Aug. 2, 1966 R. M. SHEFFIELD ETAL 3,263,723

MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

Filed July 22, 1963 7 Sheets-Sheet 1

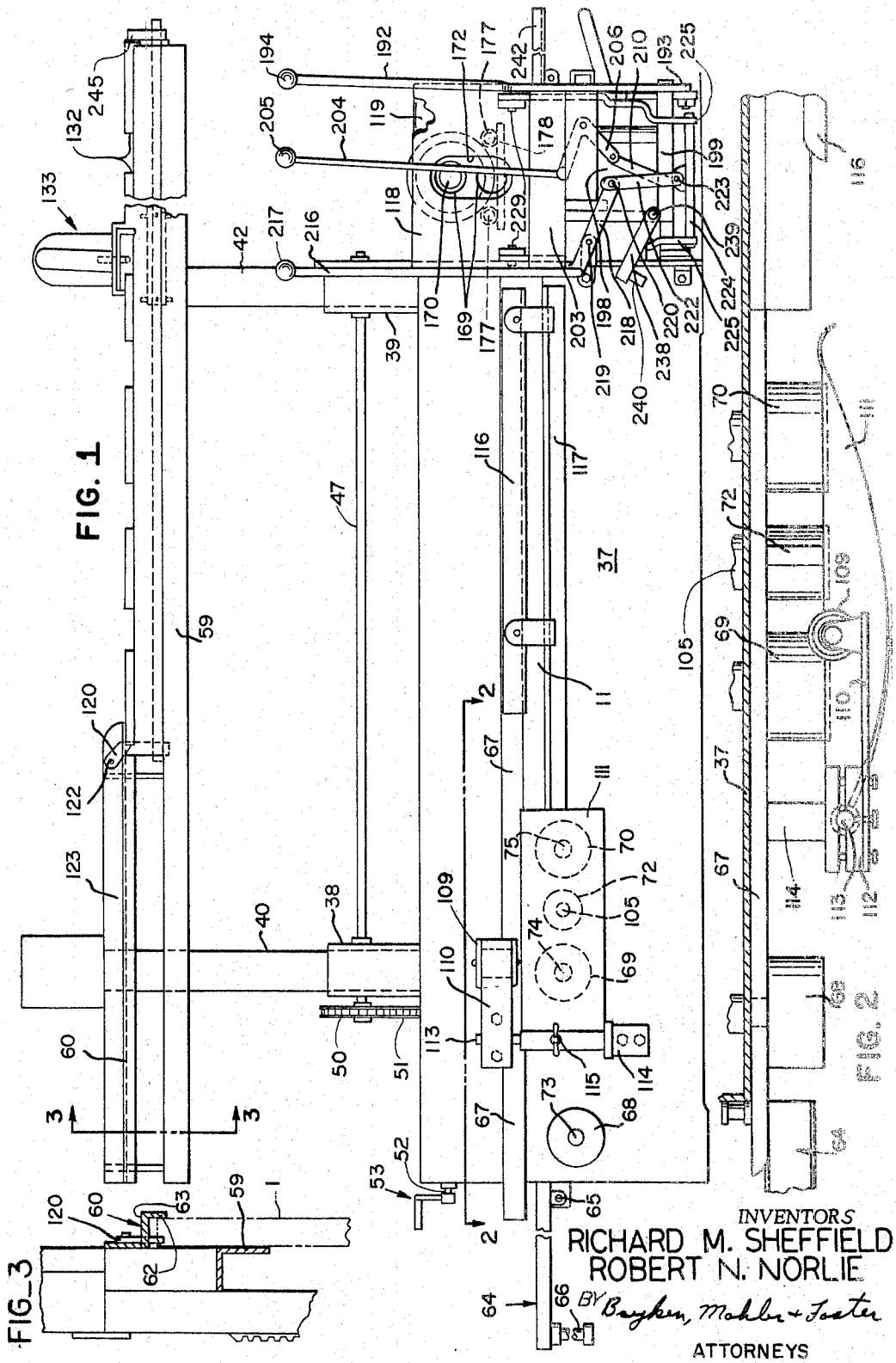


FIG. 1

FIG. 2

FIG. 3

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MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

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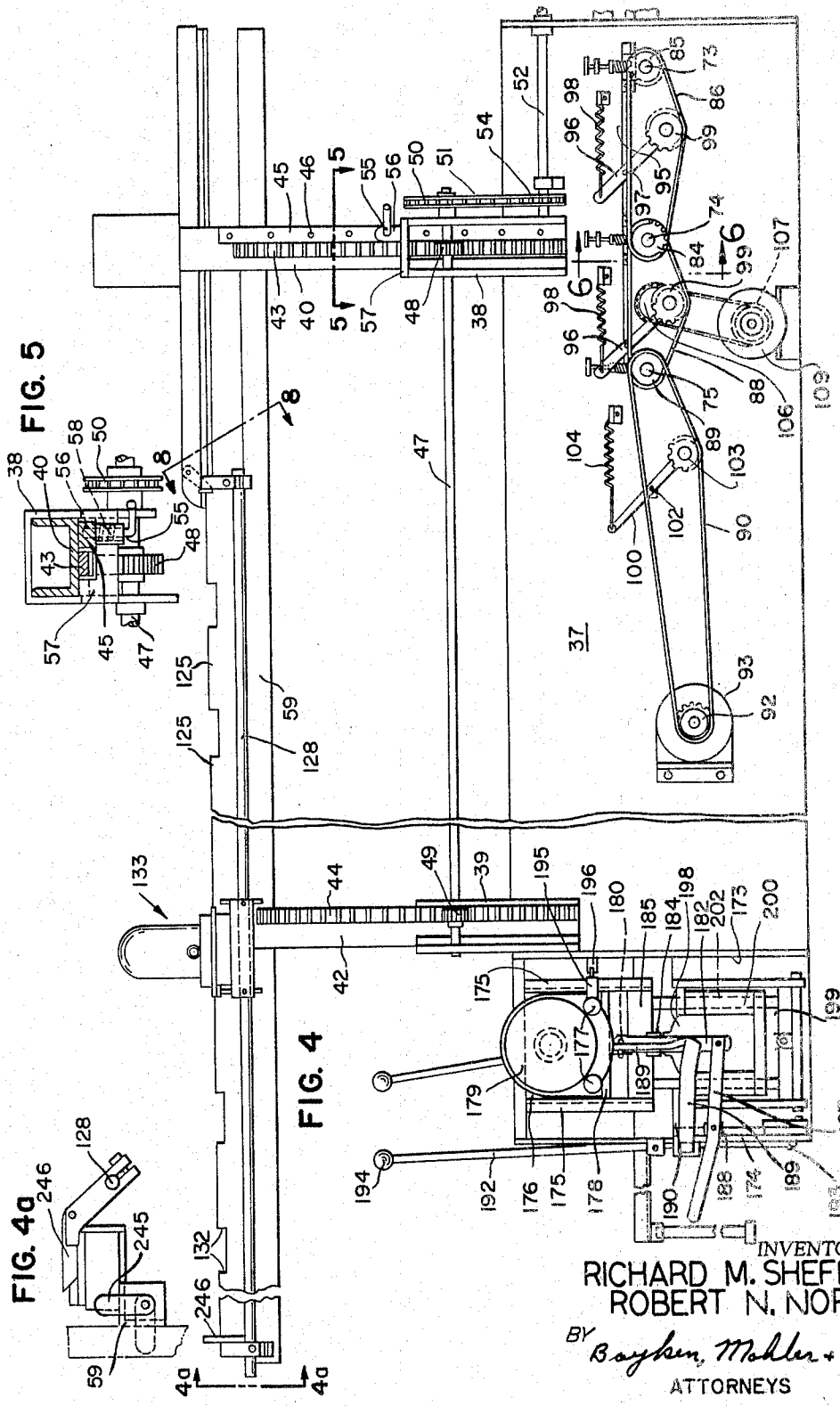


FIG. 5

FIG. 4

FIG. 4a

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MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

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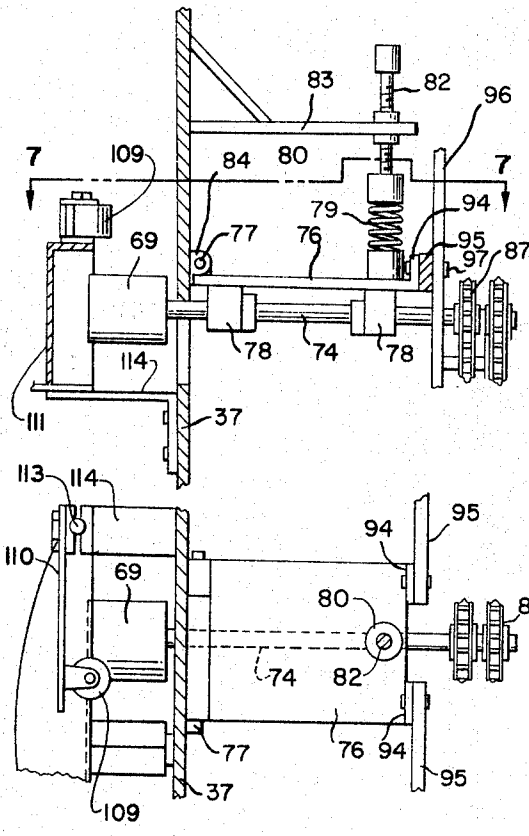


FIG. 6

FIG. 7

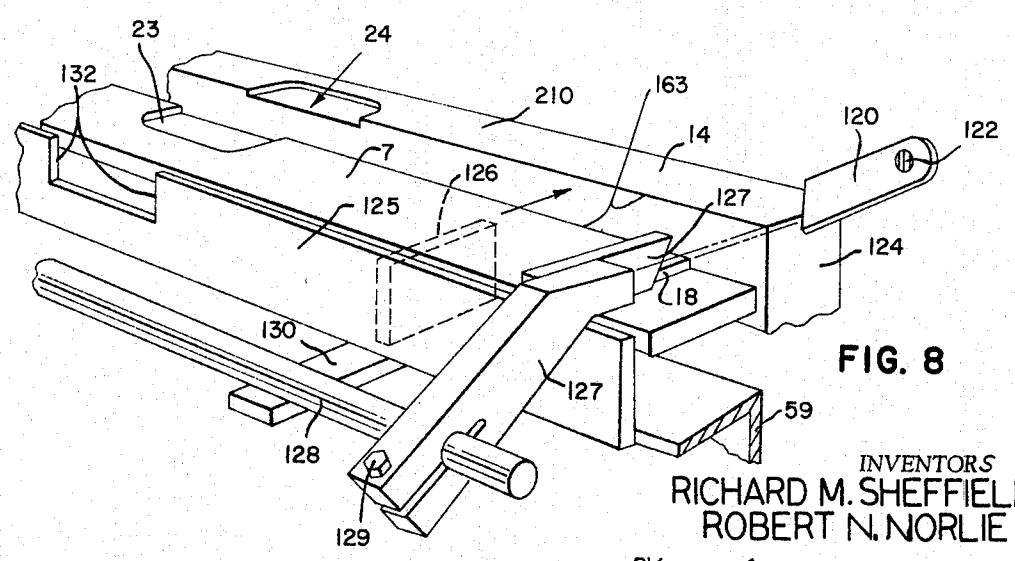


FIG. 8

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MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

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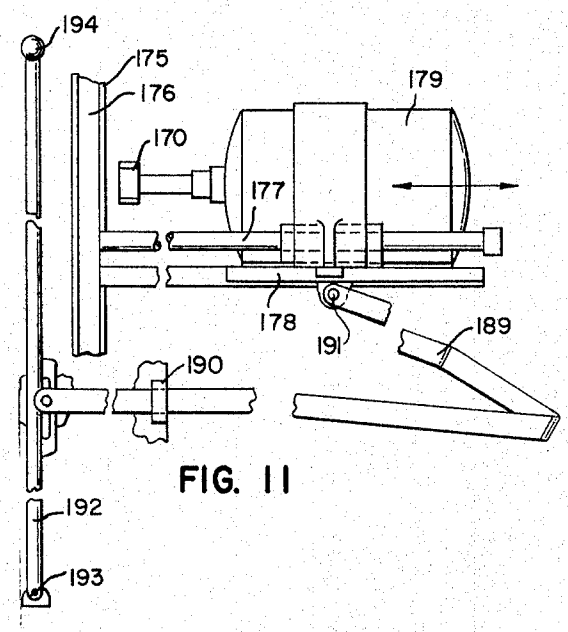


FIG. 11

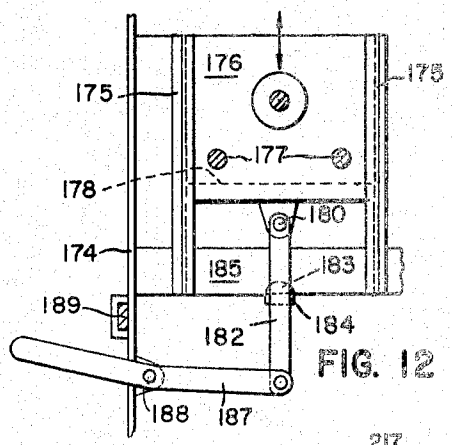


FIG. 12

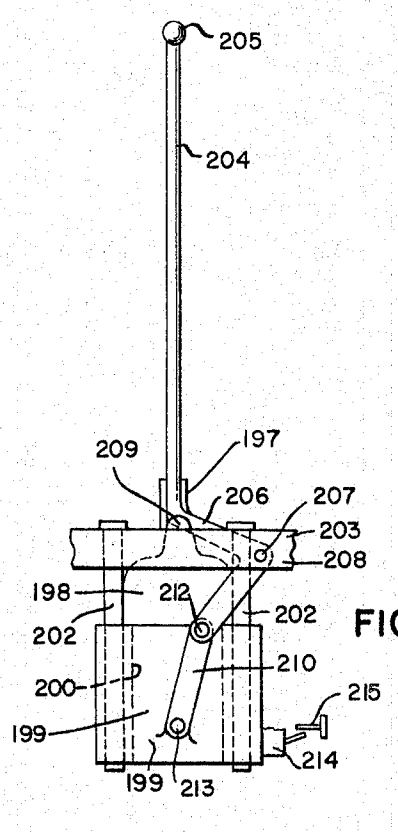


FIG. 10

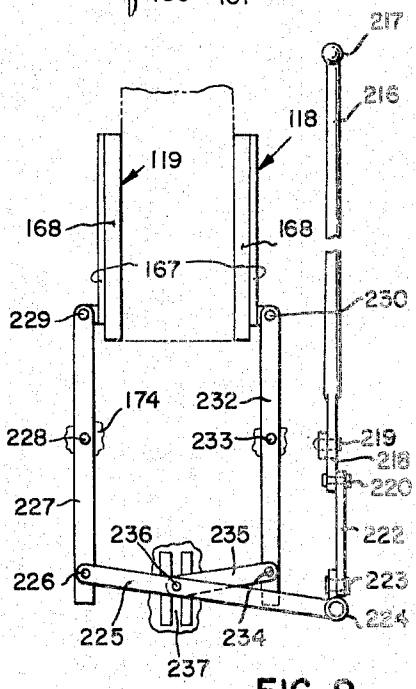


FIG. 9

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MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

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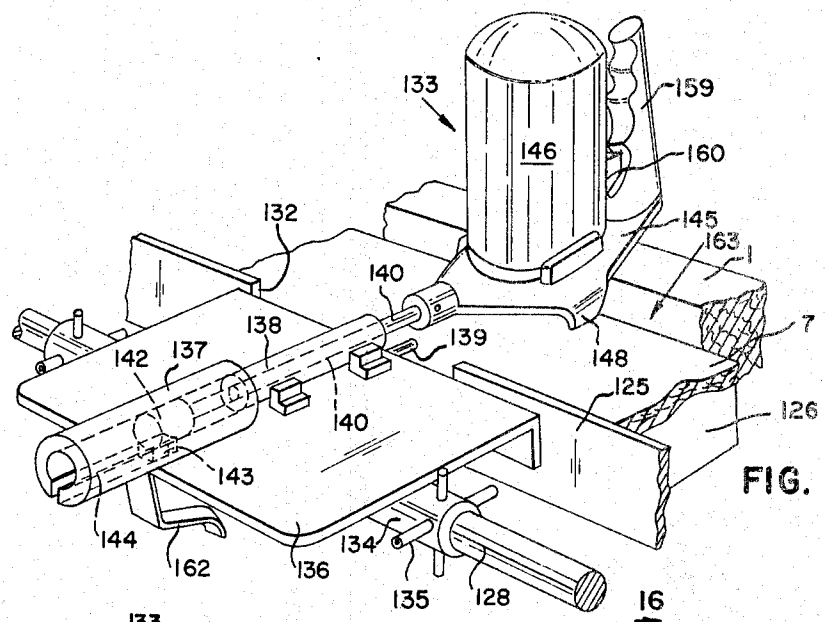


FIG. 13

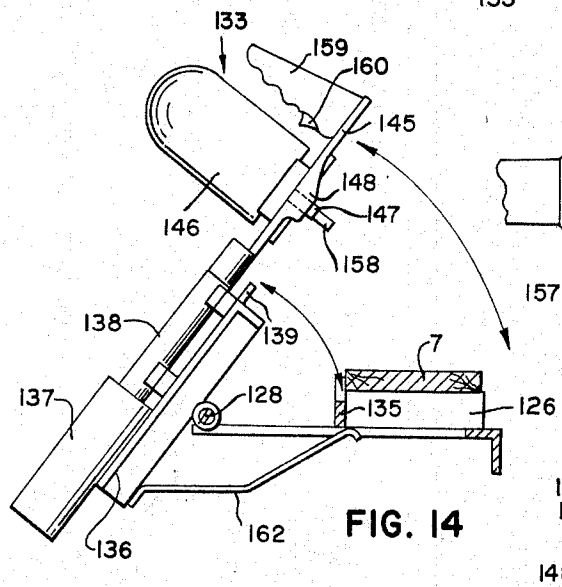


FIG. 14

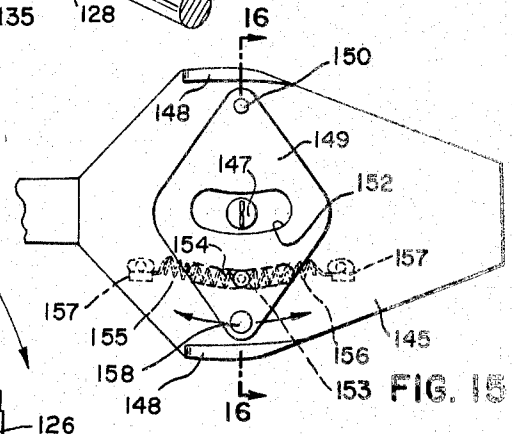


FIG. 15

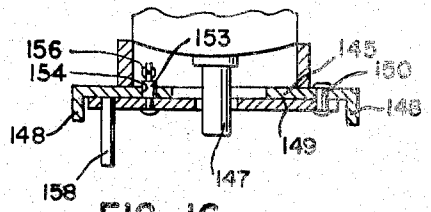


FIG. 16

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MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

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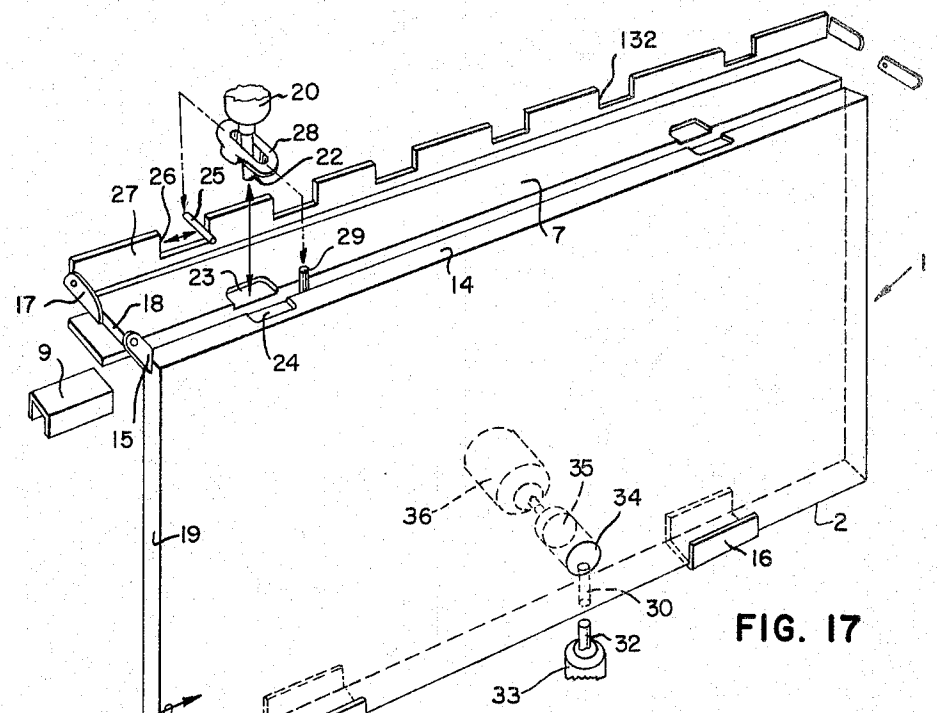


FIG. 17

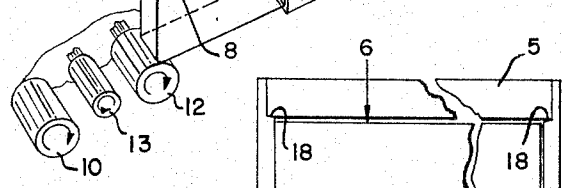


FIG. 18

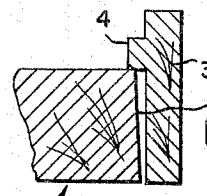


FIG. 19

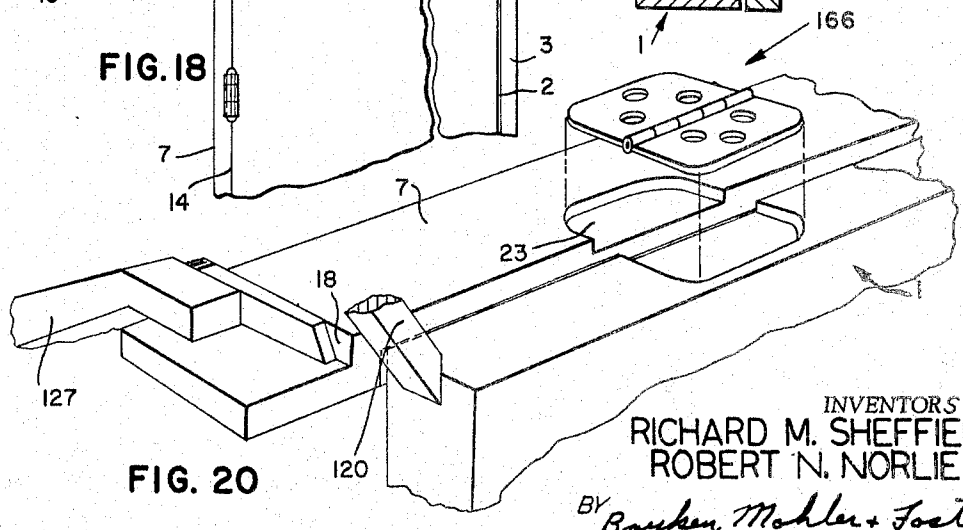


FIG. 20

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FIG. 21

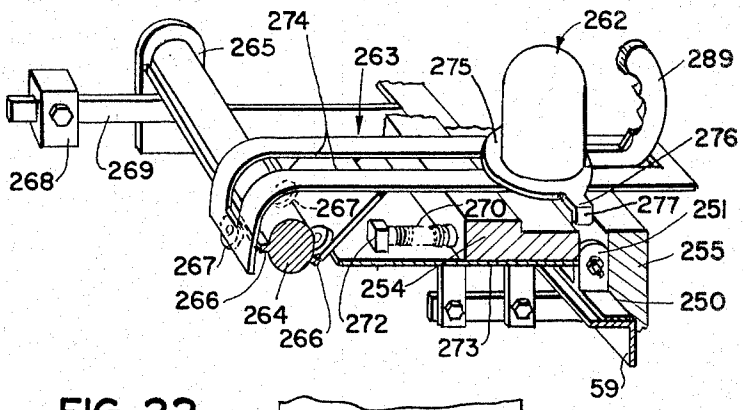


FIG. 22

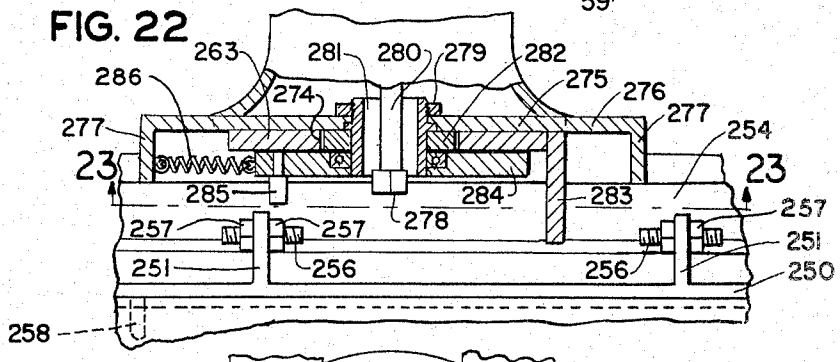


FIG. 23

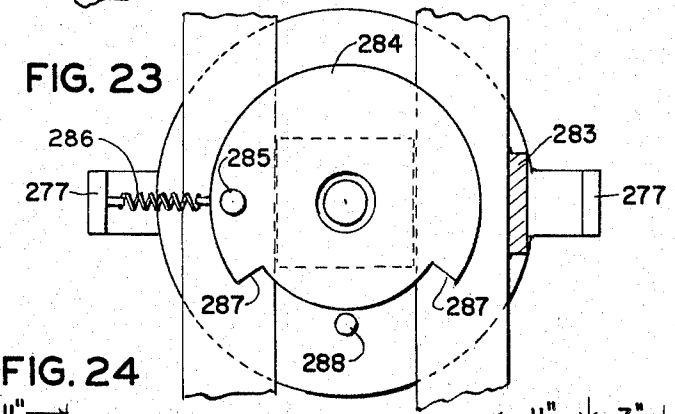
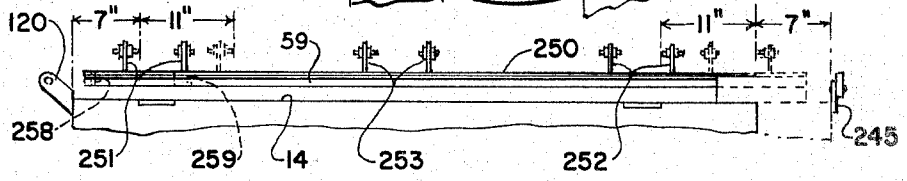


FIG. 24



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United States Patent Office 3,263,723 Patented August 2, 1966

3,263,723

MACHINE AND METHOD FOR PREPARING A DOOR AND DOOR FRAME FOR PREHANGING SUCH DOOR

Richard M. Sheffield and Robert N. Norlie, Chico, Calif., assignors to Norfield Manufacturing Co., Chico, Calif.

Filed July 22, 1963, Ser. No. 296,519
7 Claims. (Cl. 144—326)

This invention relates to a machine for preparing doors for hanging, and has for one of its objects the provision of a machine that is adapted to prepare a precut door and jamb for hingedly connecting them with greater speed and accuracy than heretofore.

In order to expedite the operation of hanging doors in a building, the building industry is adopting the method of precutting the doors and door frames to the desired size, so that the doors, after edging, will properly fit within the frames. By this operation the jambs are precut to the correct lengths and are rabbeted or dadoed along their upper edges to receive the ends of the head.

The doors themselves are of the proper length and substantially the proper width, but the longitudinally extending edge of the door that is opposite to the one that is to be hingedly connected to one of the jambs, must be "edged" or cut to provide a slight bevel transversely thereof to facilitate movement of said edge to and from closed position of the door. Also the doors are not formed with the latch opening and the lock opening for the lock and for the spindle that carries the knobs. These operations and the routing of recesses for the butts of the hinges vary according to direction the door is to swing.

Heretofore it has been the practice to chisel out gains or recesses in the jamb that is to carry the door to provide the recesses for one of the butts or leaves of the hinges. The door to be hung from this jamb is then similarly chiseled or routed out along the hinge edge for receiving the other butt or leaf of each of the hinges. These operations have heretofore been conducted separately at different places, but with indifferent consistency in the degree of accuracy that should be obtained, and the step has been quite costly from the standpoint of time. When it is considered that normally there should be approximately one-sixteenth of an inch clearance between the head of the door frame and the upper edge of the door, for inside doors after the door is hung, and a slightly larger clearance for outside doors, which must be provided for before the frame is assembled, and which clearances should be accurate irrespective of warpage or irregularities in the door and the jamb that is to be hingedly connected thereto, it is apparent why difficulty has been heretofore encountered in routing the jambs and doors for the hinge butts. Furthermore, in a properly hung door the butts should accurately fit the recesses.

One of the objects of the present invention is the provision of a machine that is provided with means for quickly edging the door, whether for a right or left swinging, and for drilling the openings for the knob spindle and latch, and for routing the recesses in the door edge and in the jamb, and which operations are performed with consistently high accuracy, both as to the relationships between the openings and recesses, i.e., their relative positions, and as to their individual proportions for the articles to be attached to the door and jamb.

Another object of the invention is the provision of a door processing machine that enables a relatively unskilled workman to form a precut door and the hinge-jamb of a door frame for the hinges that are to connect them, and to connect the door and jamb with the hinges, with absolute accuracy and within a small fraction of the time heretofore required to perform these steps.

A still further object of the invention is the provision of a simple machine that is adapted to perform the work of edging a precut door, forming the openings for the latch spindle and latch, and forming the recesses in the hinge, jamb and door edge for the hinge butts, and which machine is simple, rugged, fast in operation, and substantially more economical to manufacture than heretofore.

Another object of the invention is the provision of a machine for preparing precut doors and the jamb therefor, for hanging the door from such jamb, which machine is more compact and economical to make and to maintain than heretofore, and in which machine all operations of the door are performed with the door on edge and horizontal in its greatest dimension to thereby provide better observation of all operations and ready accesss to all parts of the door than heretofore, and in which machine the jamb is alongside and parallel with the edge of the door that is to be connected therewith and is clearly visible to the operator at all times, and which jamb may be hingedly connected with the door without effecting longitudinal movement of the door and jamb relatively after they have been routed out for the hinge butts and the latch and lock openings have been formed.

A still further object of the invention is the provision of an improved method of preparing a door and the jamb from which it is to be hung, for hingedly connecting them, and which method may include the step of edging the door along its edge that is opposite to the edge that is to be hingedly connected to the jamb.

Other objects and advantages will appear in the description and drawings.

In the drawings the words "upper edge" and "lower edge" used with reference to the door are the upper and lower edge of the door when in the machine, and not when the door is upright and hung.

FIG. 1 is a side elevational view of the machine from the side that will hereafter be called the front side, since it is the side at which the operator may stand during most of the operations.

FIG. 2 is an enlarged fragmentary sectional view taken generally along line **2—2** of FIG. 1 to show certain parts at the front side of the machine.

FIG. 3 is an enlarged, fragmentary sectional view taken along line **3—3** of FIG. 1.

FIG. 4 is a side elevational view of the machine as seen from the side opposite to the side seen in FIG. 1, the machine being shortened in length to accommodate the sketch.

FIG. 4*a* is an end elevational view of a portion of the machine as seen from line **4*a*—4*a*** of FIG. 4.

FIG. 5 is a fragmentary slightly enlarged cross sectional view taken along line **5—5** of FIG. 4.

FIG. 6 is an enlarged, fragmentary cross sectional view of part of the machine as seen from line **6—6** of FIG. 4.

FIG. 7 is a sectional view of the portion of the machine shown in FIG. 6 as seen from the line **7—7** of FIG. 6.

FIG. 8 is an enlarged fragmentary perspective view of a portion of the left-hand end of the machine of FIG. 1, generally as seen from line **8—8** of FIG. 4.

FIG. 9 is a semidiagrammatic view of the door clamping means that is at the right hand end of the machine as shown in FIG. 1, the view being substantially at a right angle to the door clamping means as seen in FIG. 1, so as to show both of the clamps.

FIG. 10 is a semidiagrammatic view of the elevating means for the drill and motor that drills the latch opening in the lower edge of the door after the door is clamped by the clamping means of FIG. 9 and which view shows the linkage as it generally appears from the same side as appears in FIG. 1.

FIG. 11 is a semidiagrammatic view of the means for moving the drill and motor for performing the step of drilling the opening for the lock, the view being substantially as the elements would appear looking at the machine from the right hand end of the machine shown in FIG. 1 and toward the left.

FIG. 12 is a semidiagrammatic view showing the means for moving and supporting the motor and drill of FIG. 11 at different levels so as to form the lock opening in the door at different distances from the lower edge.

FIG. 13 is a fragmentary perspective view illustrating the router in position over the upper edge of the door and over the jamb, for routing them for the hinge butts, which view also shows the router mounting structure and the gage structure for controlling the length of the recesses that are to be routed out.

FIG. 14 is a reduced side elevational view of the router mounting means, the router being held in a nonoperative elevated position and the jamb and part of the jamb support and the rod supporting the router for movement being in cross section.

FIG. 15 is an enlarged bottom plan view of the router support.

FIG. 16 is a cross sectional view taken along line **16**—**16** of FIG. 15.

FIG. 17 is a perspective view of a door and a jamb in the positions they occupy when in the machine of FIG. 1 showing the portions routed out for the hinge butts and the openings for the latch shaft and latch, and portions of the machine are diagrammatically illustrated to facilitate a description of the method.

FIG. 18 is a reduced, fragmentary side elevational view of a door hinge in the door frame, showing the crack or space that should be provided between the head of the frame and the door, and showing the uppermost hinge.

FIG. 19 is an enlarged, fragmentary cross sectional view, illustrating the bevelled vertical edge of the door opposite to the hinged edge.

FIG. 20 is a fragmentary perspective view similar to that of FIG. 8 as seen from the opposite side thereof, but showing a final step that may follow the step shown in FIG. 8.

FIG. 21 is a generally isometric view of a modified form of the portion of the invention that is shown in FIGS. 13–16, portions being shown in cross section.

FIG. 22 is an enlarged, fragmentary cross-sectional view taken through the lower portion of the router in a direction longitudinally of the hinge jamb, part of which is shown.

FIG. 23 is a lower plan view of the router as seen from line **23**—**23** of FIG. 22.

FIG. 24 is a greatly reduced side elevational view showing the modified gauge means, the door being indicated schematically in relation to said means.

Before making a detailed description of the apparatus of FIGS. 1–16, a reference to FIGS. 17–19 will materially contribute to an understanding of the purpose of the invention and also the steps of the method.

A precut door is generally indicated at **1** in FIG. 17. This door is normally of the proper length, and is of substantially the correct width, but the edges are square, hence, one of the longitudinally extending edges must be slightly bevelled, as at **2** in FIG. 19, so as to properly clear the jamb when it is swung outwardly of the jamb **3** and away from the doorstop **4**. Inasmuch as precut doors require bevelling the edge **2**, there may be slight variations in the width of the doors, but after bevelling the width must be precise, since precut jambs and heads to form the frame are accurately cut, and the distance between the jambs will not vary.

After the door is hung in the frame, which is done prior to securing the frame in the door opening, it should have a clearance of approximately 1/16 of an inch between the upper edge of the door and the head **5** (FIG. 18) as at **6**. This may vary slightly in the case of frames for the outside doors, due to the fact that the outside frames and doors may swell somewhat under the influence of moisture.

Whether or not the doors have the desired clearances and whether or not the latter are uniform depends upon the accuracy with which the recesses in the hinge jamb **7** and in the edge of the door adjacent to the hinge jamb are formed. It is equally important that the latch opening in the edge of the door that is opposite to the hinged edge thereof be accurately positioned relative to the keeper that is on the jamb 3, and also the through opening for the lock and latch operating shaft, that is at a right angle to the opening for the latch.

Referring to FIG. 17, the door **1**, prior to forming the edge bevel and prior to other cutting operations thereon, is positioned vertically on its side and is moved longitudinally thereof in the direction of the arrow **8** between a stationary holddown guide **9** and a pair of drive rollers **10**, **12** that drive the door endwise in the direction of said arrow **8**. A rotary cutter **13** between said rollers **10**, **12** bevels the lower edge of the door, as the door appears in FIG. 17, it being understood that said lower edge is the vertical edge **2** of the door, when the latter is hung, and which edge may be called the "latch" edge for convenience, since it is the edge from which the latch will project, being the free edge opposite to the hinge edge, the latter being identified by the numeral **14** (FIGS. 17, 18).

The drive roller **12** finally drives the door to approximately the position shown in FIG. 17, the operator moving the door past a pivotally supported positioning pawl **15**, and then reversely against said pawl, to the position shown in FIG. 17.

In this position the door may be supported on guides **16**, with hinge edge **14** alongside and parallel with the support on which the hinge jamb **7** is supported. In the arrangements shown in FIG. 17 a jamb stop **17** engages the end of said jamb, or preferably the shoulder **18** of the rabbet formed across the end of the jamb, or of the similar shoulder of a dado, and against which one end of the head **5** of the door frame is adapted to be supported in the finished door frame (FIG. 18). Both the latch jamb and the hinge jamb have the same shoulder.

The shoulder **18** of jamb **7** is offset, in a direction longitudinally of the jamb a predetermined distance, usually 1/16 of an inch in a direction outwardly of the plane in which the near edge **19** of the door is positioned.

With the hinge jamb and the hinge edge of the door in the positions above described, the next steps of routing out the recesses in said hinge edge and door edges commence.

A conventional router **20** having a vertical downwardly projecting router bit **22** is slidably supported on the jamb **7** or hinge edge **14** for cutting into the marginal portion of the jamb and the hinge edge **14** of the door a predetermined distance to form recesses **23**, **24** which are approximately the thickness of the hinge butt adapted to be seated in each recess. The width of each recess is equal to the width of each butt, and the length is the length of each butt.

The router assembly may carry a pin **25** that is adapted to be positioned in an upwardly opening recess **26** formed in a gauge member **27** for controlling the length of each recess, or the movement of the router bit longitudinally of the door, and which recess **26** also positions the cutter at the points where the recesses for the butts are to be formed. A suitable width control member **28** limits the width of the recesses **23**, **24** to equal the width of each hinge butt, and a control member **29** also on the router assembly is movably disposed between the door **1** and jamb **7** to cooperate with the width control member **28** and router, to insure the recesses **23**, **24** being of the same width. All the operator is required to do for forming the recesses **23**, **24** in the jamb **7** and in the hinge edge **14** of door **1** is to position the router

assembly so that pin **25** is in the proper recess **26**, and so that the pin **29** is between the door and the jamb, and by manual manipulation of the router over the marginal portion of the jamb and over the jamb edge of the door, within the limits imposed by the recess **26** in the gauge bar **27** and within the limits imposed by the member **28** and the two recesses **23, 24** will be formed to exactly the correct length and width and these recesses will be directly opposite to each other. Also said recesses will be absolutely square with the edge **14** and the jamb **7**.

Other recesses in gauge bar **27** are positioned for forming other recesses in the door edge and in the jamb, for one or more other hinges. These recesses **26** are, of course, properly positioned with respect to the stop pawl **15** so as to be in the right position relative to the ends of the door.

Either before or after the recesses for the hinge butts may be formed the latch opening or passageway **30** is formed by a motor driven drill **32** carried by a vertically reciprocable motor **33**, and either before or after the passageway **30** is formed, the lock passageway or opening **34** is formed by a drill **35** carried by a horizontally reciprocable motor **36**.

All of the above operations are conducted while the door is stationary after it has been driven past the edge cutter **13** and after it and the jamb **7** have been positioned alongside each other with one of their ends in a predetermined position relative to each other.

The operator may then quickly screw one of the hinge butts into recesses **23** and the other hinge butts in recesses **24**. Of course, one of the hinge butts may first be secured in the recesses **24**, and then the other hinge butts may be secured in recesses **23**, and the jamb **7** will be secured to the door. Naturally pin **29** on the router assembly is elevated out of the space between the jamb and door in order for the jamb and door to be hingedly connected.

It will be apparent that no possible error can occur by the above procedure since the recesses **23, 24** will accurately and snugly receive the hinge butts and the recesses will be exactly opposite to each other, and the shoulder **18** will be exactly the desired distance beyond the adjacent end edge of the door (which in this instance will be the upper end in the finished door when the door is vertical).

The remaining operations of plumbing the jambs **3, 7** in a doorway with the head **5** seated against shoulders **18** and against the jambs, is quickly performed in the usual manner, and the job will be completed within a small fraction of the time required by heretofore conventional methods, and with absolute accuracy, which accuracy is seldom if ever accomplished by the conventional methods.

Referring now to the other views for a more detailed description of the machine, the stationary frame of the machine comprises a vertically disposed, horizontally elongated plate **37** (FIGS. 1, 4) having a pair of vertically extending laterally opening channel strips **38, 39** rigid therewith adjacent to opposite ends thereof. These strips are thus part of the stationary frame and are frame members, and the open sides of the channels are directed rearwardly. The words "front," "forward," "rear" and "rearward" and words of similar connotation will hereafter be used with respect to the position of the operator, who normally is at the side of the frame that is opposite to the side to which the open sides of the channel members **38, 39** are directed. FIG. 1 shows the front side of the machines. FIG. 4 shows the rear side. The member **38** is at the "feed" end of the machine at which end the door **1** is introduced and member **39** is at the "discharge" end, or at the end from which the door is discharged.

Channel or frame member **38** has a vertically extending post **40** slidably held therein and the channel or frame member **39** has a similar post **42** similarly held therein (FIGS. 1, 4, 5). A vertically extending rack **43** is secured against the rear face of post **40**, and a similar rack **44** is secured against the rear side of post **42**.

Alongside and parallel with the rack **43**, and also secured to post **40**, is a vertically extending strip **45** formed with a vertical row of spaced openings **46** that are directed rearwardly of the post **40**.

Journalled for rotation on rearward extensions of the sides of channel members **38, 39** is a horizontal shaft **47** (FIGS. 4, 5) which shaft has spur gears **48, 49** secured thereto, and which gears have their teeth in mesh with the teeth of racks **43, 44** respectively. The end of shaft **47** adjacent to the channel member **38** projects from the latter and carries a sprocket wheel **50**. A jack shaft **52** spaced below and parallel with shaft **47** (FIGS. 1, 4) is journalled for rotation on the stationary frame of the machine and projects rearwardly of the feed end of the machine, and has an arm and handle **53** (FIG. 1) secured thereto for manual rotation of said shaft **52**. A sprocket wheel **54** (FIG. 4) is secured on said shaft **52** and a sprocket chain **51** connects sprocket wheels **50, 54**.

By the above structure upon actuation of the handle and arm **53** to rotate shaft **52** the shaft **47** and gears **48, 49** will be rotated in one direction or the other to simultaneously elevate or lower the posts **40, 42**.

A horizontal locking pin **55** is slidably supported for horizontal movement in a bearing **56** (FIG. 5) carried on a plate **57** secured across the top of the flanges of channel member **38**, which pin is spring-urged by a spring **58** (FIG. 5) to enter any of the openings **46** (FIG. 4) in strip **45** that is opposite thereto for supporting the posts **40, 42** at different degrees of upward extension from the channel members **38, 39** upon manually retracting the pin from the opening **46** in which it is positioned.

Secured to the upper end portions of posts **40, 42** is a horizontally extending bar **59** (FIGS. 1, 3, 4). This bar extends across the forwardly facing sides of posts **40, 42** and provides a laterally forwardly facing surface against which one laterally facing side of the upper portion of the horizontally extending door **1** (indicated in dot-dash lines in FIG. 3) is adapted to slidably engage.

Rigid with, and spaced above, the bar **59** at the feed end of the machine (left end as seen in FIG. 1) is a horizontally elongated angle strip **60**. This strip **60** is parallel with bar **59** and one leg **63** (FIG. 3) of the angle strip is horizontal to extend over the upper edge of the door **1** when the latter enters the feed end of the machine, while the other leg **62** of which is adapted to extend over the side of the door that is opposite to bar **59**. By this structure the bar **59** and strip **60** cooperate to provide an upper guide means and hold-down for the door at the feed end of the machine (FIG. 3). The function of the hold-down **9** already mentioned in describing the method (FIG. 17) is performed by bar **59** and strip **60**. The vertical adjustment of posts **40, 42** provides for the accommodation of doors of different widths.

Projecting horizontally from the feed end of the machine, and away from said end, is a horizontally extending, upwardly opening channel strip **64** (FIG. 1), one end of which is connected by a horizontal pivot **65** with the feed end of frame member **37**, as best seen in FIG. 1, while the other end of the channel member may have a depending leg **66** connected therewith for supporting said strip horizontal. The strip **64** may thus be swung upwardly to vertical position when the machine is not in use. This strip functions to receive, support, and to guide the door to the machine at the desired level, and the upper edge of the horizontally extending door will pass below the leg **63** of the strip **60** and between leg **62** and bar **59** when the door is moved from left to right, looking at FIG. 1, and into the machine.

A lower horizontally extending wooden bar **67** is secured to frame member **37** (FIGS. 1, 2) at the forward side of the latter at a level slightly above the level of the channel strip **64**, and this bar **67** is parallel with the bar **59**, and is adapted to slidably engage the side

of the door that faces the plate or frame members **37** as the door moves into the feed end of the machine. Thus bar **59** is in a position so that the door will be in a vertical plane when it is moved from the feed end of the machine toward the discharge end.

Adjacent to the feed end of the machine and projecting forwardly of frame member **37** is a rubber tired roller **68** (FIGS. 1, 2) that is supported on said member **37** for rotation about a generally horizontal axis. The upper surface of this roller is preferably slightly above the level of the door supporting bottom of the channel strip **64**, but the roller is yieldably held in such position so that it will yieldably hold the door, during movement of the latter, against the horizontal leg **63** (FIG. 3) of the angle strip **60**. The means for mounting and for rotating this roller **68** will later be described, but at this point it may be noted that said roller drives the door to the pair of drive rollers designated **10**, **12** in FIG. 17, that were mentioned in describing the method as shown in FIG. 17.

Horizontally spaced from the roller **68** in a direction away from the feed end of the machine and toward the discharge end thereof are a pair of horizontally spaced, rubber tired rollers **69**, **70** (FIGS. 1, 2) that perform the functions of rollers **10**, **12** of FIG. 17, and between rollers **69**, **70**, is the rotary cutter **72** that corresponds to cutter **13** of FIG. 17.

The rollers **68**, **69** and **70** are respectively rigid on one of the ends of shafts **73**, **74**, **75**, respectively (FIGS. 1, 4), and said shafts extend generally horizontally through openings in the frame plate **37** and project to the rear side of said plate a substantial distance.

Inasmuch as the supports for the roller shafts **73–75** are the same, a detailed description of the mounting for shaft **74** of roller **69** will suffice for all three, and such mounting is shown in detail in FIGS. 6 and 7.

A horizontally disposed plate **76** is pivotally connected along one of its edges to the rear side of the frame plate **37** by a horizontal pivot or hinge pin **77** so that plate may swing vertically about said pivot. Shaft **74**, in turn, is below said plate **76** and is supported for rotation in bearings **78** that are secured to said plate.

Adjacent to the rear edge of plate **76** that is remote from the pivot **77**, and above said plate, is a vertically disposed helical compression spring **79**. This spring is adapted to react between the rear end of plate **76** and a cap **80** on the lower end of a vertically adjustable screw **82**. This screw **82** threadedly extends through a member **83** that is rigid with the frame plate **37**. The forward edge of the plate **76** may extend below the rearwardly projecting ears **84** that carry pivot **77** to limit the downward movement of the plate **76**, but normally, when the spring **79** is under tension and before a door is moved to a position between said roller and the hold-down bar or angle strip **60**, the shaft **74** may be slightly tilted to hold the upper surface of the roller elevated above the level of the bottom of the door supporting channel **64** so that a door, when moved between the hold-down angle strip **60** and the roller **69**, will be yieldably moved downwardly to yieldably hold the upper edge of the door against said hold-down strip. It is the upper edge of the horizontally disposed door that must be maintained at the desired uniform level, since the lower edge will be bevelled by the cutter **72**, and the cutter **72** will function to cut the doors to uniform width as well as performing the bevelling operation. Thus, the tension of spring **79** must always be such that it will overcome the weight of the door.

As already mentioned, rollers **68** and **70** have the same pivoted and yieldable mounting as above described for roller **69**.

A sprocket wheel **84** is secured to the rear end of shaft **74** and a similar sprocket wheel **85** (FIG. 4) is secured to the rear end of shaft **73** mounting roller **68**. A sprocket chain **86** extends over sprocket wheels **84**, **85**. A sprocket wheel **87** (FIG. 6) is also secured on the rear end of shaft **74**, and this sprocket wheel **87** is connected by a chain **88** with a sprocket wheel on shaft **75** that is identical with sprocket wheel **85**. Also secured on shaft **75** is a sprocket wheel **89** (FIG. 4) that is connected by a chain **90** with a sprocket wheel **92** on the driven shaft of a gear transmission driven by motor **93**.

It is thus seen that rollers **68**, **69** and **70** will all be rotated in the same direction and at the same speed for driving the door from the feed end of the machine toward its discharge end.

The rear ends of the shaft **73**, **74**, **75** all project rearwardly of pivotally supported plates that carry the shafts, and three chain tighteners are provided to maintain the chains taut during the pivotal movement of the shafts and at all times, as will be described.

The plates **76** that support the shafts **73–75** may be formed with upstanding ears **94** at their rear corners (FIG. 6) and horizontally extending bars **95** extend between the adjacent pairs of plates **76** and are bolted at their ends to one of the ears on each adjacent pair of plates.

As seen in FIGS. 4, 6, and upwardly inclined arm **96** is pivoted at a point intermediate its ends to each bar **95**, as at **97** (FIG. 6) and a helical spring **98** (FIG. 4) connects one end of each bar **95** with a member rigid on the frame **37**. The lower end of each arm **96** rotatably supports a sprocket wheel **99** that engages the lower run of each chain **86**, **88** for maintaining said chains taut.

An arm **100**, similar to each arm **96**, is pivotally supported at a point intermediate its ends, as at **102** (FIG. 4) and a sprocket wheel **103** on the lower end of said arm engages the lower run of chain **90**, while a spring **104** connects the upper end of arm **100** with a member rigid with frame **37** to maintain tension on the chain **90**.

Insofar as the cutter **72** is concerned, its shaft **105** extends through the frame plate **37** and its rear end carries a pulley **106** (FIG. 4) that is connected by a V-belt or any other suitable means with a pulley **107** driven by motor **109**. The cutter is stationary insofar as any pivotal movement is concerned, and its cutting edges are formed to accurately bevel the lower edge of the door as the door is driven therepast. As seen, the distance between the cutter **72** and the leg **63** of strip **60** determines the width of the finished door.

At the front side of the machine, a rubber tired roller **109** (FIGS. 1, 2, 7) above and adjacent to roller **69** is rotatable on a vertical shaft that is carried on at the outer end of a horizontally extending leaf spring **110**. Spring **110** extends from roller **109** toward the feed end of the machine, and its end opposite to said roller is held rigid on a clamp block **112** that, in turn, is tightly, but adjustably, clamped on a stationary vertical rod **113**. This rod **113** is secured to the frame plate **37** by a bracket arm **114** (FIGS. 1, 6). Thus roller **109** functions to yieldably hold the door against the hardwood slide **67** adjacent to the point where the edging cutter **72** will bevel the lower edge of the door.

A horizontally extending housing **111** is adapted to be supported at one end from rod **113** to extend over the rollers **69**, **70** and cutter **72** as a safety measure, and a manually actuatable set screw **115** is adapted to releasably secure the housing rigid relative to the rod **13** (FIG. 1).

In the apparatus up to this point, it is seen that the door **1** will be trimmed by the cutter **72** in FIG. 1 or **13** in FIG. 17 to exactly the correct width and with the correct angularity of the lower edge relative to the planar sides of the door, it being understood that the lower edge will be the vertical edge of the hung door that is opposite to the edge from which the door will be hung. The roller **70** will drive the door to substantially the desired position for routing out the recesses for one of the butts of the hinges.

The next steps are particularly important since the success in prehanging doors mostly depends upon the accuracy with which the recesses in the hinge-jamb and "hinge-edge" of the door are positioned and formed.

After the door has been "edged," which is the term used for cutting the edge **2** (FIG. 19) to the correct transverse angle and at the same time for reducing the door to the correct width, the door will be supported in a substantially vertical plane between a horizontally extending guide bar **116** and the bar **39**, and on a horizontally extending support **117** leading to between a pair of vertically disposed clamps **118, 119** (FIGS. 1, 9). The level of support **117** is preferably such as to maintain the door, after it has been edged, so its upper edge is at the same level as when it is passing the cutter **72**.

As the door is moving from the feed end toward the discharge end, a pawl **120** that is pivoted at **122** to an upward extension **123** of the upper angle strip **60** (FIGS. 1, 3, 8) will be swung upwardly about pivot **122** by the door to ride on the upper edge of the latter, and as soon as the trailing end **124** of the door passes the pawl, the latter will drop behind said trailing edge to the position shown in FIG. 8, and the operator will then slide the door backward slightly so the rear edge will be sure to snugly engage said pawl should the door have moved beyond the latter. The clamps **118, 119** will then be moved to tightly clamp the door therebetween and to rigidly hold the door stationary and vertical. These clamps and their operating mechanism are semidiagrammatically shown in FIG. 9, and when in clamping relation they are at the point where the latch opening **30** and the lock opening **34** (FIG. 17) are to be formed. It is to be understood that this portion of the description is applicable to preparing a door and jamb for hingedly connecting them for swinging the door in one direction. A later description will deal with the situation in which the door is to swing in the opposite direction.

The pawl **15**, in FIG. 17, wherein the method is disclosed, corresponds in function and position to the pawl **120** in FIGS. 1 and 8.

In the semidiagrammatic view, FIG. 17, a horizontally extending gauge member **27** is shown. In FIGS. 4 and 8 the member corresponding thereto is designated **125** and is shown as being welded to the ends of vertically disposed webs **126** that, in turn, are secured to the bar **59** that has the laterally facing surface directed toward door **1** (FIG. 8). Thus the member **125** and webs **126** will move with bar **59** when posts **40, 42** are elevated or lowered. These webs **126** provide ribs extending at right angles to the member **125** and the upper edges of said ribs are coplanar and are adapted to support the hinge-jamb **7** flat thereon with the upper surface of said jamb in the same plane as the upper edge of door **1**. One longitudinally extending edge of said jamb is adapted to abut the laterally facing surface of the member **125** adjacent to the upper edge of the latter, and the said jamb may project slightly above the upper edge of member **125** (FIG. 8). Inasmuch as member **125** is parallel with the upper edge of door **1**, the hinge-jamb will be parallel with said upper edge.

As already explained with reference to FIG. 17, one end of the hinge-jamb **7** is rabbeted or dadoed transversely thereof to a predetermined depth to provide an axially facing shoulder **18** on which the head **5** of the door frame is supported (FIGS. 8, 18). Also, it has been explained that, after the door is hung on the hinge-jamb, a predetermined space **6** (FIG. 18) should be left between the head **5** and the upper edge of the door. The length of the hinge-jamb is such that the lower ends of the jamb will project below the lower edge of the door the desired distance for clearance between the lower edge of the door and the floor when said jambs are in position within the door opening for securing the door frame to the studding at opposite sides of such opening.

Referring back to FIG. 8 the jamb-stop **17** mentioned in connection with the method described with respect to FIG. 17 is indicated at **127** and is adjustably secured on one end of a cylindrical, horizontal bar **128** for movement axially of said bar to the desired adjusted position by means of a bolt **129**. The bar **128** is supported on and secured rigidly to the outer end portions of horizontally extending supports **130** at the ends of said bar, which supports, in turn, are rigidly secured at their opposite ends to the bar **59**.

The jamb-stop **127** projects forwardly from said bar **128** so that its outer forward end portion is adapted to extend into the head rabbet or dado that is formed in one end of the jamb for said frame head **5**, and thus when jamb **7** is positioned flat on said ribs **126** with the rabbet at its end directed upwardly, and with the rabbeted end of the jamb at the feed end of the machine, the jamb may be slid longitudinally on said ribs toward said feed end until the jamb stop engages the shoulder **18**. The jamb-stop **127** is secured on bar **128** in a position in which the face thereof facing said shoulder **18** is one sixteenth of an inch closer to the feed end of the machine than the trailing edge **124** of the door where such clearance is desired, when said trailing edge is against pawl **120**. Obviously by adjustment of the jamb stop, any desired clearance may be obtained.

The gauge member **125** is formed along its upper edge with a plurality of upwardly opening square recesses or notches **132** that correspond to the recesses **26** described relative to FIG. 17.

In an ordinary door there are usually only two hinges, the upper hinge to be positioned seven inches from the upper edge of the door and the lower hinge is preferably eleven inches from the bottom of the door. The invention is not to be restricted to such dimensions. They are used for purpose of description since they are standard.

In FIG. 8 the notch or recess **132** indicated therein is seven inches from a point along said upper edge that is even with or opposite to the trailing edge of the door or the outer end face of pawl **120**, and a second corresponding recess is formed at the other end of the member **125** that is eleven inches from a point that is even with the leading edge of the door **1** when said trailing end edge of said door is against pawl **120**.

The distance between the opposite edges of each recess or notch **132** is approximately equal to the length of the leaf on each butt hinge.

In FIGS. 1, 4, a conventional vertically disposed router is indicated generally by the numeral **133**. FIG. 13 is a view of the router assembly as generally seen from the rear upper side of the machine, the door **1** and hinge jamb **7** being indicated as well as member **125** and bar **128**.

A cylindrical sleeve **134** is slidably on bar **128** longitudinally of the latter, said sleeve having adjustable bearing and positioning posts **135** threadedly extending therethrough and engaging bar **128** for slidably supporting said sleeve on said bar and for aligning the sleeve in the bar to insure a uniform and accurate support for a platform or table **136** that is positioned over the sleeve **134**. A pair of coaxial hollow cylinders **137, 138** are secured together at one of their ends in telescopic relation and are secured on the upper side of said table **136** with said cylinders extending at a right angle relative to the gauge member **125** and cylinder **138** in a position adjacent to the latter with cylinder **137** spaced rearwardly therefrom. Obviously a single counterbored cylinder could provide the same structure.

A control pin **139** is centrally secured to the forward edge of the table **36** and projects forwardly thereof. Since the sleeve **134** is rotatable on bar **128**, as well as slidable longitudinally of the latter, the forward edge of the table may be swung upwardly (FIG. 14) and the pin **139** will move upwardly with the table. When the table is in a horizontal position, as seen in FIG. 13, the pin **139** will enter whichever recess **132** is opposite thereto, and then the movement of table **136** longitudinally of bar **128** is equal to the distance between the opposite vertical edges of each recess. In FIG. 17, the control pin **25** corre-

sponds to the control pin **139** in the apparatus of FIGS. 13 and 14.

A rod **140** (FIG. 13) slidably extends through cylinder **138** and into enlarged cylinder **137** and is provided with a head **142** that is rigid with rod **140** and reciprocable in cylinder **137** with said rod. A lug **143** rigid with head **142** projects downwardly therefrom into a slot **144** in the lower side of cylinder **137** that extends longitudinally of cylinder **137**. Thus rod **140** may reciprocate in the cylinders **137, 138** but will not rotate, and the closed end of slot **144** will act as a stop to engage the lug **143** for preventing withdrawal of rod **140** from the cylinders.

The forward end of rod **140** projects from the forward end of cylinder **138** and is rigidly secured to the rear end of a horizontally disposed router supporting plate **145**. This plate **145** may be elongated in a direction longitudinally of rod **140** and supports a conventional, vertically disposed router motor **146** thereon with the router bit (FIG. 14) **147** projecting from the lower end thereof. Such motor is indicated at **20** in FIG. 17.

The plate **145** is formed with a relatively large central opening through which bit **147** projects in a downward direction, and a pair of generally parallel, spaced, opposed runners **148** project downwardly from plate **145** along two opposite edges thereof, which runners extend substantially parallel with the longitudinal axis of plate **145** (FIGS. 13, 15, 16). These runners are adapted to engage the upper surface of the hinge jamb **7** and the upper surface of the upper edge of door **1**, according to which is being routed, and the bit **147** projects at its lower end below the level of the lower edges of said runners **148** a distance equal to the depth to which the recesses for the hinge leaves are to be formed. This depth normally is such that the outer surface of the butt or leaf in each recess is substantially flush with the adjoining surface of the hinge edge of the door, but no deeper, since a projection of the edge surface beyond the hinge would be likely to result in detrimental strain on the hinge screws with each closing of the door.

By the above structure it is seen that the length of the recesses to be routed out is controlled by the recesses **132** and control pin **139**, while the runners **148** maintain the depth, and with respect to the latter it is also pertinent to note that the runners will also follow the surface contour of the jamb. Thus if the jamb should be bowed or warped, the depth of the recess that is cut will be the same, and when the jamb is secured in position in a door opening and is straightened, the recess will remain the same. This is important.

A control plate **149** (FIG. 15) extends transversely across the underside of plate **145** and is pivotally secured at one of its ends to plate **145** by a vertical pivot **150**. This plate **145** is formed with a central slot **152** that may be formed about the axis of pivot **150**, through which the router bit **147** projects. At the side of the slot **152** opposite to the pivot **150** said control plate **149** carries an upstanding pin **153** (FIG. 16) that extends through an arcuate slot **154** (FIG. 15) formed in the router supporting plate **145**. A pair of helical springs **155, 156** extend oppositely outwardly of pin **152** above the plate **145** and generally longitudinally of slot **154**, with the latter following an arc about pivot **150** as a center, and extending equal distances to opposite sides of a straight line extending through pivot **150** and the bit **147**. This line is parallel with the axis of bar **128** and springs **155, 156** are secured at their outer ends to adjustable lugs **157** adjustably secured to the upper side of the router supporting plate **145** to yieldably hold pin **153** with its axis in the same plane as the plane in which the axes of pivot **150** and bit **147** are positioned, and which plane is preferably at a right angle to the axis of cylinders **137, 138** when the router is inoperative before a routing operation.

The control plate **149** that is below and pivotally connected with the router supporting plate **145** also carries a pin **158** (FIGS. 15, 16) depending from the end of the control plate, the axis of which pin **158** is in the same plane as that in which the axes of bit **147** and pivot **150** and pin **153** are positioned, when the router is inoperative, and which pin **158** projects from said plate **149** a substantially greater distance than the bit **147**. Thus springs **155, 156** function to yieldably hold pin **158** in the plane above mentioned as well as holding the pin **153** in said plane.

In operation, in routing out the hinge jamb **7** the handle **159** of the router is at the side thereof opposite to the rod **140**, or at the front side thereof, and projects upwardly from plate **145** to which it is secured, for grasping by the hand of an operator. The manually actuatable switch **160** thereon is conveniently positioned at the lower end of the handle for actuation by the index finger of the right hand when such hand grasps the handle for manipulating the router. The switch and router motor are, of course, in an electrical circuit (not shown) for actuation of the motor to start and to stop the latter upon actuation of the switch.

During movement of the door **1** and hinge jamb **7** to the positions thereof shown in FIGS. 8, 17, the router assembly will be swung to the tilted position shown in FIG. 14 and it is held in this position by an angularly downwardly extending arm **162** that is secured at one end thereof to the table **136** adjacent to the rear edge of the latter, and the lower end of which arm is adapted to engage the member **125** for holding the assembly in said tilted position with the router elevated. The control pin **139**, and pin **158** as well as the router bit **147**, will also be elevated so there will be nothing to interfere with the positioning of the door **1** and door jamb **7** in the positions shown in FIG. 8.

The center of gravity of the router assembly that is tiltable or swingable about the bar **128**, is at the rear side of the axis of said bar when the assembly is tilted to the position shown in FIG. 14, hence it will not accidentally fall to horizontal position, yet a relatively slight effort will be required to swing the assembly to operative position over the door and hinge jamb, and the handle **159** is conveniently located for grasping by the operator to so move the router assembly.

In operation, after the hinge jamb **7** and door **1** are in the position shown in FIG. 13, the door may be clamped and held rigid between clamps **118, 119** (FIG. 9), the details of which will be described later on, and the router assembly is then moved along bar **128**, axially thereof, to a position in which the control pin **139** will enter recess **132** that is opposite to the area to be routed out for the leaves of the butt hinge, when the assembly is swung down to routing position. However, the bit cannot engage the door or the jamb hinge, unless the depending pin **158** is in the space **163** (FIGS. 8, 13) that is between the hinge jamb **7** and door **1**, and to enter such space the router must be moved forwardly from its position when the router assembly is in tilted position which movement will result in the rear end of the router supporting plate **145** being spaced from the forward end of cylinder **138** a slightly greater distance than the distance between the rear end of slot **154** in the plate **145** a point centrally between said rear end and the middle of the slot. Thus it will be seen that the rear edge of slot **154** (FIG. 15) will limit the movement of the router bit transversely of the upper edge of the door starting from a position in which the pin **158** engages the adjacent edge of the door. In the same manner, the forward edge of slot **154** will limit the movement of the router bit transversely of the upper edge of the jamb, starting from an initial position in which pin **158** engages the side of the jamb that is adjacent thereto.

The control pin **139** being in the desired notch or recess **132** in the member **125** and the pin **158** being between the door **1** and hinge jamb **7**, it only remains for the operator to start the router motor and to move the router between the limits of the vertical opposed edges

of recess **132**, and the depths or widths permitted by the slot **154** and pin **153**, and in a matter of seconds the two recesses **23**, **24** (FIGS. 8, 17) for each butt hinge may be formed with absolute precision as to positions, depth, width and length.

The distance the router bit projects below legs or runners **148** on the router supporting plate **145** determines the depth of the recesses; the opposed edges or sides of each recess **132** in member **125** determines the length of each recess **23**, **24**, and the length of slot **154** in the router supporting plate **45** determines the width of each recess. The pawl **15** and jamb stop **17** constitute positioning means for positioning the door and hinge jamb relative to the above described means for forming the recesses for the hinge butts, so that said recesses will be formed in exactly the right positions on the door and hinge jamb so the hinge, such as indicated at **166** in FIG. 20, will exactly fit the recesses when the hinge jamb is moved to a position adjacent to the door and the door and hinge jamb will also be spaced apart the desired degree with precise accuracy when the hinge butts are secured to the door and to the hinge jamb. Also, said pawl and jamb stop determine the positions of the lock opening and latch opening relative to the ends of the door.

Whether the step of securing the hinge jamb to the door **1** is before or after the latch opening **30** and the lock opening **34** are formed is immaterial, and said openings may be formed after the hinge jamb is secured to the door **1**. However, the door, in any event, is rigidly held between clamping elements **118**, **119** during the formation of said openings.

At the right hand end of the drawings, FIG. 1, the portion of the machine is illustrated where the clamps **118**, **119** are positioned and where the openings **30**, **34** are formed. These openings are along the free edge **2** of the door that is opposite to the hinge edge, which free edge is vertical after the door is hung (FIG. 18) and is in the door opening, but the position of the door when it is being processed in the machine is such that said edge is the lower edge.

When the door **1** is in the position indicated in FIGS. 8, 17 and 20, the clamping elements **118**, **119** preferably cover the lateral sides of the door around the area in which the latch and lock openings are to be formed. Each clamp is preferably rectangular and covers a substantial portion of the door around the said areas, and each clamp has a metal backing plate **167** and a wood face plate **168** (FIG. 9). The face plates **168** are the plates that engage the opposite sides of the door, and each such plate may be formed with a pair of vertically spaced openings **169** (FIG. 1) through which the circular hole cutter or drill **170** (FIG. 11) is adapted to be moved when the cutter is in an upper position or in a lower position. The metal backing plate of each clamp may be formed with a vertically extending slot **172**. Openings **169** are at the upper and lower ends of slots **172**, and the openings come within the open areas of the slots so the metal backing plate will not interfere with the cutter **17**.

The provision of two openings is to enable the lock opening in each door to be formed different distances from the free edge of the door, and the cutter **170** can be adjusted to make a shorter or longer lock opening. Inasmuch as the two lock positions are standardized it is not necessary to provide for other positions, although it is obvious that any desired number may be provided.

The rigid frame **37** of the machine includes frameplates **173**, **174** at the discharge end of the machine that are spaced apart longitudinally of the machine (FIG. 4) and reference to the "frame" of the machine includes these plates and any means rigid therewith to which any of the movable elements may be connected or supported for movement.

A pair of parallel, vertical, stationary slide members **175** (FIGS. 4, 12) rigid with frame members **173**, **174** support a vertically disposed plate **176** for vertical movement and a pair of parallel horizontally extending bars **177** (FIGS. 1, 4, 12) rigid with said plate support a platform **178** (FIGS. 4, 11) thereon for horizontal movement of said platform on said bars **177**.

Cutter **170** is held in a chuck on one end of the shaft of a horizontal motor **179** (FIG. 11) that is secured on platform **178**.

Pivotally connected with the plate **176** at **180** (FIGS. 4, 12) is the upper end of a vertically extending bar **182** (FIGS. 4, 12) that has a lateral forwardly extending projection **183** (FIG. 12) rigid therewith intermediate its ends, which projection is adapted to be supported on a stationary rearwardly extending projection **184** (FIGS. 4, 12) on a stationary frame member **185** when the plate **176** is in a position supporting the motor **179** in the upper of its two positions. The lower end of bar **182** is pivotally connected with the end of a laterally projecting arm **187** that, in turn, is pivotally connected with a stationary part **188** of the frame. The pivot connection at **180** may be relatively loose, so that an operator may grasp the outer end of arm **187** and push downwardly to elevate projection **183** off its supporting projection **184**, and then swing the handle laterally so projection **183** will clear projection **184** to permit the motor carrying plate **176** to be lowered for engaging said projection **184** for supporting the motor **179** in the lower of its two positions. As seen in FIG. 12, the stationary member **185** is offset forwardly relative to plate **176** so that the latter can move downwardly across the rear side of said member **185**.

In the drawings the motor **179** is in the elevated position and, as already mentioned, it is movable horizontally on the bars **177**.

Depending below the table or platform **178** is a lug to which one end of a bar **189** (FIG. 11) is pivoted by pivot **191**. This bar **189** extends rearwardly and downwardly relative to its forward end where it is connected with platform **178**, and then laterally (FIG. 4) to a point outside the end frame member **174**, and then forwardly through a rigid guide member **190** to the forward side of the machine where it is pivotally connected with a vertically extending manually actuable lever arm **192** by a pin-slot connection. The lower end of arms **192** is pivotally connected with a stationary part of the machine at **193** (FIG. 11) while the upper end of the lever arm has a manually graspable knob **194** (FIG. 1). An electrical switch **195** (FIG. 4) is secured to the motor platform at one side thereof and a switch actuating element **196** is connected to a stationary part of the frame alongside the frame.

Referring to FIG. 11, upon the operator grasping knob **194** by the hand and swinging the upper end of lever **192** forwardly, the motor **179** and cutter **170** will be moved forwardly and the cutter will cut the lock opening **34** in the door. Switch **195** will automatically close the circuit to motor **179** upon the latter being moved forwardly and away from the switch actuating member **196**, it being understood that the switch and motor are in an electrical circuit (not shown) for providing current to the motor. After the opening **34** has been cut, the switch **195** will be actuated by engagement with member **196** at the end of the return movement of the motor to open the circuit to the motor.

Directly below the lower edge of the door and in vertical alignment with a line extending to the axis of opening **30** is a vertically disposed upwardly directed drill **197** (FIG. 10) supported in the chuck of a vertically disposed motor **198** (FIGS. 1, 4, 10). Motor **198** is stationary on the rear side of a vertical panel **199** that, in turn, has a pair of vertically disposed parallel horizontally spaced bearings **200** (FIGS. 4, 10) rigid therewith slidably receiving a pair of stationary cylindrical, vertical guide members **202**. Thus the panel and motor are guided for vertical reciprocable movement. As seen in FIGS. 1, 10 the guide mem-

bers 202 depend from a stationary part 203 of the machine frame.

The vertical movement of the motor is effected by a manually actuatable, vertically extending lever arm 204 (FIGS. 1, 10) that is at the forward side of the machine, and which arm has a graspable knob 205 at its upper end. At its lower end arm 204 has a lateral extension 206 (FIG. 10) rigid therewith that is one arm of a crank portion pivotally connected by a pivot 207 to rigid part 203 of the machine frame at a point intermediate the juncture between the arms of such crank portion. The other arm of said crank portion is pivotally connected at its outer end by a pivot 212 with the upper end of a vertically extending link 210 that, in turn, is pivotally connected at its lower end by a pivot 213 to an ear that is rigid with the lower portion of the motor supporting panel 199. An operator at the front side of the machine may elevate the motor and its drill 197 by swinging the upper end of lever arm 204 to the right to thereby move the motor supporting panel upwardly on guide rods 202, and a reverse swinging of the lever arm will result in lowering the panel to the lower end of its movement where a forward projection 209 at the juncture between arms 204, 206 will engage stationary frame member 203. Upward movement of the motor is limited by engagement between frame member 203 and plate 199.

A switch 214 that is in the circuit with motor 198 may be carried by the panel 199 for movement therewith to and from a stationary switch actuating member 215 for actuation in the same manner as the switch 195, so that the motor 198 will be automatically actuated for actuating drill 197 upon upward movement of the panel 199 and the circuit will be opened automatically to stop the motor upon the latter reaching the lower end of its movement.

Referring now to the actuating means for actuating the clamps 119, 118. FIG. 9 semidiagrammatically illustrates this mechanism, which view, taken with FIG. 1 that shows the same mechanism at a right angle to the view in FIG. 9, shows a vertically extending lever arm 216, which is provided at its upper end with a hand graspable knob 217 for manually actuating said lever. The lower end of lever 216 is formed with a laterally projecting extension 218 rigid therewith (FIG. 1), which extension is connected by a pivot 219 with a stationary part of the machine for swinging of said lever arm and its extension about said pivot. The outer end of extension 218 is connected by a pivot 220 with the upper end of a vertically extending link 222. The lower end of link 222, in turn, is pivotally connected at 223 with an ear that is centrally between the ends of a horizontal bar 224 (FIGS. 1, 9). The ends of bar 224 pivotally connect with one of the ends of a pair of opposed, parallel, relatively long arms 225 (FIGS. 1, 9) and the other ends are pivotally connected at 226 with the lower ends of a pair of opposed, vertical links 227, which links, in turn, are connected at points intermediate their upper and lower ends by coaxial horizontal pivots 228 that are rigid with the frame plates 173, 174. The upper ends of the links 227 are connected by coaxial horizontal pivots 229 with lugs secured to the rear of the rear clamps 119 adjacent to the lower edge of the latter, but spaced above said lower edge so that the upper end portions of the links 227 will extend over a sufficient portion of the back of clamp 119 to prevent the upper portion of clamp 119 from swinging toward the clamp 118 about pivots 220.

Clamp 118 is provided on its back, or forward side, with lugs corresponding to those on the back of clamp 119, that are connected by coaxial horizontal pivots 230 with the upper ends of a pair of parallel, horizontally spaced, opposed links 232 that correspond to links 227. These links 232 are pivotally connected by coaxial horizontal pivots 233 with frame plates 173, 174 at points intermediate the ends of said links. The lower ends of links 232 are connected by coaxial horizontal pivots 234 with one of the ends of a pair of relatively short links 235, and the latter are connected at their opposite ends by coaxial horizontal pivots 236 with the long links 225 at a point spaced from pivots 226 the same distance as between each pivot 236 and the pivot at the end of the link 235 that is connected therewith. Each of the pivots 236 includes an extension that projects into a vertical slot 237 between guide bars that are rigid with the frame plates 173, 174 respectively.

By the above structure, upon swinging the arm 216 to one side about pivot 219, the bar 224 will be elevated to swing links 227, 232 so the clamps 118, 119 will move into clamping engagement with the door, which is the position shown in FIG. 9, and upon swinging the lever 216 in the opposite direction, the clamps will move apart. When they are in clamping relation a lock bar 238 that is pivoted to a stationary part of the frame by pivot 239 (FIG. 1) is adapted to be swung from a generally horizontally extending position out of engagement with extension 218 to a position frictionally engaging the underside of said extension at a point between pivots 219, 220 at one end thereof to prevent accidental release of the clamps when the latter are in clamping relation to a door. The locking bar 238 (FIG. 1) includes a lateral projection 240 thereon that may be manually grasped to swing the locking bar into and out of locking relation with extension 218.

It is to be noted that in FIG. 9 only the links and their pivotal connectors (225–236) that are adjacent to the end plate 174 are shown, it being understood that corresponding links and pivots are adjacent to end plate 173.

The cutter 35 and drill 32 that are shown in FIG. 17 have their counterparts in cutter 170 and drill 197, and an upwardly opening channel strip 242 is at the end of the machine opposite to the strip 64, and is connected pivotally with the frame plate 174 in the same manner as strip 64 and functions to support the door when the latter is moved out of and away from the discharge end of the machine.

The rapid and accurate hinging of a door to the hinge jamb and the edging of each door, as compared with the conventional method, is believed to be apparent. The standard publication entitled "Carpentry for the Building Trades" by E. A. Lair and published by McGraw-Hill Book Company, Inc., New York, sets out the conventional method in which some seven time consuming essential steps are enumerated, some of which are entirely dependent upon the accuracy with which the individual recesses for the hinge butts are measured, marked and chiseled out, with no certainty that the final results will be uniformly accurate.

Insofar as the forming of the lock opening 34 and latch opening 30 are concerned, either may be formed before the other.

The door clamps 118, 119, and the cutters or drills that form the latch opening 30 and the lock opening 34 are fixed insofar as their movement longitudinally of the machine is concerned, and as the lock and latch are normally closer to the bottom of an installed door than to the top, the positioning of the ends of the door is made relative to the latch and lock openings.

When a door that is to be swung in one direction is to be edged and the hinge recesses are to be formed, the jamb stop 127 and pawl 120 to position the door and hinge jamb are, for example, the nearest notch or recess in member 125 as seen in FIG. 8, and may be seven inches from the end edge 124 whereas the shoulder 18 of the hinge jamb is closer to the jamb stop by the distance 6 (FIG. 18).

The next to the farthest notch 132 in this example will be eleven inches from the leading end of the door.

When the hinge jamb and door are to be prepared for swinging from the hinge jamb in a reverse direction to the above, the door 1, after edging, is moved to engage the door stop 245 (FIG. 4*a*) which is at the end of the

bar **59** opposite to the end of feed or receiving end, said stop being swung down from the inoperative position shown in full line in FIG. 4*a* to the dotted line position to engage the leading end of the door. This stop **245** is seven inches from the farthest notch **132** from the receiving end of the machine, and when the leading end of the door is against stop **245** the second notch **132** from the receiving end of the machine is eleven inches from the trailing end of the door.

A jamb stop **246** corresponds in structure to the jamb stop **127** and is also carried by the bar **128** at the end of the latter opposite to said stop **127**. The stop **246** will perform exactly the same function as stop **127** to position shoulder **18** relative to the leading edge of the door to provide for space **6** when the door is in the frame. Of course, the hinge jamb is reversed end for end to the position shown in FIG. 8 when the stop **246** is used.

Intermediate notches **132** provide for proper forming of recesses intermediate the butt receiving recesses already described, as in the case of doors having a central hinge.

The door stop **245** is, of course, in a position so that the lock opening and latch opening to be formed in the door will be closer to the trailing end of the door than to the leading end by the desired amount. Hence, once the door is clamped, the routing of the hinge recesses and the forming of the lock and latch openings may be performed without changing the position of the door.

Referring to the modified form of the invention, the bar **59** (FIGS. 1, 8) is seen at **59** in FIG. 21 but in this instance said bar carries a horizontally extending strip **250** that has rigidly secured thereto at one end a pair of upstanding lugs **251**, and a similar pair **252** is at the opposite end, while a third pair **253** is at a point intermediate the two end pairs (FIG. 24).

The width of these lugs, transversely of strip **250**, is equal to the spacing between the hinge jamb **254** and the door **255** (FIG. 21). In fact they function as a positioning means to properly space the door and jamb during the cutting of the butt receiving recesses, and this is also the correct spacing for securing the hinges to the door and jamb.

Each lug has an adjustable stop **256** (FIG. 22) that is adjustable longitudinally of the strip **250**, and each stop is held in adjusted position by nuts **257** respectively positioned at opposite sides of each lug.

The distance between and the relative positions of the stop members on each pair of lugs with respect to the door and jamb are critical.

The strip **250** may carry a pin **258** at one end that is rigid therewith and that is adapted to fit in a hole in the horizontal upper leg of bar **59**, thus removably holding the bar against longitudinal movement (FIGS. 22, 24). A second opening may be formed in bar **59** at **259** (FIG. 24).

For purpose of description, the pawl **120** of FIGS. 1 and 8 is shown at **120** in FIG. 24 being at the left end of strip **250**, as seen in the latter figure, while the stop **245** of FIGS. 1 and 4*a* is indicated at the right hand end of FIG. 24. In the modified form of the invention these stops and the jamb stops **127** (FIG. 8) and **246** (FIG. 4*a*) are unchanged and function exactly as already described. The jamb **254** indicated in FIG. 21 is for an outside door, which is the only difference between it and the jamb **7**.

The adjacent ends of the pair of stops **256** on each pair of lugs **251–253** are spaced apart a distance equal to the length of each of the hinge butts. These adjacent ends may be termed "stop" ends, or "effective" ends, since the opposite end of each stop performs no function.

The stop **256** on the lug **251** that is at the left end of strip **250** is the one nearest the door stop **120** and the distance between the "stop" or "effective" end of said stop is preferably seven inches from the left hand end of door **14**, as indicated in FIG. 24, or exactly the same distance as the left hand recess **132** in bar **125** of FIG. 8 is spaced from the trailing end of door **1**, the bar **125** being no longer used in the modified form of FIGS. 21–24.

The distance between the stop end of the stop member **256** that is at the right hand end of strip **150** (FIG. 24) is eleven inches from the leading end of the door **1** when the latter is against stop **120**.

Referring now to FIG. 21 the router **262** is slidably mounted on the forward end of an arm **263** that extends rearwardly to a bar **264** that may generally be compared to bar **128** in FIG. 13. However, bar **264** is rotatably supported at its opposite ends in bearings **265** that are rigid on the frame of the machine. A pair of radially outwardly projecting ribs **266** integral with bar **264** extend longitudinally of the latter and rollers **267** carried by arm **263** roll on said ribs, thus supporting arm **263** for movement longitudinally of bar **264**.

The arm **263** projects forwardly from bar **264**, and at each end of the bar are counterweights **268** that, in turn, are adjustable along arms **269** that project rearwardly from and that are rigid with bar **264**. These counterweights are to balance the weight of the router and may be adjusted to automatically elevate the router when the latter is not in use.

In the present form of the invention, the jamb **254** is yieldably held against the lugs **252** by a plurality of expansion springs **270** each of which reacts between a stop **272** that is rigid with a horizontal plate **273** that, in turn, is rigid with the frame of the machine. Only one of these springs is shown in FIG. 21, and one or more corresponding springs are carried on plate **273** at points spaced along the jamb.

By the above structure the jamb **273** is yieldably held during routing thereof for the hinge butts, and is held in the proper position relative to the door **255**.

As already stated, the router **262** is movable on arm **263** longitudinally of the latter. Arm **263** is formed with a central slot **274** extending longitudinally thereof. The base plate **275** of the router extends across the upper side of said arm **263** and has extension **276** thereon projecting oppositely outwardly from the opposite side thereof at right angles to the length of arm **263**. These extensions **276** have downwardly directed runners **277** at their ends that function in the same manner as the runners **148** of FIG. 13, to ride on the door and jamb during the routing operation to control the depth of the recess. The router bit **278** (FIG. 22) will obviously cut into the jamb **254** to the depth it projects below the lower ends of runners **277**.

A tubular sleeve **281** is centrally secured to base plate **275** by a nut **279**, and the bit shaft **280** extends through said sleeve. A guide **282** rigid on said sleeve is positioned within slot **274** in arm **263** and which guide has straight sides at opposite sides of the slot to prevent rotation of the router while permitting it to move longitudinally of arm **263**.

Rigidly secured on arm **263** is a depending plate **283** (FIGS. 22, 23) that is adapted to extend downwardly into the space between the door and the jamb to a level below the stops **256** so as to engage said stops upon movement of the router and arm **263** longitudinally of the door and jamb.

Below the arm **263** is a plate **284** that is rotatable on the lower end of sleeve **281** and this plate carries a depending pin **285** that is adapted to perform the same function as the pin **158** of FIGS. 15, 16. A spring **286** connects between one of the runners or depth gauges **277** and plate **284**, or if desired with pin **285** to yieldably hold the pin on a line that extends centrally through the drill bit, and that is at a right angle to arm **263** or parallel with the door and jamb to be routed out.

The plate **284** is cut out at one side to provide circumferentially facing shoulders **287** that are adapted to engage a rigid pin **288** depending from the base plate

275, said pin being equally spaced between said shoulders when the router is inoperative, as seen in FIG. 23.

In operation, assuming the door and jamb are in the same position as indicated in FIG. 17 with respect to the door and jamb stops 15, 17 at the left hand end of the machine, and which stops are designated 120 and 127 in FIG. 8, the router 262 is swung down so that the depending member 283 is between the gauge screws 256 on ears 251. The router is grasped by handle 289 and may then be moved toward the jamb to rout out the recess for the hinge butt. The pin 285 will engage the jamb to rotate plate 284 until one shoulder 287 engages pin 288, which limits the width of the recess being routed out. The runners 277 will, of course, ride on the jamb to control the depth of the recess, and the length of the recess will be determined by the spacing between the stops 256 on upstanding lugs 251. The jamb will be yieldably held or clamped against the ears 251–253 during the routing out of the recess.

The door edge is then routed out in the same manner, and the recesses in the door edge and the jamb will snugly receive the hinge butt.

The operator may then (in a two-hinged door) elevate the router by swinging it upwardly about the axis of bar 264, and move it to the right hand end of the machine where it will be swung down so that the member 283 is between the stops 286 carried by lugs 252, and the routing operation on the jamb and door is completed.

In the case of a three-hinged door, the same operation is repeated by moving the router to position the control member 283 between stops 286 on lugs 253.

The router may then be released to swing to elevated position, and the hinges are quickly positioned and screwed to the jamb and door, after which the door and jamb may be quickly released and removed from the machine.

In the event the door being hung is one that is to be swung in a direction opposite to that of the door above described, it is merely necessary to move the strip 250 to the right and to reposition pin 258 in the opening at 259 (FIG. 24). By positioning the door against the end stop 245 and the jamb against the adjacent end stop 246, the butt receiving recesses formed by the router, as above described will be located correctly for the oppositely swinging door and hinge, with the right hand recess seven inches from the end of the door and the left hand recess eleven inches.

By the modified structure a roller mounted router is provided, and which router is counterbalanced so as to preclude accidental operation, while still maintaining ease of operation. Also the jamb is held against accidental movement during the routing operation, and the bar 125 of FIGS. 5, 8 is eliminated as a stop for the jamb and as a gauge member. Inasmuch as the critical edge of the jamb is the edge that faces the door, the use of the springs 270 and the spacing lugs 251–253 precludes any error due to any possible variations in the width of the jamb as well as insuring against accidental movement of the jamb during routing of the latter. The routing, of course, in the modified arrangement, occurs between the points where the lugs 251–253 of each pair thereof engages the jamb.

While we have shown a particular form of embodiment of our invention, we are aware that many minor changes therein will readily suggest themselves to others skilled in the art without departing from the spirit and scope of our invention.

We claim:

1. The method of prehanging a door on the hinge-jamb of a door frame that includes the steps of:

(a) supporting the door to be hung on edge in a horizontally extending position with the butt-facing surface of its hinge-edge facing upwardly;

(b) stationarily supporting the hinge-jamb having a butt-facing surface and to which hinge jamb said door is to be hung in a horizontally extending position offset longitudinally of said door and parallel with said hinge-edge and with its butt-facing surface facing upwardly at substantially the same level as said butt-facing surface of said hinge-edge on said door and offset laterally of said door a distance substantially equal to the normal spacing between said butt-facing surfaces when connected by the butts of door hinges when the said butts are coplanar;

(c) moving said door longitudinally thereof to a position alongside said jamb and at the same time bevelling the longitudinally extending edge of said door that is opposite to said hinge edge according to the direction in which said door is to swing after being hung;

(d) then holding said door and said jamb stationary with their butt-facing upper surfaces coplanar and spaced apart a distance equal to the distance between the jamb and door after the door is hung and when the hinge butts are coplanar;

(e) then routing out recesses in said butt-facing upper surfaces for the hinge butts while said door and jamb are so held stationary relative to each other and finally, and while still holding said door and jamb stationary;

(f) securing said hinge butts in said recesses.

2. Apparatus for forming butt receiving recesses on one longitudinally extending edge of an elongated rectangular door and in the hinge-jamb from which said door is to be hung and for forming the latch and lock openings in said door along the opposite longitudinally extending edge of said door, comprising:

(a) a horizontally elongated stationary rigid frame one end thereof being a receiving end and the opposite end thereof being a discharge end;

(b) a door support on said frame extending longitudinally thereof for receiving and for supporting said door vertically disposed, but horizontally extending with said one edge facing upwardly, for horizontal movement of said door longitudinally thereof in one direction from said receiving end to said discharge end;

(c) door moving means on said frame adjacent to said receiving end for moving said door in said one direction;

(d) cutting means on said frame adjacent to said receiving end engageable with said opposite edge of said door for bevelling said opposite edge to the desired angle relative to the position of the hinges that are to hingedly connect said door with said hinge-jamb, during movement of said door in said one direction and past said cutting means to a location on said door support for connecting a hinge-jamb thereto;

(e) a hinge-jamb support on said frame adapted to support said hinge-jamb thereon in a position parallel with and horizontally alongside said one edge of said door and spaced from the latter, when said door is in said location, a distance equal to the spacing between said hinge-jamb and said door when said hinge-jamb and said door are connected by butt hinges with the upper surface of said hinge-jamb that is adjacent to said door being horizontal and coplanar with the upper surface of said one edge whereby such butt-hinges may be directly secured to said hinge-jamb and door without moving the hinge-jamb and door relative to each other after the recesses for the butts of said hinges are formed;

(f) a router having a depending router bit and a carriage on said frame carrying said router as a unit, therewith for generally vertical movement from an elevated position in which said bit is spaced above said hinge-jamb and door to a lowered routing position in which said bit is adapted to rout out said upper surfaces of said door and hinge jamb to a depth substantially equal to the thickness of the butts

of butt-hinges for connecting said door and hinge-jamb, and vice versa;

(g) carriage supporting means on said frame supporting said carriage for said generally vertical movement of the latter and for reciprocable movement of said carriage longitudinally of said door and jamb at all times;

(h) said carriage and router including router supporting means supporting said router thereon for transverse movement of the latter transversely relative to the length of said frame when said butt is in routing position relative to said door and said hinge jamb;

(i) means on said carriage for limiting the said transverse movement of router when in said routing position to distances in said door and hinge-jamb equal to the widths of the butts of the butt hinges that are to connect said door and hinge jamb;

(j) control means on said frame at points spaced apart longitudinally of the latter distances equal to the spacing of said butt hinges longitudinally of said door and jamb and means on said carriage in cooperative relation to said control means for limiting the movement of said router longitudinally of said frame at each of said spaced points to a distance equal to the length of each of the butts of said butt hinges when said router is in routing position;

(k) stop means on said frame for positioning said door and said hinge jamb longitudinally of said frame so that said control means on said frame will be at positions relative to said door and hinge jamb for routing out butt-receiving recesses in said upper surfaces of said door and hinge jamb at the correct points along said door and said jamb;

(l) separate latch and lock opening means on said frame adjacent to the discharge end of the latter and in positions relative to said stop means for drilling latch and lock openings in said door along said opposite longitudinally extending edge of said door, said stop means being adapted to position said door relative to said latch and lock forming means for the formation of the latch and lock openings in said door in the correct predetermined relation to the recesses formed by said router bit at the same time said stop means positions said door for the formation of said butt receiving recesses in the latter;

(m) holding means on said frame for releasably holding said hinge-jamb and said door rigid and stationary relative to each other when said door is in said location on said door support and said hinge-jamb is on said hinge-jamb support during said drilling of said latch and lock openings by said latch and lock opening forming means.

3. Apparatus as defined in claim 2:

(n) means for removably securing said control means on said frame in two positions thereof relative to said frame longitudinally of the latter;

(o) said stop means being in two pairs thereof respectively adjacent to the receiving end of said frame and said discharge end for positioning said door and said hinge-jamb in one of two positions according to the position of said control means, whereby said butt-receiving recesses may be correctly positioned relative to the ends of said door and said hinge-jamb according to the direction in which the door is to swing when it is connected with said hinge-jamb.

4. Apparatus as defined in claim 2:

(n) said lock opening forming means including a horizontally disposed power driven drill supported on said frame for reciprocable movement transversely of the length of said frame through a door when the latter is positioned by said stop means;

(o) means for so supporting said power driven drill;

(p) said holding means including a pair of opposed clamping plates supported on said frame adjacent to said discharge end of the latter for movement toward and away from each other and from said door when the latter is positioned by said stop means for releasably clamping said door therebetween to hold said door rigid during the forming of said lock opening;

(q) said latch opening forming means including a vertically disposed power driven drill supported on said frame for reciprocable vertical movement into and out of the lower edge of said door when the latter is positioned by said stop means;

(r) separate means respectively connected with said lock opening forming means and with said latch opening forming means for actuating them for said horizontal and said vertical movement thereof.

5. Apparatus as defined in claim 4:

(s) said lock opening forming means and said latch opening forming means including electric motors in an electrical circuit respectively movable horizontally and vertically with said drills and connected with the latter for rotating the latter;

(t) switches in said electrical circuit and switch actuating means for automatically closing said circuit to each motor upon movement thereof and the drill connected therewith toward said door for forming a said lock opening and the latch opening in the latter and for automatically opening said circuit upon movement of each motor and the drill connected therewith away from said door.

6. Apparatus as defined in claim 5:

(u) separate manually actuatable means respectively connected with said lock opening forming means, said latch opening forming means and said clamps for actuating said lock opening forming means and said latch opening forming means for movement toward and away from said door and for actuating said clamps for movement into and out of door clamping relation.

7. Apparatus for preparing an elongated door, one longitudinally extending edge of which has a butt-facing surface for one butt of butt-hinges, and an elongated hinge-jamb having a butt-facing surface extending longitudinally thereof for the other butt of said butt-hinges for hanging said door from said hinge-jamb, and which hinge-jamb has a head-edge at one end for securement of the head of a frame for said door thereagainst, said apparatus comprising:

(a) rigid, stationary frame;

(b) door and hinge-jamb supports on said frame for supporting said jamb and said door alongside and parallel with each other in a horizontally extending hinge-connectable position with said butt-facing surfaces on said jamb and door facing upwardly;

(c) a cutter for cutting butt receiving recesses in said butt-facing surfaces when said door and said jamb are on said supports in said hinge-connectable position;

(d) a carriage means movably supported on said frame supporting said cutter for movement as a unit therewith longitudinally and transversely of said butt-facing surfaces and to a uniform predetermined distance into said jamb and door from said surfaces when said jamb and door are supported in said hinge-connectable position for forming recesses for the butts of said butt-hinges, and means supporting said carriage means for said movement;

(e) control means respectively on said frame and on said carriage means for positioning and for retaining said cutter at the correct positions along said door and jamb for forming the butt-receiving recesses in said butt-facing surfaces on said door and jamb and for limiting the movement of said cutter longitudinally and transversely of said door and jamb to distances respectively equal to the length and width of

each butt-hinge at each of said last mentioned positions;

(f) door-moving means on said frame for moving said door longitudinally thereof to said hinge-connectable position relative to said jamb;

(g) spacing means on said frame adapted to extend between and to space said door from said hinge-jamb when they are in said hinge-connectable position relative to each other;

(h) jamb-engaging means carried by said frame adapted to engage said jamb and to hold said jamb against said spacing means;

(i) door engaging means on said frame for releasably holding said door stationary substantially against said spacing means;

(j) said jamb-engaging means being yieldable for yieldably holding said jamb against said spacing means;

(k) cutter means on said frame for bevelling the lower longitudinally extending edge of said door during movement of said door by said door engaging means to said hinge-connectable position;

(l) rigid guide means adapted to engage said butt-facing surface on said door during movement of said door to said last mentioned position and

(m) said door moving means being power driven rollers adapted to frictionally engage the lower edge of said door;

(n) means for yieldably urging said rollers upwardly for yieldably holding the upper edge of said door against said guide means whereby said rollers will be adapted to move doors of different widths to said hinge-connectable position;

(o) and power means connected with said rollers for rotating them to so move said door.

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