Jan. 23, 1962 L. E. AUSTIN ET AL 3,017,691

SPRING ASSEMBLING MECHANISM

Filed Dec. 19, 1958 2 Sheets-Sheet 1

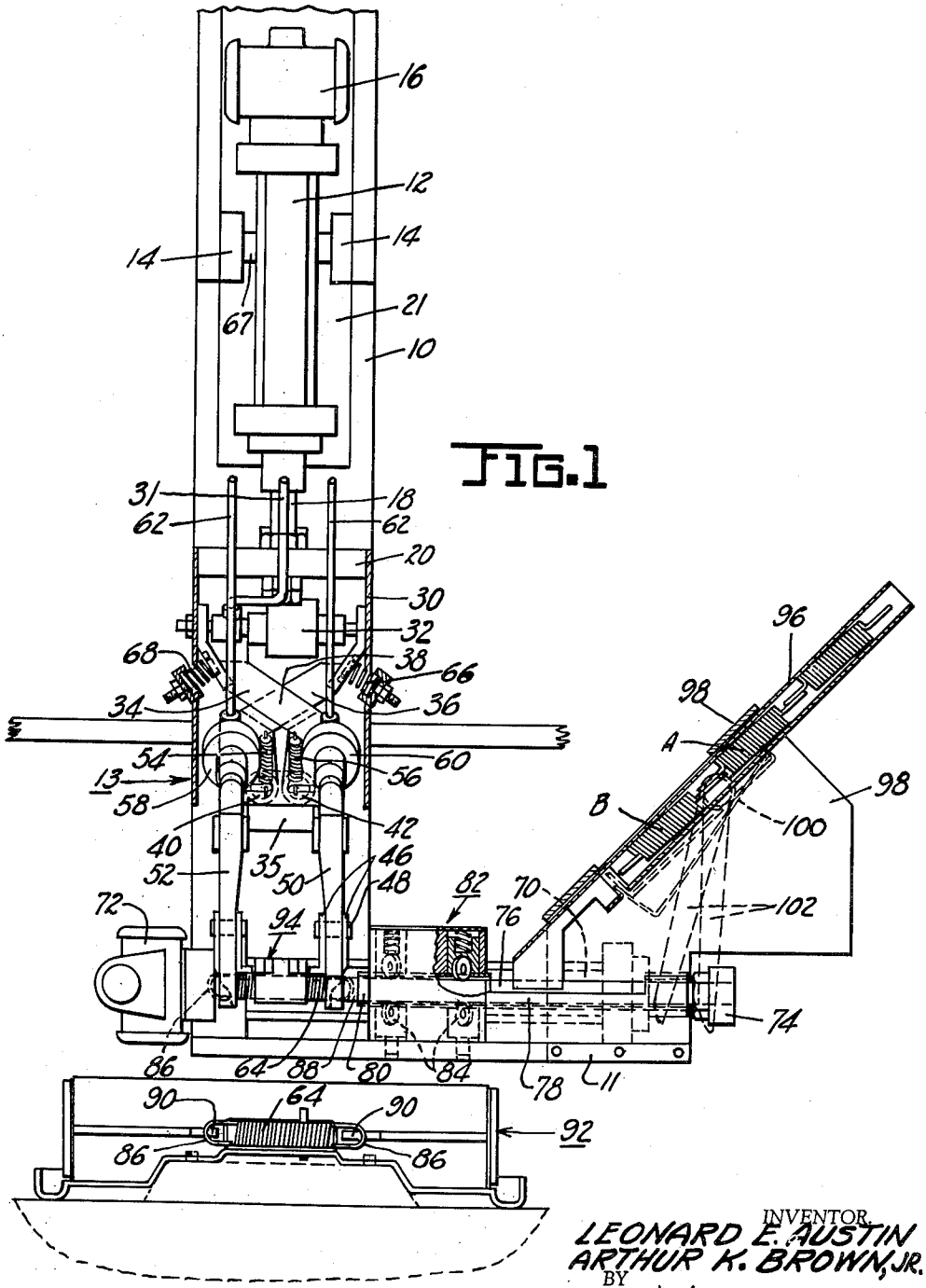


FIG. 1

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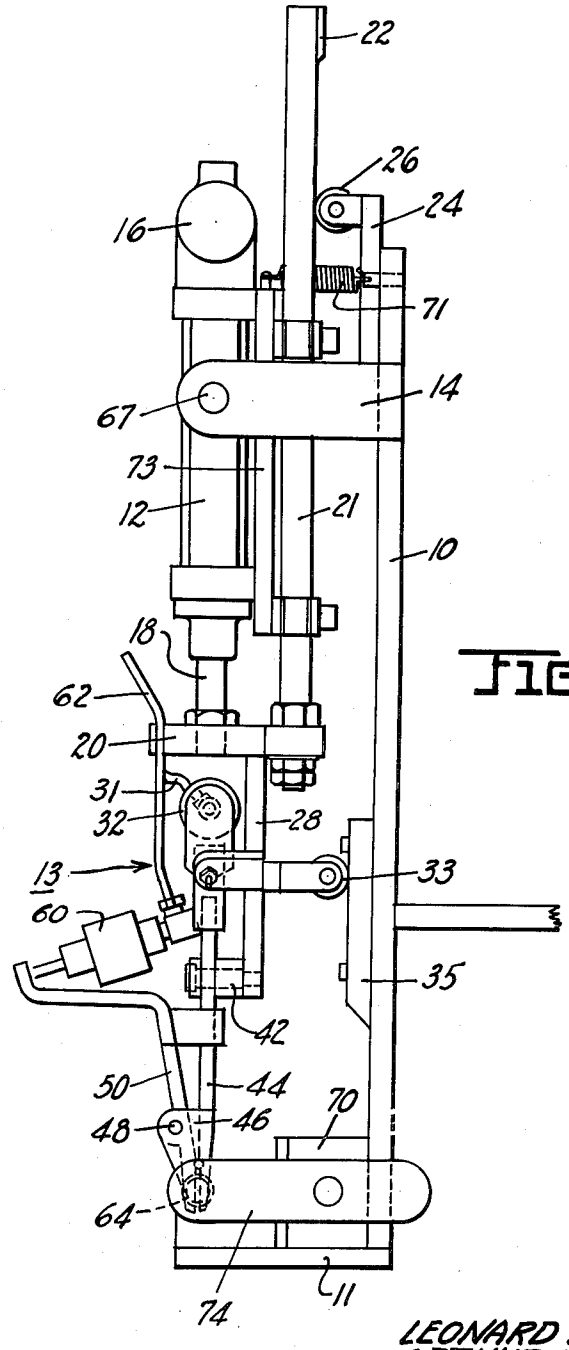


FIG. 2

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SPRING ASSEMBLING MECHANISM

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9 Claims. (Cl. 29—211)

This invention relates in general to a spring assembling mechanism and in particular to a power operated mechanism for incorporating a yieldable member in a unit of which said member is a part.

It is an object of our invention to provide a relatively simple assembly mechanism, including a bodily and angularly movable gripper and lazy tongs unit actuated by a plurality of pressure differential operated motors, for successively gripping a workpiece such as an automotive brake helical spring having eye shaped end portions, then stretching said workpiece and at the same time bodily lowering the same to a position adjacent members to which the workpiece is to be connected, then releasing the workpiece so that the same will grip said members, then bodily returning the gripper and lazy tongs unit to its original that is starting position, then positioning another workpiece in position to be processed by the lazy tongs and gripper unit and thereby complete the cycle of operations.

Yet another object of our invention is to provide, in one unit, a bodily movable combined lazy tongs and gripper mechanism operable to successively grip a workpiece, then stretch said workpiece and at the same time bodily lower the same to a certain position, then release the workpiece, and lastly return the lazy tongs and gripper mechanism unit to its off position.

A further object of our invention is to provide, in combination with a lazy tongs and gripper unit operable to grip and stretch a workpiece, a power operated orienting and feeder mechanism operable to feed workpieces to said unit and during said feeding operation align the workpiece with the unit and so position the same that it may be later secured to a certain member with which it is to be connected.

Other objects of the invention and desirable details of construction of parts will become apparent from the following detailed description of an illustrative embodiment of the invention, taken in conjunction with the accompanying drawing illustrating said embodiment, in which:

FIGURE 1 is a front elevational view of the workpiece assembly mechanism of our invention; and

FIGURE 2 is a side elevational view of the mechanism of FIGURE 1.

Referring to the two figures of the drawings disclosing a preferred embodiment of our invention a vertically extending standard **10** serves as a pivotal support for a workpiece handling lazy tongs and gripper unit **13** through the medium of a double acting pressure differential operated motor **12**, the cylinder of said motor being pivotally mounted to spaced apart ears **14** secured to said support. The support **10** is secured to a base plate or platform **11**. This motor **12** is controlled by an electrically controlled valve **16**; and its piston, not shown, is connected, by a rod **18**, to a support structure including a member **20**. To this member there is connected a rod **21** having a cam member **22** secured to its upper end portion. A plate **24**, secured to the support member **10**, has secured thereto a cam roller **26**; and this roller is contacted by the cam **22** to, in combination with a cam **35**, rotate the motor about the ears **14** when motor is energized to move its piston downwardly.

A support plate **28**, secured to the support member **20** and constituting a part of the support structure, serves as a support for a housing member **30**, FIG. 1, within which

is housed a floating single acting pressure differential operated motor **32**. The housing member is provided with openings in its sides to facilitate an operation of the motor **32**; and said member is secured to the support member **20**; and to the floating motor **32** there is connected a fluid transmitting conduit **31**. A cam roller **33**, mounted on the support plate **28**, contacts the cam member **35** which is secured to the support plate **10**. The casing and piston of the motor **32** are connected, respectively, to lever arms **34** and **36** of a lazy tongs unit, said arms being crossed at **38**, FIGURE 1. One of these arms is pivotally mounted on a pivot member **40** and the other on a pivot member **42**, FIGURE 1, said pivot members being mounted on the support member **28** as is disclosed in FIGURE 2. Beyond the pivots the arms **34** and **36** are extended downwardly to provide the fixed arms of gripper units the extension of the arm **34** being indicated by the reference numeral **44**, FIGURE 2. To the fixed arm **44** there are secured ears **46**; and a pivot pin **48**, extending through these ears, serves as a pivotal mounting for a movable arm **50** of one of the gripper units. A movable arm member **52** of the other gripper unit is pivotally mounted to the fixed that is stationary arm, not shown, of this unit. Springs **54** and **56**, secured at one of their ends to the lazy tongs lever arms **34** and **36** and at their other ends to posts secured to the movable arms **50** and **52**, serve to return said movable arms to their gripper off position.

Single acting pressure differential operated motors **58** and **60**, to which are connected fluid transmitting conduits **62**, serve, when energized, to rotate the arms **50** and **52** to actuate the gripper units. The inner ends of these motors are pivotally mounted to the lever arms **34** and **36** respectively of the lazy tongs unit. As to the motor **32** when the same is energized the arms **34** and **36** are actuated to bodily move the gripper units outwardly, FIGURE 1, thereby stretching a yieldable workpiece **64** which is at the time gripped by the two gripper units. The lever arms **34** and **36** are accordingly the principal part of a workpiece spreading lazy tongs unit. Springs **66** and **68**, mounted in the housing **30**, serve to return the arms of the lazy tongs unit to their off position when the motor **32** is de-energized. The lazy tongs and gripper mechanism together constitute a pivotally mounted bodily and angularly movable unit indicated by the reference numeral **13** and said unit serves to handle the workpiece **64**; all as will be described in detail hereinafter. The workpiece disclosed herein is a brake shoe return spring for an automotive brake. However, the mechanism of our invention is adapted to process any elongated bodily stretchable member which may be gripped at its ends, then stretched and secured at said ends to members adapted to at least temporarily hold the workpiece in its stretched condition.

Describing now the mechanism for positioning the workpiece **64** in place between the gripper units a double acting pressure differential operated motor **70**, controlled by a valve **72**, is mounted on the platform **11**. The piston, not shown, of this motor is connected to a crosspiece **74**, FIGURE 2; and to one end of said crosspiece there is connected a rod **76** which parallels the motor. This rod **76** is cradled in a trough member **78** which is secured to a sleeve portion **80** of an orienter unit **82**. This unit, which is disclosed and claimed in Ettinger, U.S. application for patent (No. 775,907, filed November 24, 1958), includes spring biased rollers **84** extending through openings in the sleeve **80**. When the workpiece **64** is pushed through the sleeve by the rod **76** the rollers **84** serve to rotate the workpiece about its longitudinal axis thereby meshing looped that is eye shaped end portions **86** of the workpiece with a slotted end portion **88** of the rod **76**. This orienter mechanism therefore serves to rotate the workpiece about its longitudinal axis and when the rod **76** is withdrawn by the reverse operation of the motor **70**

the workpiece is left in the desired position, that is in a position to be later secured to hooks **90** on the brake shoes of an automative brake **92**, FIGURE 1.

The workpiece **64** is pushed, by the operation of the motor **70**, into a spring loaded clamp **94** mounted on the base plate **11**; and in this operation the ends of the workpiece are positioned between the gripping ends of the arms of the two gripper units said units being at the time in their off that is open operation. The clamp **94** serves to hold the workpiece in position preliminary to the operation, by the lazy tongs gripper unit **13**, of securing the workpiece in place in the brake unit.

As to the means for feeding the workpieces to the trough portion **78** a tubular chute member **96**, secured to the base plate **11** by a support member **98**, houses said workpieces the same being fed to the chute by suitable power means, not shown, or manually by an attendant. An escapement mechanism, including a U-shaped member **100** rocked by a crank **102** secured thereto, serves, when the member **100** is rocked counterclockwise, to hold a workpiece A in place and permit a workpiece B to slide down the chute and into the trough **78**; and when the member **100** is rocked clockwise, with the pushing of a workpiece into the clamp **94**, said member assumes the dotted line position shown in FIGURE 1. In this latter operation the workpiece A slides down the chute and takes the temporarily fixed position formerly occupied by workpiece B. As is disclosed in FIGURE 1 the end of the crank **102** is actuated by the crosspiece **74**.

Briefly describing now the cycle of operations of the mechanism of our invention it is assumed that a workpiece **64** to be processed is in its correct that is oriented position in the clamp **94** the looped or eyelike end members **86** thereof lying in a vertical plane; that the motor **70** has been reversed, that is that a workpiece is held by the upper end of the escapement member **100** and a workpiece has slid into the trough **78**; that the arms of the lazy tongs have been returned, by the springs **66** and **68**, to their off position; that the gripper units are open and that their end portions are surrounding the ends of the workpiece to be processed; and that a brake unit **92** is in place ready to receive a return spring, that is a workpiece.

The motors **58** and **60** are then energized to effect an operation of the gripper units to grip the workpiece; and immediately after this operation is completed the motors **12** and **32** are concurrently energized to bodily move the lazy tongs and gripper unit **13** downwardly toward the brake **92** and at the same time operate the lazy tongs mechanism to elongate the spring in preparation for its being fastened to the hooks **90** of the brake shoes of the brake unit. In this operation the rollers **26** and **33** contact their cooperating cams **22** and **35** respectively, the cam **22** serving to rotate the unit **13** about a pivot **67**, by virtue of the operation of a preloaded tension spring **71**, to align the workpiece with a line joining the hooks **90** of the brake. The spring **71** is secured at one of its ends to the stationary member **24** and at its other end to a fixedly mounted rod **73**. The operating mechanism as a whole is so constructed and the synchronization of the parts thereof is so determined that the ends of the workpiece reach a position immediately adjacent the hook ends **90** of the brake shoes when the pistons of the motors have completed their movement.

The gripper motors **58** and **60** are then de-energized to open the grippers thereby permitting the stretched workpiece to contract somewhat, the eyes **86** thereof coming into contact with the hooks **90** of the brake shoes. The control mechanism for the motors, not shown and constituting no part of this particular invention, is then operative to energize the motor **12** to bodily move the lazy tongs and gripper unit **13** upwardly to its off position; and concurrently de-energize the motor **32** thereby permitting the then compressed return springs **66** and **68** to operate to return the lazy tongs to their off position.

In this operation the return spring **71** operates to angularly rotate the lazy tongs and gripper unit **63** clockwise about the pivot **67**.

Completing the description of the operation of the mechanism of our invention when the lazy tongs and gripper unit **13** is back in place the motor control means, not shown, operates to energize the motor **70** to position another workpiece in the clamp **94**. This having been done the controls operate to effect a return operation of the motor **70** to again fill the trough by the operation of the escapement mechanism.

There is thus provided, by the workpiece processing mechanism of our invention, automatically operated power operated means for transferring workpiece units, such as a helical spring, from a chute or equivalent means to a mechanism being assembled such as an automotive brake; the units being connected, by the operation of the processing mechanism, with parts of said mechanism being assembled.

While the preferred embodiment of the invention has been described in considerable detail, we do not wish to be limited to the particular construction shown which may be varied within the scope of the invention, and it is the intention to cover hereby all adaptations, modifications and arrangements thereof which come within the practice of those skilled in the art to which the invention relates.

We claim:

1. A workpiece assembly mechanism for transferring workpieces from one location to another said mechanism including a vertically mounted standard having spaced apart ear members projecting outwardly from the upper end of the standard, a motor including a casing and a power element said casing being pivotally mounted on the other ends of the ear members, a support structure connected to the power element of the motor, a workpiece handling pair of relatively movable first lever members pivotally mounted on said support structure and pair of second lever members each of which is pivotally mounted on one of said first lever members and movable in a plane normal to the plane of movement of said first lever members, power means for operating the pair of second lever members to thereby grip said workpiece between said first and second lever members, power means for operating the relatively movable first lever members to thereby stretch said workpiece to facilitate its being coupled to structure with which it cooperates, means for effecting an angular movement of the support structure when the motor is energized, and means for transferring workpieces from a chute to a position immediately adjacent said first and second lever members when the latter is in position to pick up said workpieces.

2. A workpiece assembly mechanism as claimed in claim 1 wherein the means for effecting angular movement of the support structure includes cam means fixedly secured to said standard and engageable with said support structure.

3. A combined toggle and gripper mechanism adapted to grip and stretch a tubular shaped bodily yieldable workpiece, said mechanism including a support member, a toggle mechanism for stretching the workpiece including a pair of relatively movable spaced apart lever members pivotally mounted on the support member, and a pair of gripper units each having a stationary arm pivotally mounted on one of the lever arms of the toggle mechanism, first motor means carried by said support member and operatively connected to said stationary arms for actuating the same to forcibly grip said workpiece between said stationary arms and said spaced apart lever members, and second motor means carried by said support member and operatively connected to said relatively movable lever members for actuating the same to stretch said workpiece.

4. A workpiece assembly mechanism comprising a support member, a bodily and angularly movable lazy tongs and gripper unit pivotally mounted on said support member and movable toward and away from the point about which it pivots, said lazy tongs and gripper unit including relatively movable first and second arms and gripping means operatively connected to and movable toward and away from said first and second arms, power means operatively connected to said gripping means for actuating the same toward said first and second arms to thereby engage and securely grip said workpiece, power means operatively connected to said relatively movable first and second arms for actuating the same to thereby effect distortion of said workpiece and facilitate assembly of said workpiece to structure with which said workpiece cooperates, power means operatively connected to said lazy tongs and gripper unit for actuating the same to a certain position relative to the structure with which said workpiece cooperates, and power actuated feeder means for supplying said workpiece in an oriented position to said lazy tongs and gripper unit to facilitate gripping of said workpiece by said first and second arms and said gripping means.

5. A workpiece assembly mechanism comprising a support member, a lazy tongs and gripping unit including a pair of relatively movable spaced apart first lever members movable in the plane of said unit and a pair of second lever members each operatively connected to one of said first lever members and movable in a plane normal to the plane of said unit, a workpiece source, power actuated feeder means operatively connected to said source for transferring said workpiece from said source to a position adjacent said first and second lever members and for orienting said workpiece relative to said first and second lever members to enable it to be gripped between said first and second lever members, power means operatively connected to said second lever members for actuating the same to grip said workpiece, power means operatively connected to said first lever members for actuating the same to thereby effect distortion of said workpiece to facilitate assembly of said workpiece to structure with which said workpiece cooperates, and means including a motor having a casing pivotally mounted on said support member and a power element operatively connected to said lazy tongs and gripper unit for actuating the same to a certain position relative to said cooperating structure.

6. A workpiece assembly mechanism comprising a support member, first motor means including a casing pivotally mounted on said support member and a power element movable relative to said casing, a lazy tongs and gripper unit operatively connected to said power element and actuated thereby bodily and angularly relative to the pivot point of said casing to a certain position relative to a workpiece, first motor means operatively connected to and carried by said lazy tongs and gripper unit for actuating the gripper portion of said unit to grip said workpiece, second motor means operatively connected to and carried by said lazy tongs and gripper unit for actuating the lazy tongs portion of said unit to distort said workpiece to facilitate assembly of the same to structure with which said workpiece cooperates, and means including a cam member secured to said support member and operatively connected to said lazy tongs and gripper unit for controlling the angular position thereof as said unit moves bodily in response to energization of said first motor means.

7. A workpiece assembly mechanism comprising a support member, first motor means including a casing pivotally mounted on said support member and a power element movable relative to said casing, a frame member operatively connected to said power element and actuated thereby bodily and angularly relative to the pivot point of said casing, a pair of relatively movable first lever members pivotally mounted on said frame member, a pair of second

lever members each of which is pivotally mounted on one of said first lever members and together therewith forming a clamp, second and third motor means carried by said frame and operatively connected to said first and second lever members, respectively, for actuating the same, means for feeding a workpiece to a certain position and at the same time orienting the same relative to said first and second lever members to facilitate engagement therewith, said first and second lever members being actuated sequentially by said second and third motor means such that said workpiece is clamped between said first and second lever members and then distorted by said relatively movable first lever members, and a cam member operatively connected to said frame member for effecting angular movement thereof when said frame member is moved bodily in response to energization of said first motor means to thereby facilitate connecting said workpiece to structure with which said workpiece cooperates.

8. A workpiece assembly mechanism comprising a support member, a bodily and angularly movable lazy tongs and gripper unit, pivotally mounted on said support member and movable toward and away from the point about which it pivots, said lazy tongs and gripper unit including a frame, first and second relatively movable lever members pivotally mounted to said frame for movement in a common plane of operation and provided with spaced apart workpiece engaging end portions, third and fourth lever members pivotally mounted to said first and second lever members, respectively, for movement perpendicular to said plane of operation, said third and fourth lever members being provided with spaced apart end portions which together with said first named end portions form spaced apart workpiece engaging clamps, a workpiece source, power actuated feeder means operatively connected to said source for transferring said workpiece from said source to a position immediately adjacent said first named end portions, power means operatively connected to said third and fourth lever members for actuating the same to thereby clamp said workpiece between said first and second named end portions, power means operatively connected to said first and second lever members for actuating the same to thereby distort the workpiece to facilitate its being coupled to spaced apart members with which it will cooperate, and power means operatively connected to said frame for bodily and, at the same time, angularly actuating the same about its pivot mount to a predetermined position to facilitate coupling said workpiece to said spaced apart members, said first named power means being operative to actuate said third and fourth lever members to thereby release said workpiece into operative engagement with said spaced apart members.

9. A spring assembly mechanism comprising a support member, a bodily and angularly movable lazy tongs and gripper unit pivotally mounted on said support member, said lazy tongs and gripper unit including a frame, first and second relatively movable lever members pivotally mounted on said frame for movement in a common plane of operation and provided with spaced apart spring hook engaging end portions, third and fourth lever members pivotally mounted on said first and second lever members, respectively, for movement perpendicular to said plane of operation, said third and fourth lever members being provided with spaced apart end portions which together with said first named end portions form spaced apart spring hook engaging clamps, power actuated feeder means operatively connected to said source for transferring said spring from said source to a position immediately adjacent said first named end portions and for orienting the spring hooks relative to said first named end portions, power means operatively connected to said third and fourth lever members for actuating the same to thereby clamp said spring hooks between said first and second named end portions and later release said spring hooks, power means operatively connected to said first

and second lever members for actuating the same to thereby stretch said spring to facilitate its being coupled to spaced apart members with which it will cooperate, power means operatively connected to said frame for bodily moving and, at the same time, angularly moving said frame about its pivot mount to move said spring to a predetermined position relative to said spaced apart members, said first named power means being operative, in turn, to actuate said third and fourth lever members to

thereby release said spring hooks into operative engagement with said spaced apart members.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,017,691 January 23, 1962

Leonard E. Austin 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.

Column 3, line 9, for "operation" read -- position --.

Signed and sealed this 24th day of July 1962.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents