cables **40** and **42** respectively. With door **24** in its closed position against doorway **22**, the unattached end of cable **40** is then inserted into aperture **80** of block **34** and through aperture **96** in flat strip **59**, and aperture **100** in flange **20** of side wall **16**. Also, the unattached end of cable **42** is likewise inserted into aperture **80** of block **32** and through aperture **94** in flat strip **58**, and aperture **98** in flange **18** of side wall **14**. The unattached ends of cables **42** and **40** may be retained against withdrawal from apertures **98**, **100** in flanges **14**, **16** respectively, by means of cylindrical stop members **106** which may be crimped thereon. Furthermore in order to protect nylon coated cables **40**, **42** from abrasive contact with the edges of apertures **98**, **100**, and also in order to prevent members **106** from passing through apertures **98** and **100**, cable retainers **107** having a centrally projecting apertured portion **109** may be inserted onto cables **40**, **42** and positioned between member **106** and the apertured flanges as best shown in FIG. 4 of the drawings.

With the ends of cables **40**, **42** secured against flanges **20**, **18** respectively, in the manner described, and with door **24** in its fully opened horizontal position, the elongation of coil springs **36**, **38** and the position of stop members **104** on cables **40**, **42** should be such that stop members **104** on cables **40**, **42** are in abutment with ends **78** of blocks **34** and **32** respectively as best shown by the broken line portions in FIG. 2. In other words when door **24** is in its fully opened horizontal position, it is supported against further downward movement by stop members **104** and not by springs **36**, **38**. In this connection the lengths of cables **40** and **42** are preferably such that they extend, when door **24** is fully opened, from their secured position in flanges **20** and **18** around blocks **32** and **32** and slightly beyond block ends **78** where eyelet portions **102** and stop members **104** are mounted thereon.

Referring now to FIGS. 5 and 6, as door **24** is opened from its closed position against doorway **22**, the angle of wrap, that is the arc of engagement between cables **40**, **42** and the flared surface portion of aperture **80** is increased as the door approaches its fully opened horizontal position. This increase in the angle of wrap is an important factor in the ability of the apparatus of this invention to support door **24** in any of its infinite number of opened positions.

The foregoing description of the counterbalancing apparatus of the present invention is an exemplary embodiment for purposes of illustration, and as such it should be understood that various changes, modifications and substitutions may be made in connection with some or all of the elements of the combination which comprises the invention without departing from the spirit of the invention as defined by the claims which follow.

We claim:

1. In a dishwashing machine having a housing structure including opposite side walls, a doorway and a door pivotally mounted to said structure and movable relative to said housing between various opened positions and a closed position closing said doorway, a door counterbalancing mechanism comprising: a pair of bearing blocks mounted on the front of said door adjacent the opposite side edges thereof; a pair of coil springs each connected at one end to a bearing block and extending toward each other across the front of said door; and a pair of cables each connected at one end to the unattached end of said springs and engaged in sliding contact against and around said blocks and attached at the other end to the side walls on opposite sides of the door whereby said door is supported in its various opened positions.

2. The dishwashing machine set forth in claim 1, in which each of said bearing blocks are formed with a continuous path for receiving a cable therein in sliding engagement therewith.

3. The dishwashing machine set forth in claim 1, wherein said cables are encased within a plastic coating and provided with stop means on at least one of said cables for preventing further movement in one of the opened positions.

4. The dishwashing machine set forth in claim 3, wherein said stop means are formed on said cable adjacent the end thereof attached to one of said coil springs for preventing movement of said cable through said bearing means.

5. The dishwashing machine set forth in claim 1, wherein each of said bearing blocks is provided with a hook portion for engaging an end of said coil spring.

6. The dishwashing machine set forth in claim 2, wherein the continuous path formed in said bearing block comprises an open groove portion and an aperture portion formed therethrough.

7. In the combination of a housing structure including side walls, a doorway having spaced sides, a door pivotally mounted with respect to said housing and said doorway and movable between an open position and a closed position closing said doorway, and a counterbalancing mechanism for said pivotally mounted door, the improvement comprising: said counterbalancing mechanism including a flexible, elongated member having two end portions, means for attaching one of said end portions onto said door and adjacent one side of said doorway, means for attaching the other of said end portions onto said housing and adjacent the other side of said doorway, a bearing block secured onto said door adjacent said other side of said doorway, said elongated member extending across said door and around said bearing block, said bearing block having a surface frictionally engaging said member whereby said surface restrains movement of said member along said surface to hold said member in an infinite variety of adjusted positions on said bearing block, and said elongated member including an elastic, expandable section intermediate said doorway sides to urge said door toward the closed position.

8. The improvement as defined in claim 7 wherein said frictionally engaging surface includes an elongated groove in said bearing block for receiving said flexible, elongated member extending around said bearing block.

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F. DOMOTOR, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,248,161 April 26, 1966

Myron E. Ullman, Jr., et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2 and 3, for "assignors to Mullins Manufacturing Corporation, of Columbiana, Ohio, a corporation of Ohio," read -- assignors to Mullins Manufacturing Corporation, of Salem, Ohio, a corporation of Delaware, --; in the heading to the printed specification, lines 5 and 6, for "assignors to Mullins Manufacturing Corporation, Columbiana, Ohio, a corporation of Ohio" read -- assignors to Mullins Manufacturing Corporation, Salem, Ohio, a corporation of Delaware --.

Signed and sealed this 28th day of November 1967.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents