April 11, 1967 M. GOLDSTEIN 3,313,327

APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

Filed March 7, 1966 6 Sheets-Sheet 1

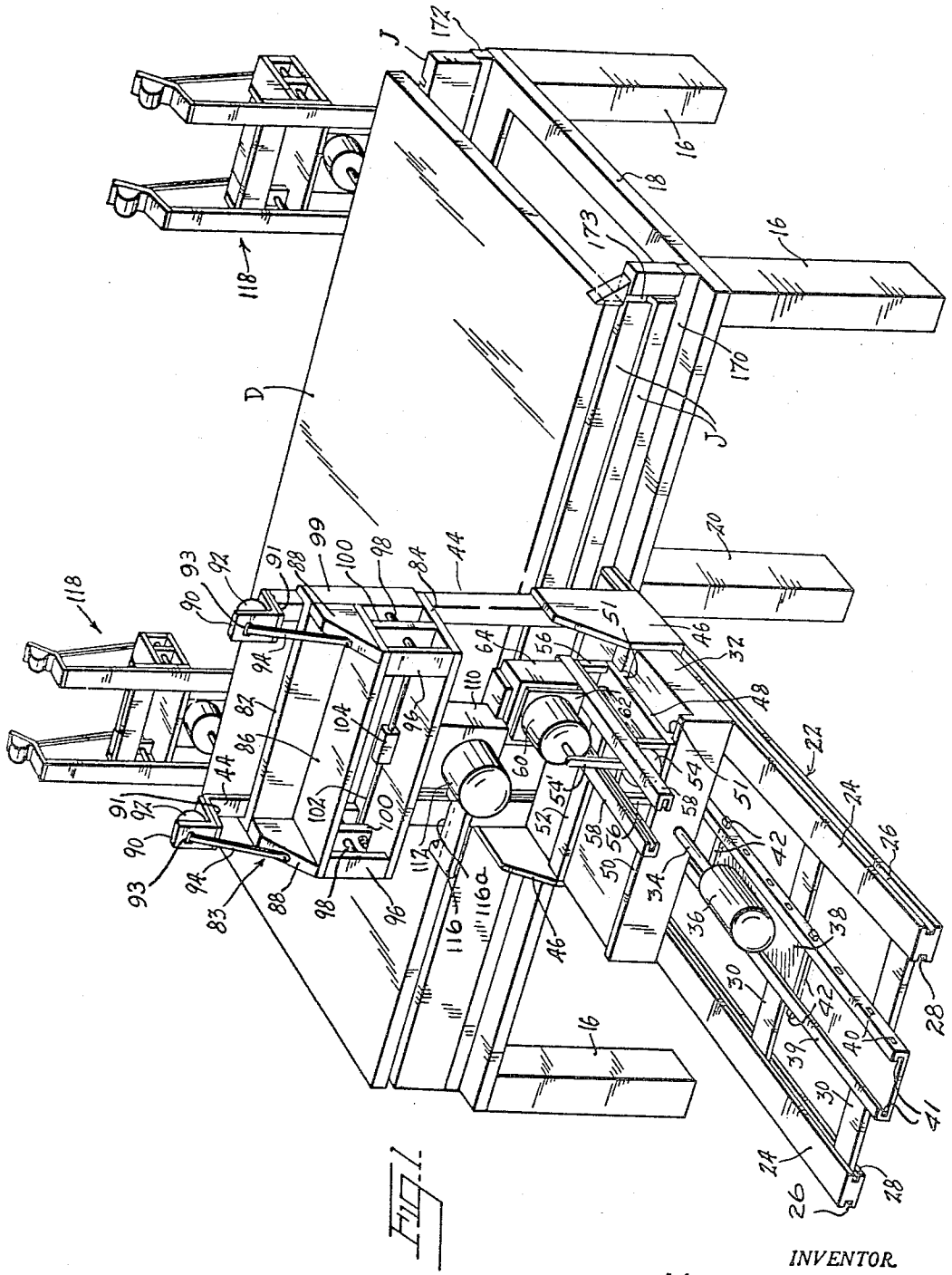


FIG. 1

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Filed March 7, 1966 6 Sheets-Sheet 2

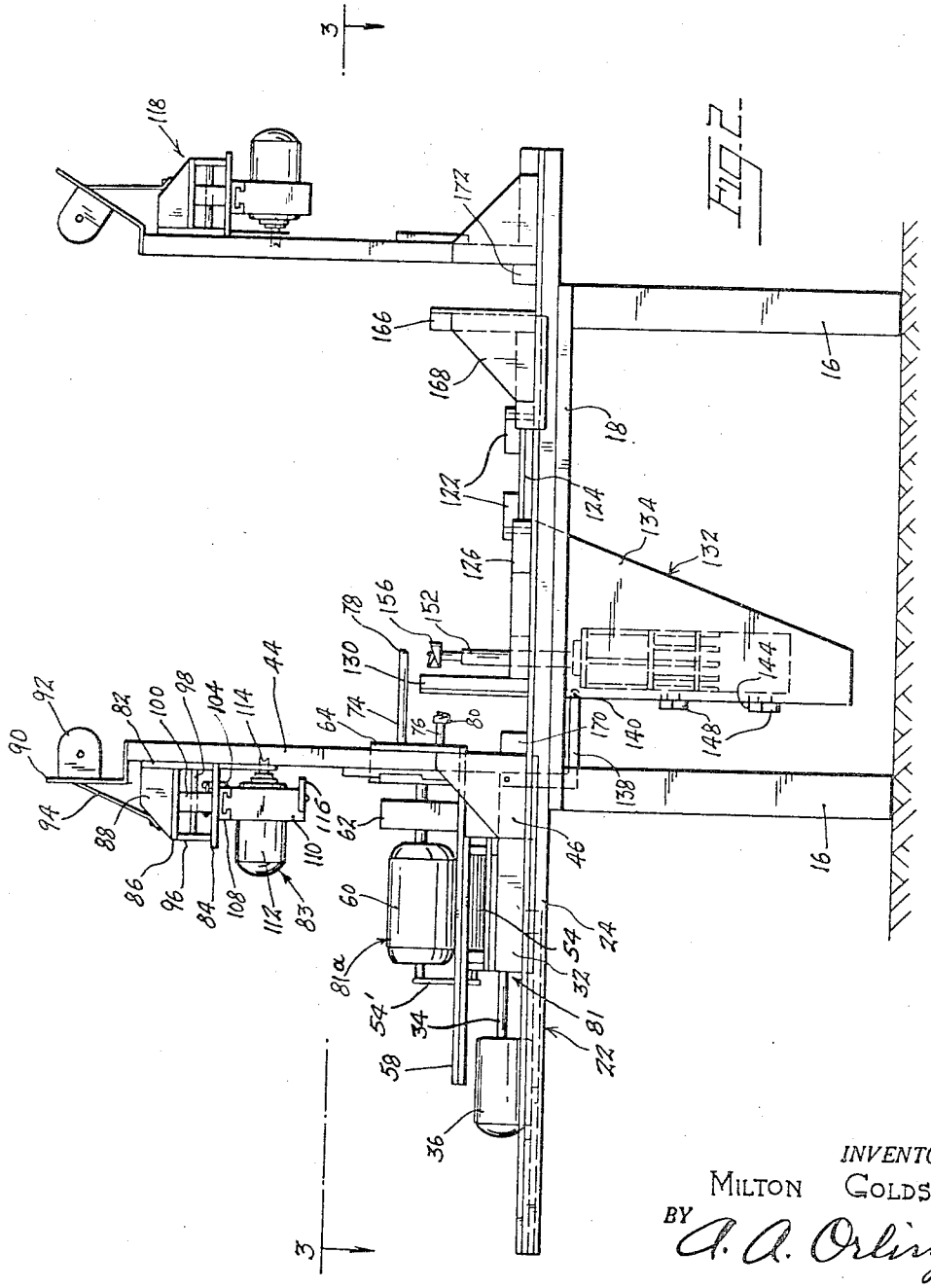


FIG. 2

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APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

Filed March 7, 1966 6 Sheets-Sheet 3

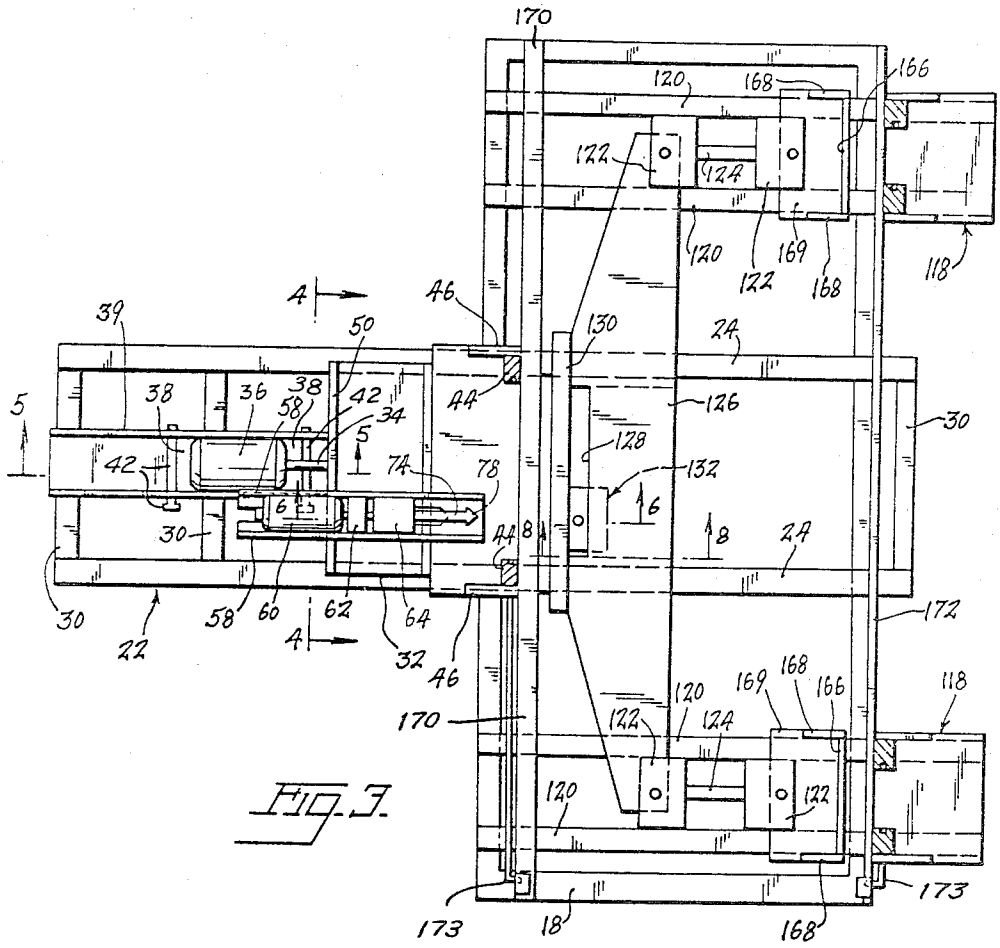


FIG. 3.

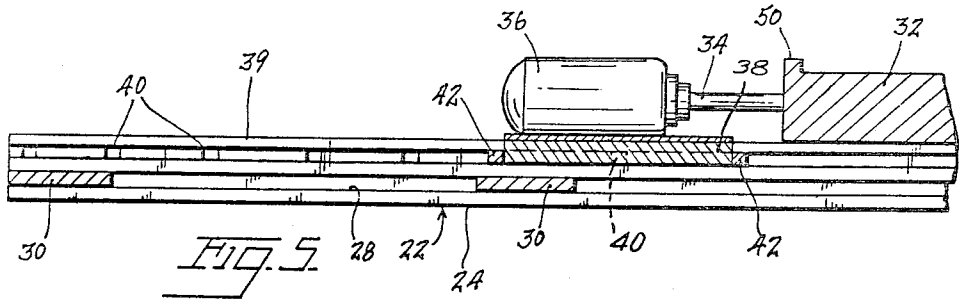


FIG. 5.

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APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

Filed March 7, 1966 6 Sheets-Sheet 4

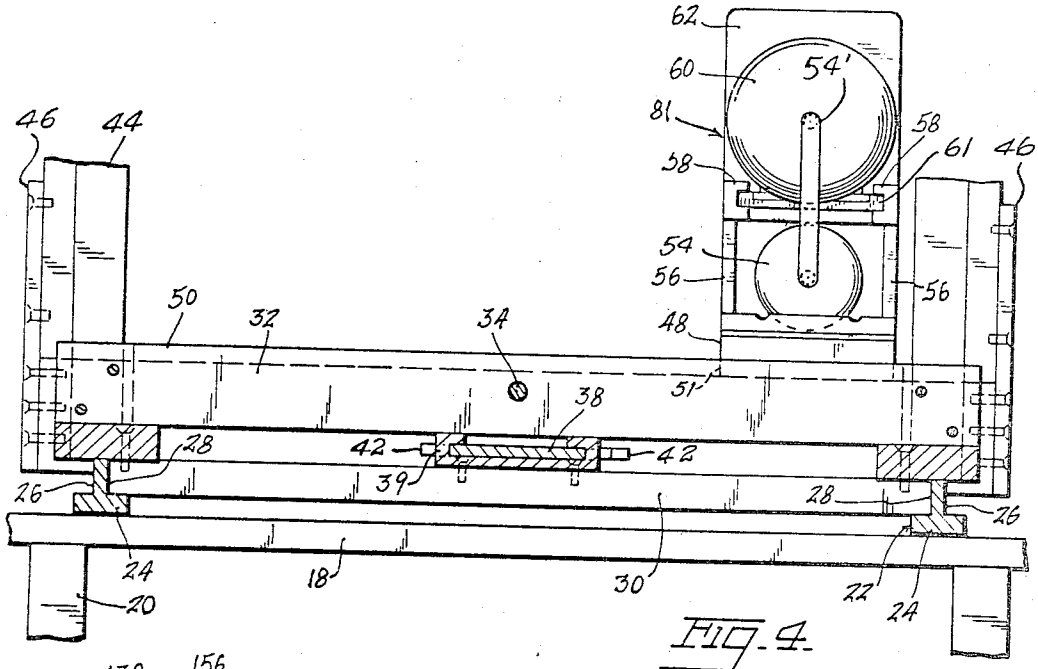


FIG. 4

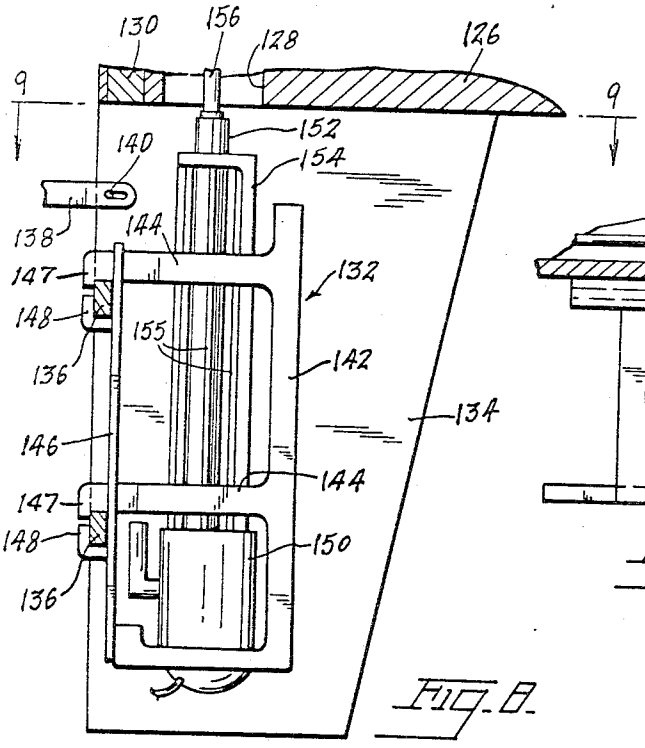


FIG. 8

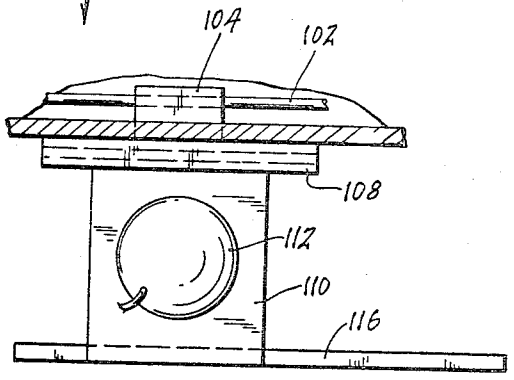


FIG. 7

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APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

Filed March 7, 1966 6 Sheets-Sheet 5

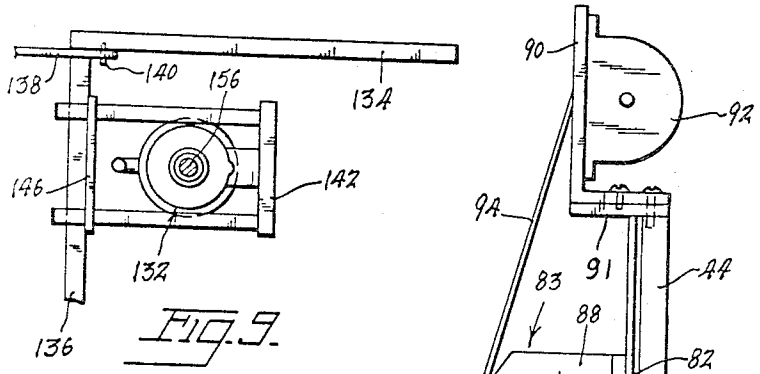


FIG. 9.

FIG. 6.

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APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

Filed March 7, 1966 6 Sheets-Sheet 6

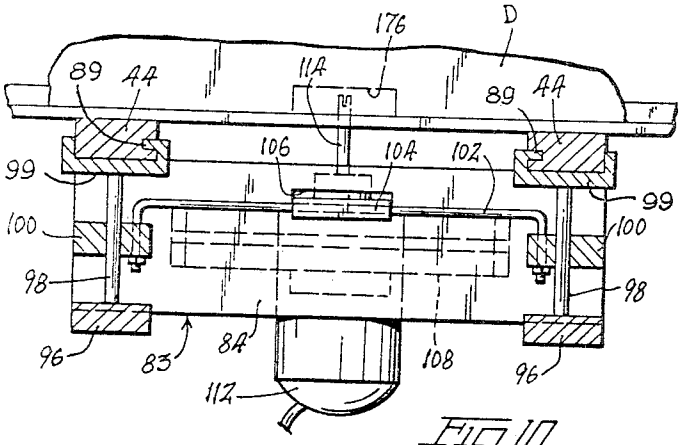


Fig. 10.

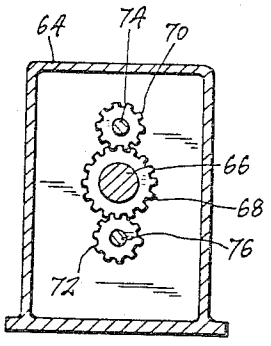


Fig. 12.

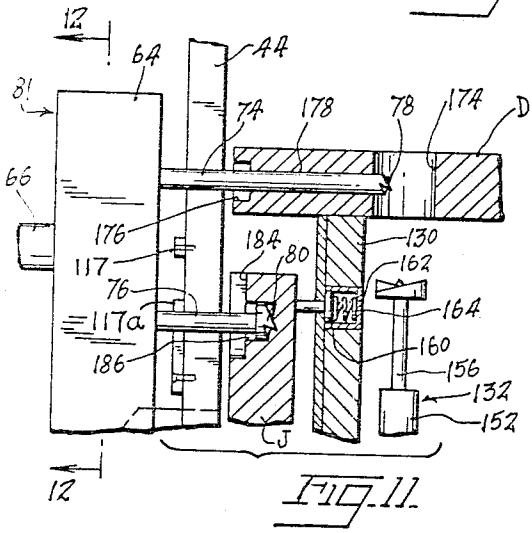


Fig. 11.

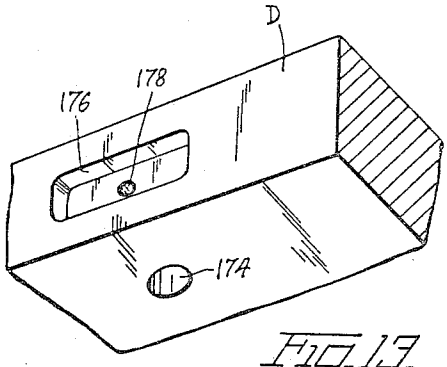


Fig. 13.

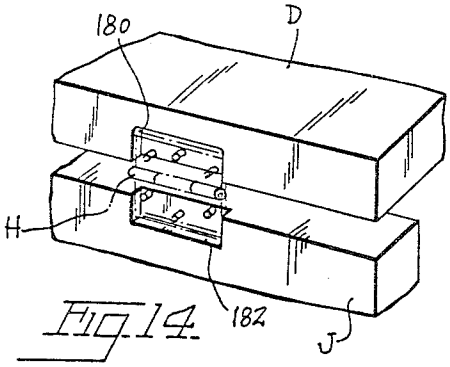


Fig. 14.

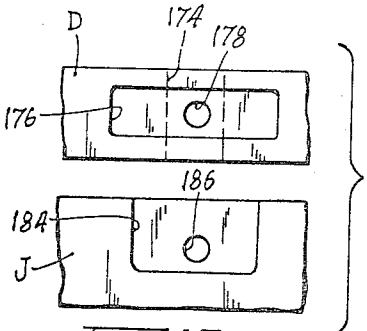


Fig. 15.

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United States Patent Office 3,313,327 Patented Apr. 11, 1967

3,313,327

APPARATUS TO WORK SIMULTANEOUSLY ON A DOOR AND ITS FRAME JAMBS

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Filed Mar. 7, 1966, Ser. No. 532,231
1 Claim. (Cl. 144—2)

This application is a continuation-of part of my co-pending application Ser. No. 282,044 filed May 21, 1963, now Patent No. 3,238,980 which in turn was a continuation-in-part of my then co-pending application Ser. No. 765,572 filed Oct. 6, 1958, and now abandoned.

This invention is an apparatus which holds a door and either and advantageously both of the jambs of a door frame for it positioned in an effective relationship to one another, and comprises tools and means for operating them to form simultaneously in the door and its jambs the necessary recesses and holes for receiving the hardware items (e.g. lock and bolt, bolt plate, bolt and latch receiving plate, and hinges), which enable attaching these items in proper register of them between the door and its jambs, all while they are held so positioned to one another. The apparatus enables repeating the same operations on successive sets of doors and respective jambs, with each of them identically held with respect to the others.

More specifically, the invention is an apparatus which holds a door flatwise on it while at the same time supporting a door jamb, and usually both side door jambs and with each, on a long edge of it and perpendicularly to the door and aligned parallel and adjacent to a respective long edge of the door.

The apparatus also includes elements that hold tools and have means for positioning and operating them to form in the door and jamb or jambs, while thus supported, the various recesses and cavities to receive the hinges and lock and the parts for latching it.

An important part of the invention is an improved method of preparing jointly in the doors and their associated jambs the recesses and holes for receiving the essential hardware items. This method involves holding the door and either or both of its associated jambs in the already indicated relative position to one another, and, while holding them so positioned with respect to one another, preparing on them mechanically and in proper register the various holes and recesses for receiving the necessary door and jamb hardware for hanging, latching and locking the door, and attaching the hinge butts at their respective places to the door and the jamb.

In current large scale building operations involving constructing a considerable number of homes or apartments in large housing developments, a great number of identical doors is required. Heretofore, doors and their jambs generally have been made available as individual members without their having formed in them any of the various recesses and holes or cavities for receiving the foregoing essential door hardware.

Thus, the general practice has been to let the individual carpenters on the job measure off and mark on each door and its side jambs individual locations where to rout and cut out separately the various recesses and holes, and thereafter manually to rout and cut out each of them separately, to receive the various pieces of door hardware.

It has been attempted to provide apparatus for holding only a door at a time and placing against certain areas of it separately and successively individual templates to guide different tools in then cutting out separately in the door alone the lock hole, boring the bolt hole, and routing out the lock plate recess; and subsequently for allowing manually lifting the door and setting it into a framework to hold it upright with its hinge receiving edge facing upwardly and then after placing long that edge a suitable template or templates, to allow the recesses for receiving the hinge butts to be routed out.

While such attempts were helpful in a measure, there still remained much to be desired, and, among other shortcomings, the carpenters on the job still had to mark out in the same conventional way the location for the various recesses and holes, and rout and cut them out separately on the door jambs.

These and other disadvantages and shortcomings are avoided by the apparatus and method of the invention tion which provide a number of advantageous time and cost saving features.

An important feature of the method and apparatus of the invention is that they enable forming the various recesses and holes for the door and jambs hardware items at a specific combination of locations along the required edges and parts of the door and jambs, and to form the selected combination of recesses and holes at the same locations on successive sets of a door and its associated jambs, and to do so at the same time.

Another feature of the apparatus and the method is that they enable turning out repeated such sets of a door and either or both jambs, with each set having its recesses in the jambs accurately positioned in accurate register with the related recesses and holes or cavities in the door.

A further feature of the method and apparatus of the invention is that they enable forming these various recesses and holes for the needed hardware items in each set of a door and its associated jamb or jambs in a minimum time interval, thereby to provide a high production rate of sets of doors and jambs, with uniform layout of the various recesses and holes from set to set so that any of the doors can be used with any of the required side jambs.

Still another feature of the invention is that it facilitates regular and easy repeated operation of the required combination of steps in the routing and cutting of these various recesses and holes, and allow the combination of steps to be conducted readily and efficiently by two or even one operator, or even to be adapted to automated operation.

Yet a further feature of the apparatus and method is that for the entire combination of operations which it performs on successive sets of a door and associated jambs, the apparatus requires a minimum of floor space and can be constructed at a cost low enough for the resulting savings to make the investment economically practical with continued saving in operation time and labor cost.

Further features and advantages of the invention are seen from the detailed description of an illustrative, but not restrictive, embodiment shown in the accompanying drawings wherein:

FIG. 1 is a perspective view of said embodiment of the overall apparatus, with a door and its respective frame jambs supported on it in suitable relative positions for their respective recesses and holes to be made in them in proper register in the inter-related operations on them;

FIG. 2 is an end elevation of the apparatus as seen from the right of FIG. 1, but omitting the door and jambs;

FIG. 3 is a sectional view of the apparatus on reduced scale, along line 3—3 of FIG. 2 and seen as directed by the arrows;

FIG. 4 is an enlarged transverse sectional view through the bolt hole recess forming assembly, taken on line 4—4 of FIG. 3, and seen as directed by the arrows;

FIG. 5 is a fragmentary sectional view through the bolt holes forming assembly, taken on line 5—5 of FIG.

3, on substantially about the same scale as, and normal to, FIG. 4, and seem as directed by the arrows;

FIG. 6 is an enlarged vertical sectional view on line 6—6 of FIG. 3, and showing a fragment of a door and of the jamb adjacent it;

FIG. 7 is a detail sectional view, on the same scale as FIG. 6, through the bolt plate recess forming assembly substantially on line 7—7 of FIG. 6;

FIG. 8 is a detail sectional view, on an enlarged scale, through the lock-handle hole forming assembly, substantially on line 8—8 of FIG. 3, and showing a fragment of the carriage plate;

FIG. 9 is a plan sectional view of the lock-handle hole forming assembly, taken on line 9—9 of FIG. 8;

FIG. 10 is a horizontal section through the bolt plate recess forming assembly, taken on line 10—10 of FIG. 6;

FIG. 11 is a fragmentary sectional view on the same cutting plane as FIG. 6, showing a door and jamb at a later stage in the finishing operation;

FIG. 12 is an enlarged sectional view through the gear box, taken on line 12—12 of FIG. 11;

FIG. 13 is an enlarged perspective view of the part of the door showing its lock and bolt hole, and bolt plate receiving recesses;

FIG. 14 is an enlarged fragmentary perspective view showing part of the finished door and a jamb with their respective hinge-receiving recesses in register; and

FIG. 15 is an exploded, side elevational view of part of the finished door and the other jamb showing the respective bolt holes, and bolt plate and latch plate receiving recesses.

The apparatus includes a rectangular table (of a size to support a door placed horizontally) having corner legs **16**. Securely supported atop said legs is a horizontal, rectangular table top or platform frame **18**, advantageously formed with its entire inner enclosed area left open, as best seen in FIGS. 1 and 3. Intermediate legs **20** can be provided for additional support intermediate the ends of both longer sides of frame **18**.

When holes and recesses are to be made in a set of a door and its jambs, they are supported from the upper surface of frame **18**, as hereinafter more fully described.

Lock and bolt holes and plate recesses making assembly

A trackway designated **22** (as a whole) extends (FIGS. 1 and 3) horizontally transversely across the long sides of platform frame **18** intermediate its ends and at a location embracing the approximate position along the proximate part of the door and its accompanying jamb, wherein holes and recesses for the lock, its bolt, bolt plate and strike plate are to be made. Trackway **22** includes elongated side rails **24**, **24** projecting on that side (conveniently called the lock and bolt working side) a substantial distance horizontally outwardly from the adjacent long side of platform frame **18**.

Outwardly facing grooves **26** extend longitudinally along the outwardly facing sides of rails **24**; and correspondingly extending confronting grooves **28** extend along their opposing respective inner sides. A few separate cross bars **30** with their ends fixedly engaged in the opposed inner grooves **28** are spaced apart longitudinally along trackway **22** to reinforce it and provide a support for the lock side motor and tool carrying assembly **81**.

In that assembly, freely slidable upon the outwardly projecting portion of trackway **22**, and in a direction normal to platform frame **18**, is a carriage **32** (here illustrated, for example, as a wide, generally flat block). An internally threaded bore extends from its opening located substantially medially in the outermost vertical face wall (normal to trackway **22**) of carriage **32** to receive in tight engagement the corresponding external threads along the outer end of shaft **34** which extends

outwardly from the (inside) piston of 2-way air cylinder or air motor **36**.

Air cylinder **36** is mounted on base plate **38** which is selectively locatably slidable along elongated runway **39** having along its sides inwardly turned longitudinal flanges presenting opposed engaging grooves **41** slidably embracing the side edge portions of base plate **38**. A series of longitudinally spaced apart anchoring holes **40** is provided in the vertical wall of each of the engaging grooves **41** to provide a longitudinally spaced apart series of pairs of directly opposed such holes. These serve, after adjusting base plate **38** to a suitable selected working location, to receive against each of its ends an outer holding or stop bar **42**, one of which is inserted in and extends through the oppositely aligned holes **40** of its respective pair of them (see FIG. 5).

Fixedly secured to the opposed corners of the inner (or platform frame) end of carriage block **32** are upwardly projecting standards **44**, the securing of which to block **32** is reinforced by side brace plates **46**, the lower end of each of which has an inturned flange slidably engaged in an outer groove **26**.

Supported atop of carriage **32** for transverse adjustment across it is tool carrier plate **48**, the outer end of which is slidably carried on upwardly projecting lip **50** extending transversely along the upper outer end of block **32** (see FIGS. 1, 3 and 5). The inner end of plate **48** similarly is slidably supported upon transversely extending spacer bar **52** extending from side to side of carriage **32** and parallel to lip **50**. Guide flanges **51** depending from the underside of plate **48** adjacent the inner vertical sides of lip **50** and spacer bar **52**, guide carrier plate **48** and hold it on top of said lip and spacer bar. Tool carrier plate **48** remains by its own weight at whatever location along them it is moved.

A positioning motor, conveniently the air-motivated piston-bearing cylinder **54**, is mounted on plate **48**, at each of whose four corners are fixedly secured upwardly projecting, short posts **56**. To their upper ends are secured a trackway, here composed of horizontal spaced apart elongated guide bars or tracks **58** having confronting grooves and extending parallel to the line of movement of the carriage block **32**.

A tool operating motor **60** is disposed upon its support plate **61**, slidably mounted in the grooved guides **58**. The shaft of motor **60** projects toward platform frame **18** and extends through a bearing **62** into a gear box **64** (detailed in FIG. 12).

As seen in FIG. 12, shaft **66** of motor **60** extends into gear box **64** conveniently centrally thereof. Secured to shaft **66** is gear **68** in mesh with pinions **70**, **72** disposed above and below it. Shafts **74** and **76** are secured to the pinions and project forwardly out of the gear box. Exteriorly of the gear box, shafts **74** and **76** are provided with drill bits **78** and **80** respectively. The shafts **74** and **76** of drill bits **78** and **80** respectively are of such length to give the required depth to both bolt holes when motor **60** is advanced by operation of air cylinder **54** the length of its advancing stroke.

From FIGS. 1, 2, 5 and 6, it is seen that, with the door and both jambs supported as shown in FIG. 1, carriage **32** (as a unit with its standards **44**, motor **60** and gear box **64**, being designated **81**) is moved to adjust it to a conveniently practical operational starting location on trackway **22**, and fixed there by inserting a stop bar **42** in each of the two separate pairs of opposed openings **40** adjacent the ends of plate **38**. Then, by opening a treadle-operated valve controlling a compressed air source (all not shown) to enter the advance-motivating port of air-cylinder motor **36**, motor and tool assembly **81** can be adjusted as a unit toward platform frame **18** to clamp the jambs in place relative to the door (as more fully explained much further below) and set drill bits **78** and **80** in longitudinal position for use.

The bolt-hole forming assembly including air-motivated

cylinder 54 and motor 60, all generally designated 81*a*, then can be adjusted transversely along carriage 32, by being slid over lip 50 and spacer bar 52, to position drill bits 78 and 80 at the location opposite the position along the long edge face of the door where they are to be operated to form the bolt holes in the door and that jamb respectively. Thus, with the door and that jamb in the same lengthwise relationship to one another as they are to have when finally assembled for use, drill bits 78 and 80 can drill out the separate bolt holes in the door and jamb respectively in the precise relative positions they will need to be in when the door is to be mounted in the assembled door frame.

Bolt and strike plates forming assembly

The bolt plate and strike plate recesses forming assembly 83 (seen in FIGS. 1, 2 and 6) includes a vertical guide plate 82 slidable along and extending transversely across from one to the other of standards 44, adjacent their upper ends. A horizontal plate 84 is slidably supported in relation to plate 82 and projects horizontally outwardly as to it. A second horizontal plate 86 is spaced above plate 84 and fixedly secured to vertical plate 82 and reinforced thereto by side brace plates 88, 88.

Assembly 83 includes means to enable imparting to an operating tool motion vertically, for example, to rout out the height of a recess, as well as outwardly (i.e. into the door and/or jamb) to provide the desired depth of the recess. In addition, where necessary or desired, such means also can allow moving the tool in either direction parallel to the length of the door or jamb to give a recess a desired width greater than the diameter of the tool.

FIGS. 1, 2, 6 and 10 best show an illustrative combination of means, and their operation, of assembly 83. It is vertically slidable as a whole along standards 44 by the provision of the tongue and groove connections between standards 44 and tongues 89 of assembly 83.

To brackets 90, carried on and fixedly secured to outwardly (i.e. away from frame 18) horizontal extensions 91 from the upper ends of standards 44, are secured spring balance housings 92 which house coiled elongated flexible springs 94 extending downwardly from slots 93 (one in each housing) and with their outer lower ends secured to brace plates 88. The counterweighting effect of spring balances 94 facilitates up and down movement of assembly 83 (to an operating level and also during the routing of the bolt and latch plate recess in the door D and the strike plate recess in the jamb J) as well as that to and away from the operating level for operation of its tool, and also enables leaving the assembly at a selected out of the way level, when not in use (FIGS. 1, 2 and 6).

FIGS. 6 and 10 show outer corner posts 96 extending between plates 86 and 84 and fixedly secured to horizontal plate 86. Vertically spaced away from both plates 84 and 86 and extending horizontally from posts 96 to shoes 99 are guide rods 98 which extend through horizontal bores through respective slide blocks 100. Thereby the latter can slide toward and away from shoes 99 (and thus also from the door and jamb to be worked on).

In a horizontal plane intermediate that of rods 98 and lower plate 84 and parallel to the latter, extends rod 102 having at its outer ends rearwardly turned extensions, each passing through its own corresponding bore in its respective block 100 and secured against motion relative to them by nuts threaded onto the outer threaded ends of these extensions. Intermediate its ends, rod 102 extends through a horizontal bore in the upper end of a tongue 104 which depends vertically through an opening 106 in lower plate 84 to shortly below its underside.

Opening 106 is substantially, and even to about fifty percent, wider than tongue 104 is thick, depending on the depth for the recess, thereby to permit correspondingly limited forward and rearward movement of blocks 100 and tongue 104 during the routing of, and thus to predetermine, the depth of the bolt plate and strike plate recesses. For example, on starting the routing of such recess, tongue 104 is positioned as in FIG. 10, and as the router bit advances into the work, tongue 104 also advances toward standards 44. Then when tongue 104 contacts the thus forward limit of opening 106, it is stopped and so halts the advance of the recess router bit to the thus controlled depth.

Tongue 104 ends rigidly secured to the forward wall of a horizontal guide track 108 (FIG. 6) rigidly attached to the underside of the lower plate 84 and longitudinally paralleling platform frame 18. A downwardly open dove-tail groove in guide track 108 slidably receives a correspondingly formed tongue extending similarly along the top of motor-support block 110 embracing motor 112 from which forwardly projects shaft 114 with a router bit at its outer end extending between standards 44 toward the door and jamb.

Recess size guide 116, fixedly horizontally secured to the underside of support block 110, extends parallel to and toward the adjacent long side of frame 18, and advantageously to the extent of part of the thickness of standards 44 (FIG. 6) except at notch 116*a* cut out of guide 116 to let it extend lengthwise and terminate at the outer end of notch 116*a* beyond one of the standards 44 (conveniently the left one as seen in FIG. 1).

For guide 116 to limit the extent of recess routing in the vertical direction (as in FIG. 6), recess size stops 117 and 117*a* are secured to the outer face of standard 44 (the one in FIG. 6 in view of the above chosen location of notch 116*a*). Accordingly, in routing a bolt plate recess 176 in door D, one can start routing with the upper surface of guide 116 touching the underside of stop 117 and in later completing the routing work with the underside of guide 116 contacting the upper surface of stop 117*a*. Thus, recess 176 will be given its selected (actual width) but in the vertical direction as seen in FIG. 6 (corresponding to its actual width when door D later is placed upright in its door frame).

To rout a strike plate recess in jamb J, motor 112 carrying router bit 114 is retracted by drawing back support 110 (as it is suspended from plate 84 and in turn from slide blocks 100 as they slide along guide rods 98). A third stop 117*b* is provided. Support 110 is lowered to a level where the upper limit for the recess can be set by then pushing support 110 toward the jamb and working with the upper surface of guide 116 contacting the underside of stop 117*a* and continuing the routing downwardly and finally completing it with the underside of guide 116 contacting the upper surface of stop 117*b*. Thereby the width of the strike plate recess (184 as seen in FIG. 15) in jamb J is controlled.

For the bolt and strike plate recesses of FIGS. 13 and 15 and also the hinge recesses of FIG. 14, the routing is operated by starting in one direction, say, horizontally parallel to the length (which actually is the upright height) of the door and jamb as held in the apparatus. For doing that support 110 is moved horizontally parallel to the long side of frame 18, for example, starting with the right hand end of notch 116*a* (FIG. 1) of guide 116 contacting the grooved face of the adjacent standard 44, and working the routing along to later finishing with the outer end of notch 116*a* contacting the opposite face of that standard 44. During that operation, just as for the bolt plate recess (p. 12 lines 14–21 above), the upper surface of guide 116 contacted the underside of stop 117.

Horizontal routing then is reversed at the next lower level to return to just under the starting point, and continuing so back and forth and progressively lower until completing the lowest horizontal cut with the underside of guide 116 contacting the upper surface of stop 117*a*. Such rectangular cutting (horizontally progressively lower and lower) is repeated until the advancing face of horizontal guide track 108 contacts tongue 104 (FIG. 1) when the desired depth of the recess is completed.

The foregoing description of major operating assem-

blies relate to operations primarily conducted on what may be referred to on the lock side operations of the apparatus.

Hinge recess forming assemblies

As the opposite side of platform frame 18, are mounted hinge recess-forming assemblies (generally designated 118, FIGS. 1–3) for forming the generally similar pairs of hinge recesses in a door D and jam J, for receiving butt hinges H (FIG. 14). There can be included as many such recess-forming assemblies as are needed for the number of hinges planned to be used along the length (or height, in use) of the door as hung in its frame.

Advantageously all of the hinge-recess-forming assemblies are identical. Generally, they are composed and constructed substantially identically with bolt plate and strike plate recesses-forming assembly 83 including its standards 44, and form recesses similarly to how it does. Therefore, no particularized and extensive description need be given of assemblies 118 and their operation. They have no assemblies 81 and 81*a*, base 32, air motor 36, or runway 39, but have standards 44 fixed to supports on their own side.

However, for making a pair of matching hinge recesses with one in the door in register with the other in the jam, assemblies 118 need no recess stop 117*a*, and both recesses for a pair are made in one continuous operation. Such operation then does not require withdrawing the router bit on shaft 114 by retracting support block 110 after making the recess in the door, before lowering and then advancing it again to make the recess in the jamb.

Instead, that continuous operation merely involves advancing block 110 to begin routing the recess in the door and while so routing advancing sidewise to complete that recess, and then continuing and lowering block 110 till the underside of guide 116 contacts the upper surface of stop 117*b*, and starting routing the recess in the jamb and going on similarly to complete that recess. That provides a pair of recesses as in FIG. 14.

Jamb clamping and door supporting assembly

Pairs of tracks 120 (FIG. 3) are fixedly mounted on platform frame 18 adjacent opposite ends thereof, one pair of tracks being provided adjacent each end of it. These tracks conveniently extend fully from one to the opposite longitudinal edge of frame 18.

Slidably mounted upon each pair of tracks 120 is its own separate pair of blocks 122 spaced apart along the tracks and rigidly connected by a connecting rod 124 extending between them. Each pair of blocks 122 and a connecting rod 124 constitutes upon each pair of tracks 120 separate guide means for an elongated carriage plate 126 extending in a plane paralleling and disposed below the plane of the door to be held in the apparatus. Carriage plate 126 serves as a base from which is suspended the lock-hole boring assembly referred to below.

Carriage plate 126 thus is mounted for slidable adjustment transversely of platform frame 18. In carriage plate 126, intermediate the ends and nearer assembly 83, is an elongated slot 128 extending longitudinally of plate 126. The outer side wall of slot 128 is defined by an upwardly projecting abutment wall or plate 130 providing an abutment for one side of a jam J to be clamped against it on the key side.

Door lock-hole forming sub-assembly

Depending from carriage plate 126 is a door lock-hole forming assembly generally designated 132 (FIGS. 2, 6 and 8), supported between depending vertical curtain walls 134 fixedly secured to carriage plate 126 and abutment plate 130. Fixedly connected between walls 134 are vertically spaced apart, horizontal track bars 136.

An L-shaped arm 138 (FIG. 6), fixedly connected to track 22, and having a slot receiving a lug 140 carried by one of curtain walls 134, allows limited transverse adjustment of carriage plate 126. This serves to locate

lock-hole forming assembly 132 a selected distance inwardly from the adjacent edge of a door to be worked on for forming a lock-hole at a desired location in it.

Assembly 132 includes a frame 142 (FIG. 8) having vertically spaced apart arms 144 at each side of it. Frame 142 also includes a vertically disposed outer or front plate 146 receiving the outer end portions of arms 144. Beyond the plane of plate 146, arms 144 have depending extensions 147 confronting upwardly projecting extensions 148 rigidly secured to plate 146 to cooperate with arm extensions 147 to form slot openings receiving track bars 136.

This above arrangement supports frame 142 depending from carriage plate 126 for adjustment longitudinally as to platform frame 18, so that the lock-hole can be formed at its selected location along the length of the door.

A frame 154 (FIG. 8) is disposed vertically in frame 142. and a motor 150, with its shaft 152 extending upwardly from it, is slidably mounted upon frame 154 for adjustment in a vertical direction, by means of rods 155 slidably engaged in openings formed in frame 154 and secured to the motor casing. Means can be employed, such as a foot treadle (not shown) or an air-motivated piston-and-rod-bearing positioner (not shown) such as air-motivated cylinder 54 (FIGS. 1 and 2), for shifting motor 150 upward to provide a corresponding upward movement of drill bit 156 secured to the upper end of motor shaft 152.

Jambs and door supporting means

Abutment wall 130 holds means for bearing against the adjacent surface of door jamb J (see FIG. 6) which is to have a bolt hole and striker plate recess, and to hold it in place against standards 44. That means includes one or more plungers 158, each having a head 160 slidable in a housing 162 mounted in abutment wall 130, and backed by a spring 164 held under compression within the housing and bearing against the plunger head normally to urge the plunger outwardly from the abutment wall against the jamb J.

Means also is provided to support the other side jamb (for receiving hinge recesses) for the door frame, along the side of the platform where the hinge recess forming assemblies 118 are mounted. This means (seen best in FIGS. 2 and 3) includes relatively short, vertically disposed abutment plates 166 spaced apart longitudinally adjacent the long side of platform frame 18 and secured by side braces 168 to plates 169 which are fixed to respectively adjacent blocks 122. Abutments 166 thus are interconnected to carriage plate 126 for unitary movement with it, thereby to set the space between both of the side jambs for the door frame. Such interconnection can be fixedly adjustable to the width of different doors.

Extending longitudinally on opposite long sides of platform frame 18 are elongated support bars 170 and 172 (see FIG. 2). These support the opposed jambs J for the door frame while the operations are being performed on them. Bars 170 and 172 are relatively narrow in width to permit vise-like clamping of each jamb to its respectively adjacent standards 44.

In using the apparatus, one jamb J is placed with a long edge resting on bar 170 and with its header frame-receiving slot facing outwardly (i.e. toward the outside of the apparatus) with the vertical yet shorter arm of the L-shaped stop 173 engaged in the upper part of said header frame-receiving slot and with the extension from the upper outer end of that arm of stop 173 resting on the surface of the top of the end portion of that jamb beyond that slot.

The other jamb is placed similarly on bar 172 along the opposite side of the apparatus, with its header frame-receiving slot directly opposite that slot of the first jamb and also facing outwardly (from its own side) and with another stop 173 similarly inserted in the upper part

of its slot with the upper outer end extension of the stop similarly resting on the corresponding part of that second jamb. The door then is supported flatwise (about the distance of the outside diameter of a door hinge pin sleeve) above the jambs and on top of abutment wall 139 and plates 166, and with its end which is to be its top abutting against the upright ends of the outer extensions of stops 173, all as seen in FIG. 1.

The jambs and door then are held fixed in suitable working position relative to one another, by operating the compressed air-motivated positioning cylinder 54 (as explained in the second paragraph before the description of the "bolt and strike plates recess-forming assembly") to advance standards 44 of assembly 81 to clamp the jambs and also the door in such position.

While FIG. 1 shows only one stop 173 (i.e. on the side adjacent assembly 83), it is desirable to have a corresponding one on the other long side of the apparatus (as seen in the lower right hand corner of FIG. 3). The upper outer end extensions of stops 173 position what is to be the upper end of the door (when installed) in proper relation to what is to be the underside of the header frame. While stops 173 are used at one end of the apparatus for finishing left-hand doors, by providing corresponding attachments for them, they may be transferred to the other end for use when finishing the right-hand doors.

With the jambs and door so supported, the knob-lock hole, bolt hole, bolt plate recess, and hinge recesses of the door D can be formed by suitable substantially simultaneous operation of the corresponding respective tool-operating assemblies of the apparatus; and with substantially concurrently routing out of the striker plate recess, bolt hole recess, and hinge recesses on the respective jambs.

For performing these various foregoing operations, the several individual drill bits and router bits can be located selectively at such particular positions, and be made of such respective shaft lengths, suitable to enable producing the particular specifications for these various holes and recesses by the operation of these tools over their movement distances respectively provided by the settings of the different forming size guides included in the apparatus.

There is a certain flexibility in the order in which the various tool operating assemblies of the apparatus can be used, influenced in a measure by whether two operators, one for each side, or only one operator, will be used, and the location of the controls for all of the operations within the reach of a sole operator to run all at the same time so long as enough are automated, for example, as already described.

Drill bits 78 and 80 will need to be run in sequence respectively by tool-operating assembly 81*a* and assembly 132 which is operated to form the knob-lock hole.

Thus, for example, it may be advantageous first to form the knob-lock hole. For that, assembly 132 is shifted longitudinally of carriage plate 126 relative to the location selected for the lock hole along the length of the door. Carriage 126 then is adjusted transversely of the door to position drill bit 156 the required distance inwardly from the adjacent long edge of the door. Then, by starting motor 150 and raising it (e.g. by compressed air motivated cylinder), drill bit 156 is advanced from its lower position toward the door and will pass upwardly through it (see FIG. 6) to bore through it lock hole 174.

While lock hole 174 is being formed, hinge-forming assemblies 118 could be operated to rout out of the opposite long edge of the door and its adjacent jamb pairs of hinge recesses (e.g. with one recess 180 in the door, FIG. 14, and its associated recess 182 in the hinge receiving jamb for the door frame). Then, while one operator proceeds to insert the leaves of the butt hinges H in their respective recesses and to screw-fasten them to the door and jamb, another operator, after boring of the lock hole is completed, can be occupied on the lock side of the apparatus with tool assembly 81*a*.

There this operator can work the treadle to open the treadle-operated valve connected with the compressed air source (not shown), whereby compressed air enters the advance-motivating port of air-cylinder motor 54 (FIGS. 1, 2 and 4). At the same time the switch is closed to start motor 60 and thereby, through gear box 64, set in operation drill bits 78 and 80 to bore out simultaneously the bolt hole 178 to communicate with lock hole 174 in door D and the bolt-end-receiving hole 186 in jamb J (FIGS. 2, 11–13 and 15) until bits 78 and 80 reach their respective positions seen in FIG. 11. The treadle-operated two-way valve then is reversed to allow the compressed air to enter the assembly-retracting port of air-motivated cylinder 54 to withdraw drill bits 78 and 80.

As assembly 81*a* is being withdrawn, an operator can be lowering tool assembly 83 (from an elevated out of the way position), so that when drill bits 78 and 80 are out of the way, bolt plate or latch-mechanism recess 176 can be routed in that long edge of door D by router bit 114. For that, assembly 83 is adjusted to set router bit 114 to its proper elevation and then manipulating motor-support 110 upwardly and downwardly sufficiently while motor 112 operates router bit 114 to rout out recess 176 to the selected depth and width in door D, with the assistance of guide 116 and stops 117 and 117*a* (as described above). Support 110 can be adjusted longitudinally of the door as may be needed to give that recess any desired greater length (see FIGS. 2, 6 and 13).

Motor support 110 then is retracted to withdraw router bit 114 from recess 176 and lowered for the top surface of guide 116 to be able to contact the under surface of stop 117*a*. Then bolt plate recess 184 is routed out of the adjacent jamb J (FIGS. 6 and 15).

Alternatively, the treadle which operates the two-way valve controlling the air flow to the air-motivated cylinder for raising motor 150 of tool assembly 132 toward the underside of the door, can be arranged also to close a switch for operating motor 150, and be located with its operating pedal near enough to the hinge side of the machine to be operated by foot from that side. Then a single operator can operate that treadle by foot to raise tool assembly 132 and start motor 150 to operate drill bit 156 to bore out the knob-lock hole, while at the same time operating tool assembly 118 to rout out hinge recesses on the hinge side of the door and its adjacent jamb.

When knob-lock hole 174 is completed, its tool assembly 132 can engage a limit switch to close a circuit to energize a solenoid to operate the two-way valve (all not shown) to admit compressed air in the port of the withdrawal-activation part of the air-motivated cylinder to retract assembly 132.

Retraction of assembly 132 then can set a switch which closes the circuit to energize a solenoid to operate the treadle which operates the two-way valve (all not shown) for controlling the air supply to air-motivated cylinder 54, to allow compressed air to enter the port of its advance-motivating part. At the same time that circuit can energize motor 60 so that as tool assembly 81*a* is advanced drill bits 78 and 80 can bore out the bolt holes 178 and 186 respectively in the door and adjacent jamb. In the meantime, the operator has been completing operation of hinge recess tool assemblies 118 in routing out hinge recesses on the hinge side of the door and its adjacent jamb, and has been inserting screws in, and screwing down, the hinges in their recesses.

When bolt hole drilling tool assembly 81*a* has advanced the distance for which its piston advance is set, drilling of the bolt holes in both the door and its adjacent jamb is completed. At that moment, assembly 81*a*

can close a limit switch (not shown) in a circuit which excites a solenoid to turn the two-way valve to allow compressed air to enter the retraction port of air-motivated cylinder **54** thereby to withdraw tool assembly **81***a*.

The operator, then finished with installing the hinges, can come around to the lock side of the apparatus and operate tool assembly **83** (in the manner earlier above described) to rout out the bolt plate recess in the door and the striker plate recess in the jamb, if that in the meantime was not done by another operator or automatically.

The expression a "building door" used herein in the appended claims embraces any door to be mounted in a door frame and for use in any part of any building, through the doorway of which door a person might walk.

The combination of latch-mechanism recess **176** and bolt hole **178** and also the combination of strike or bolt plate recess **184** and bolt hole **186** are not to be restricted to their respective forms shown in FIGS. 13 and 15. Instead, each of latch-mechanism recess **176** and strike or bolt plate recess **184** can be bored out in the form of a counter-bore concentric with bolt holes **178** and **186** respectively, and the largest radius of the counter-bore can be greater than the distance from the center of bore hole **186** to the nearer edge of the jamb (e.g. near numeral **186** in FIG. 15) whereby the outermost level of the counter-bore will intersect that edge and so cut a broken circle with a cord at that edge, beyond which the strike edge of the corresponding substantially circular strike plate will extend when installed.

While the invention has been explained by detailed description of certain specific embodiments of it, it is understood that various modifications and substitutions can be made within the scope of the appended claim which is intended also to include equivalents of the specific embodiments.

What is claimed is:

Apparatus to enable producing relatively simultaneously in a door and the jambs for a frame for it the required recesses and holes for receiving the respective door hanging and locking hardware in their respectively required locations, to allow assembling the door in its frame merely by fitting said hardware in place and securing the necessary parts of the frame and the hardware, which apparatus comprises

support means for releasably supporting a door in a fixed position;

means for releasably supporting a hinge-receiving jamb on one long edge thereof and adjacent a long edge of the door and with the width of the jamb positioned perpendicular to the door and aligned with said adjacent long edge thereof;

a plurality of hinge leaf recess routing mechanisms each separately respectively enabling routing a pair of complementary hinge leaf recesses one of each pair of said recesses to be routed in said aligned long edge of the door and the other recess of each pair to be routed in the aligned outer surface of said adjacent jamb;

means for boring a lock-hole in its required location in said door, said boring means being so located to enable it to carry out said boring at said location in said door;

door lock bolt hole boring means for boring through the edge of said door adjacent said door lock-hole a door lock bolt hole to communicate with said door lock-hole, said door lock bolt boring means being so located to enable it to carry out said boring operation at said location in said edge of the door; and

means for releasably supporting a lock-side jamb; and

strike-plate and bolt receiving hole boring means to enable boring in a said lockside jamb a strike-plate and bolt-receiving hole, said means being so located to enable it to carry out said boring operation at a location in said lock-side jamb to enable it to receive the locking end of the door lock bolt when said door and jamb are assembled in their frame.

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