

Feb. 6, 1951

J. K. EICHELBERGER

2,540,106

NAILING MACHINE

Filed June 3, 1946

6 Sheets-Sheet 1

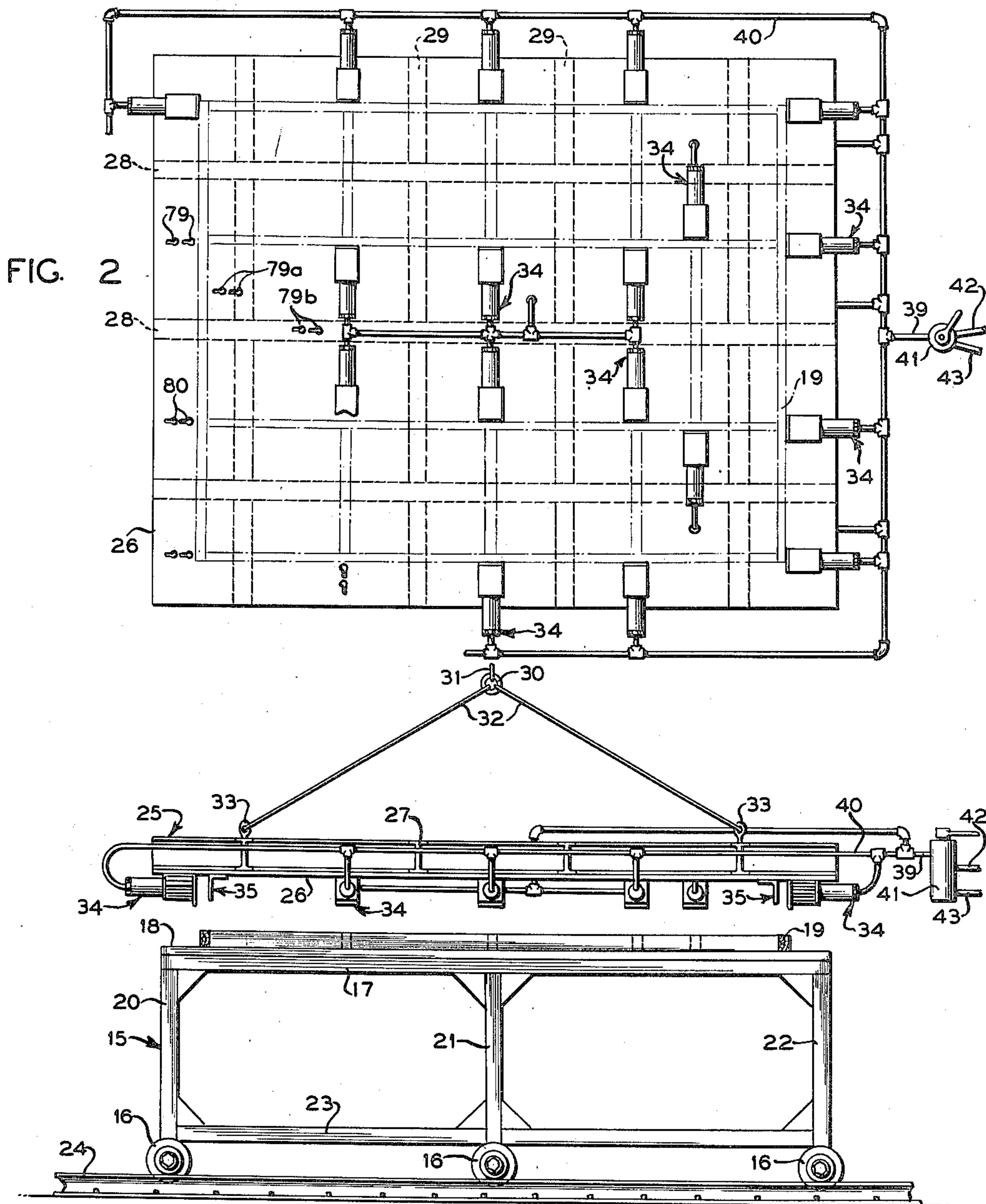


FIG. 1

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FIG. 4

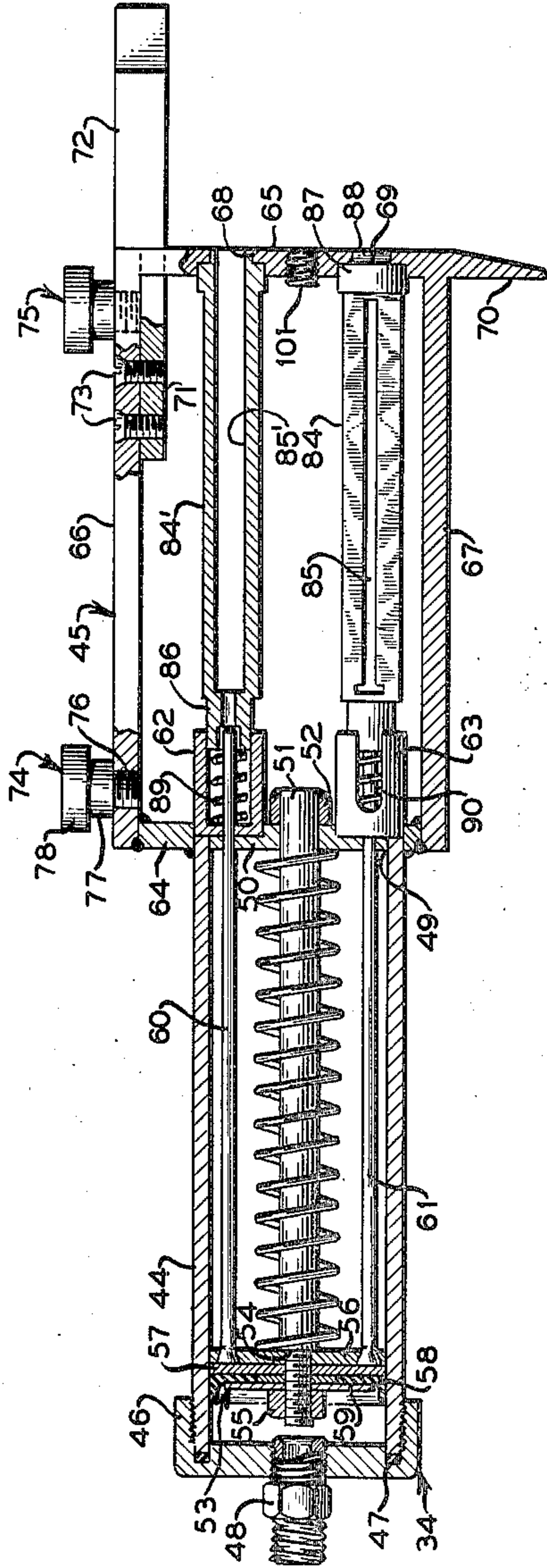
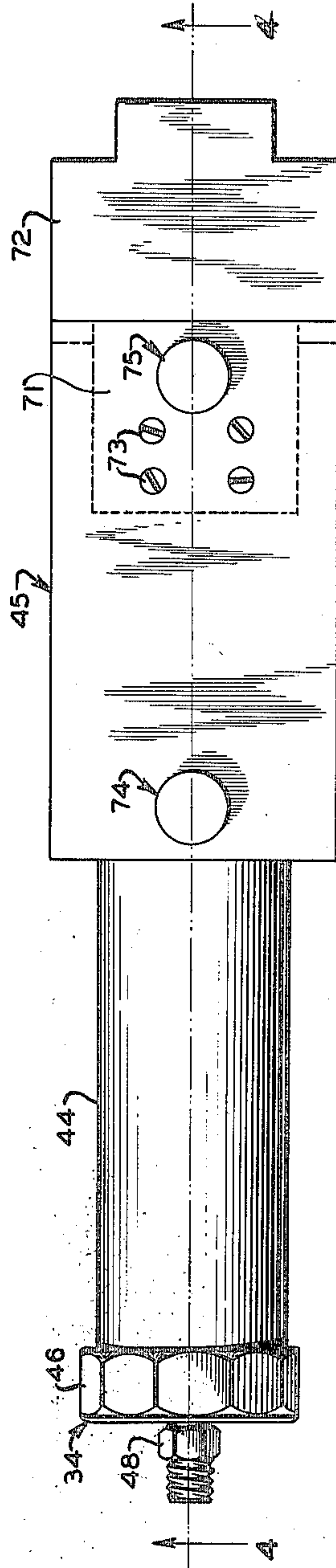


FIG. 3



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FIG. 13

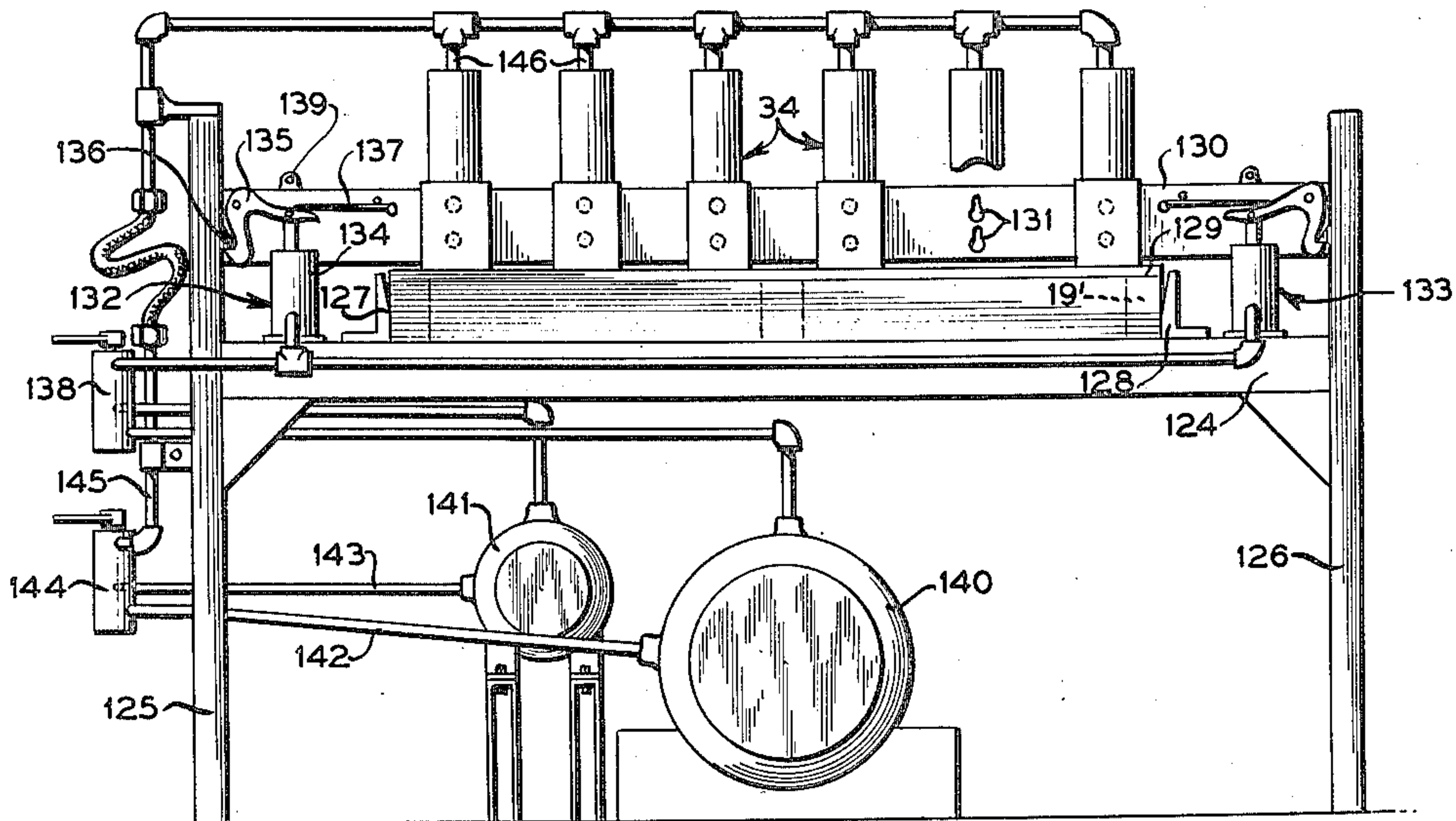


FIG. 5

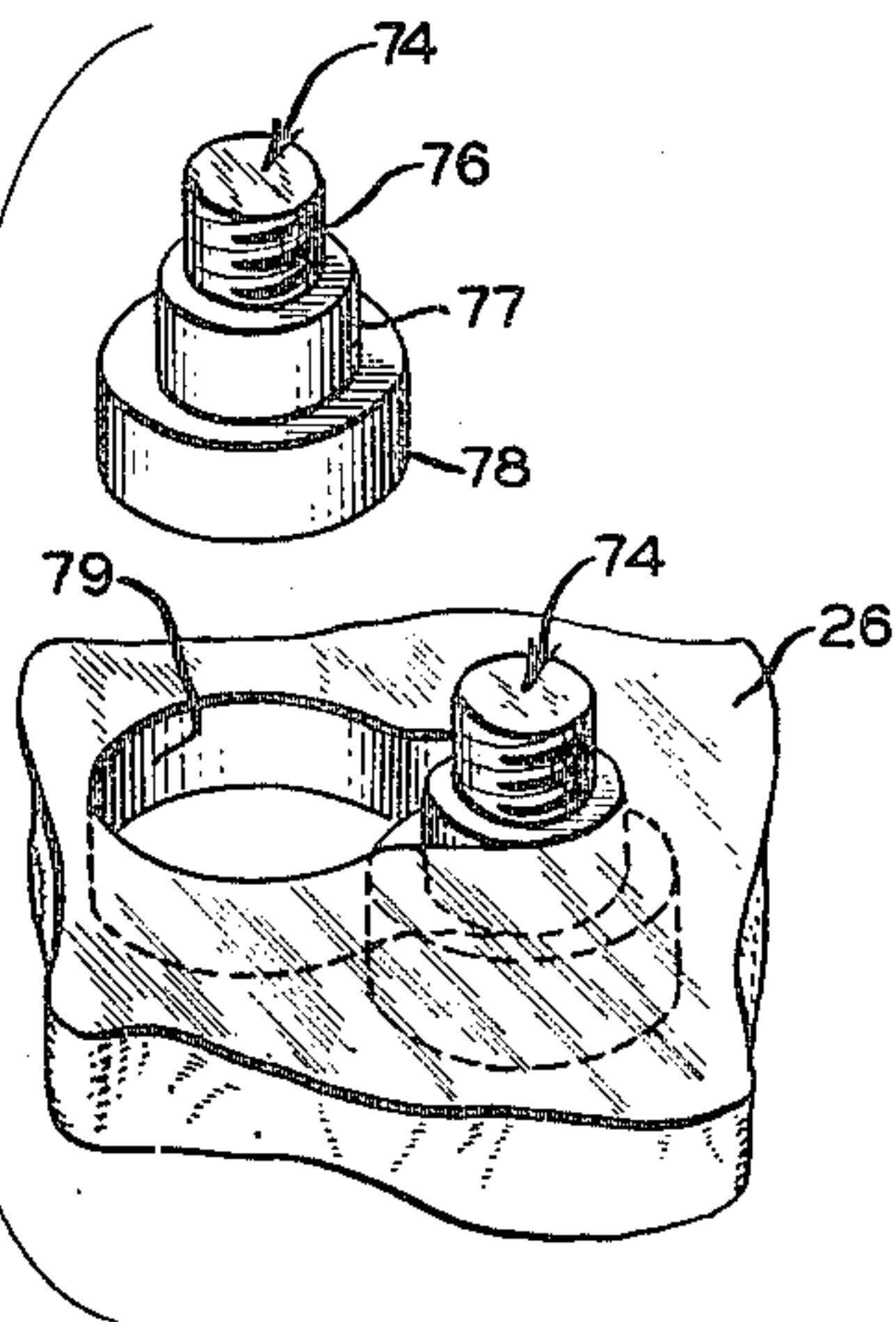


FIG. 11

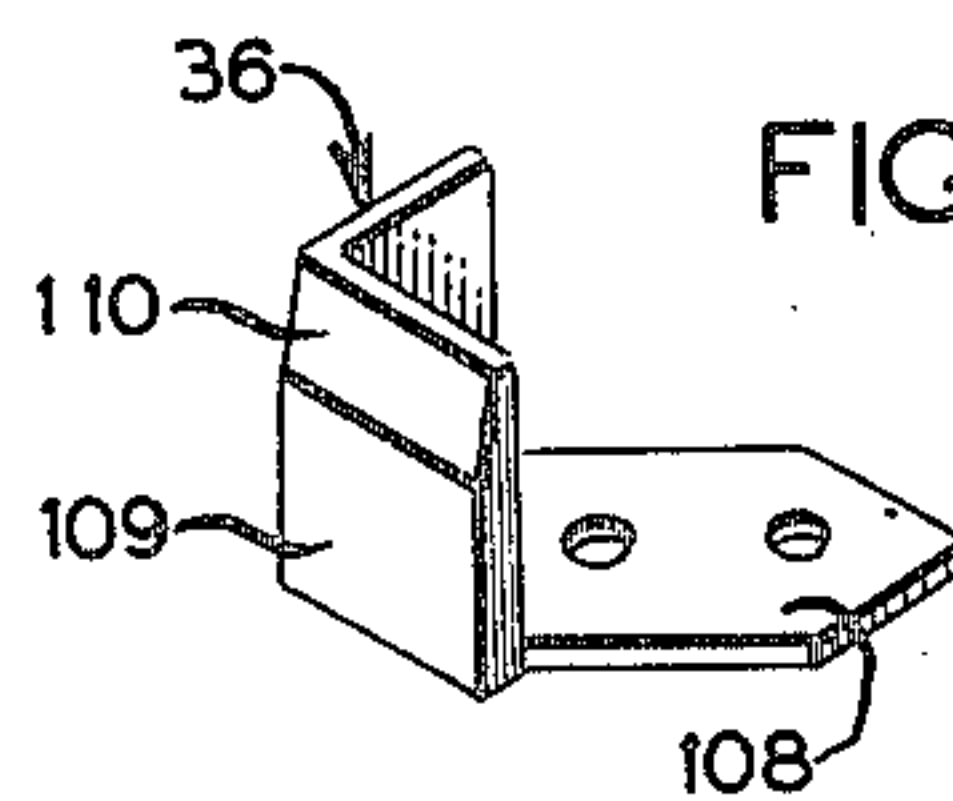
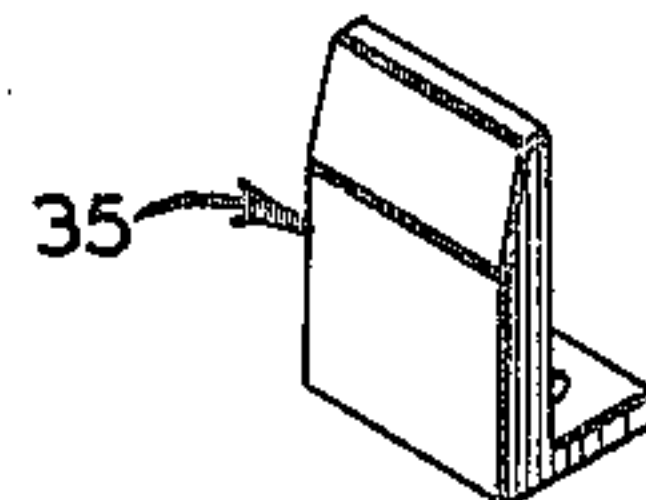


FIG. 12



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FIG. 7

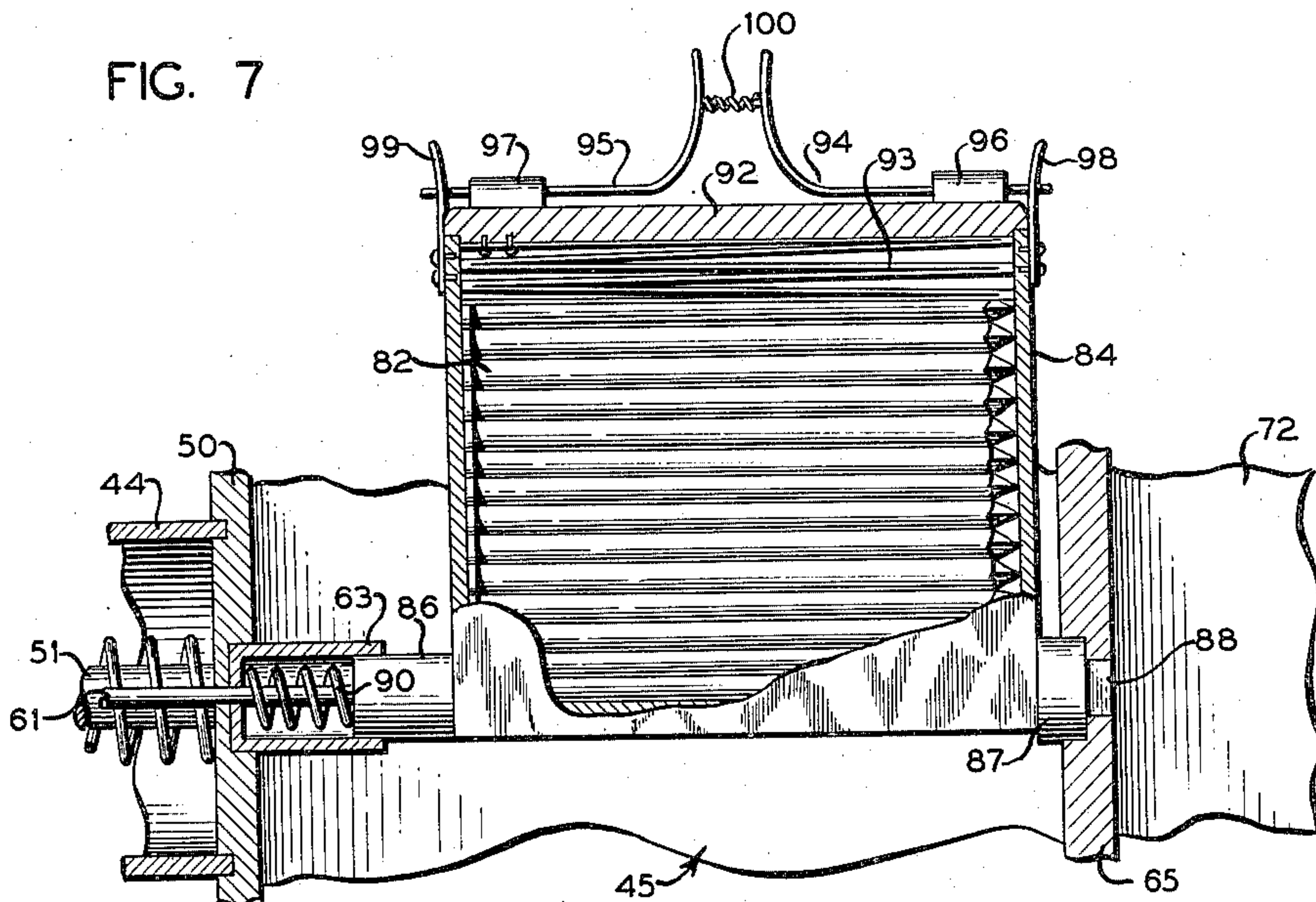


FIG. 6

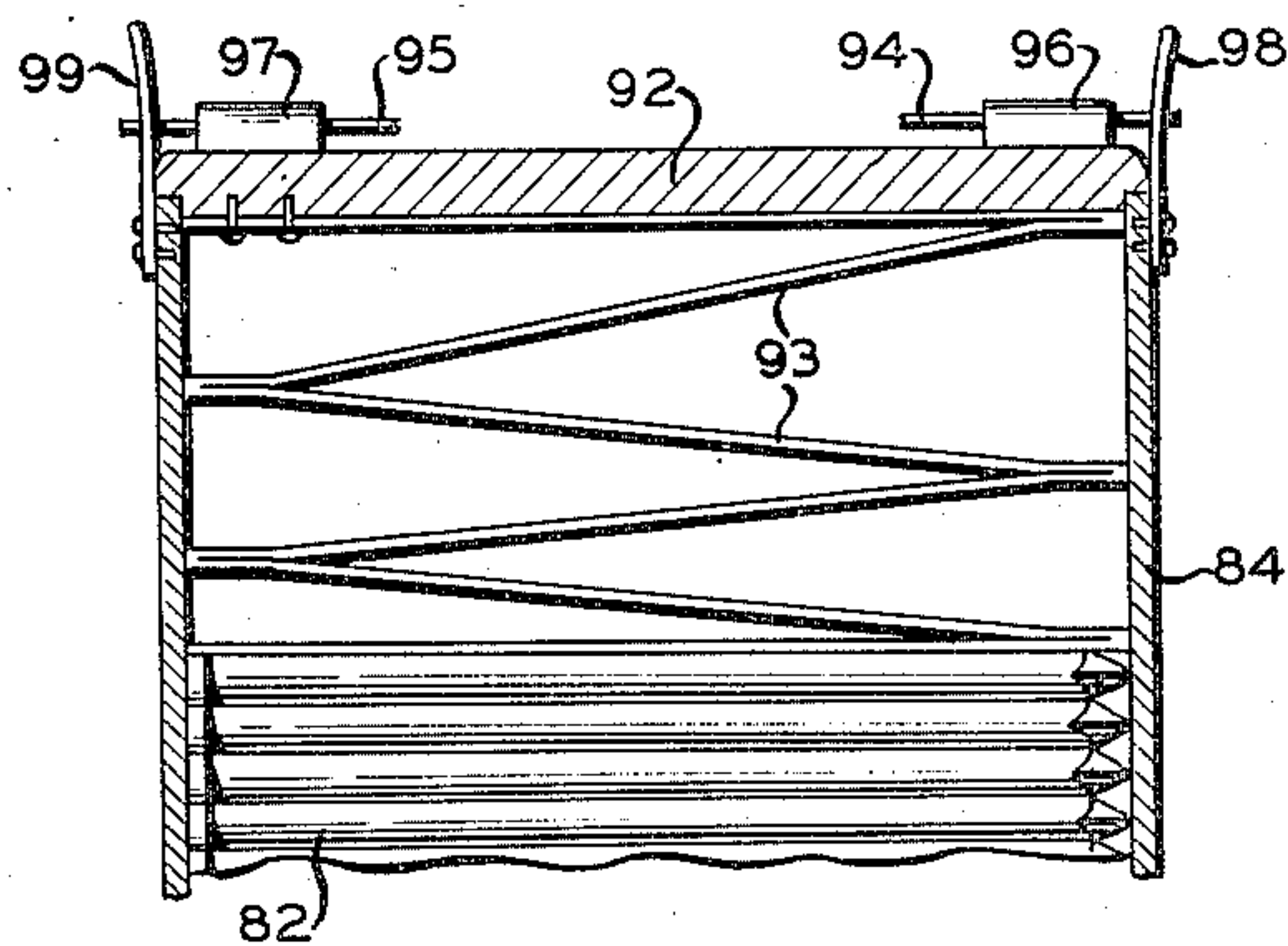
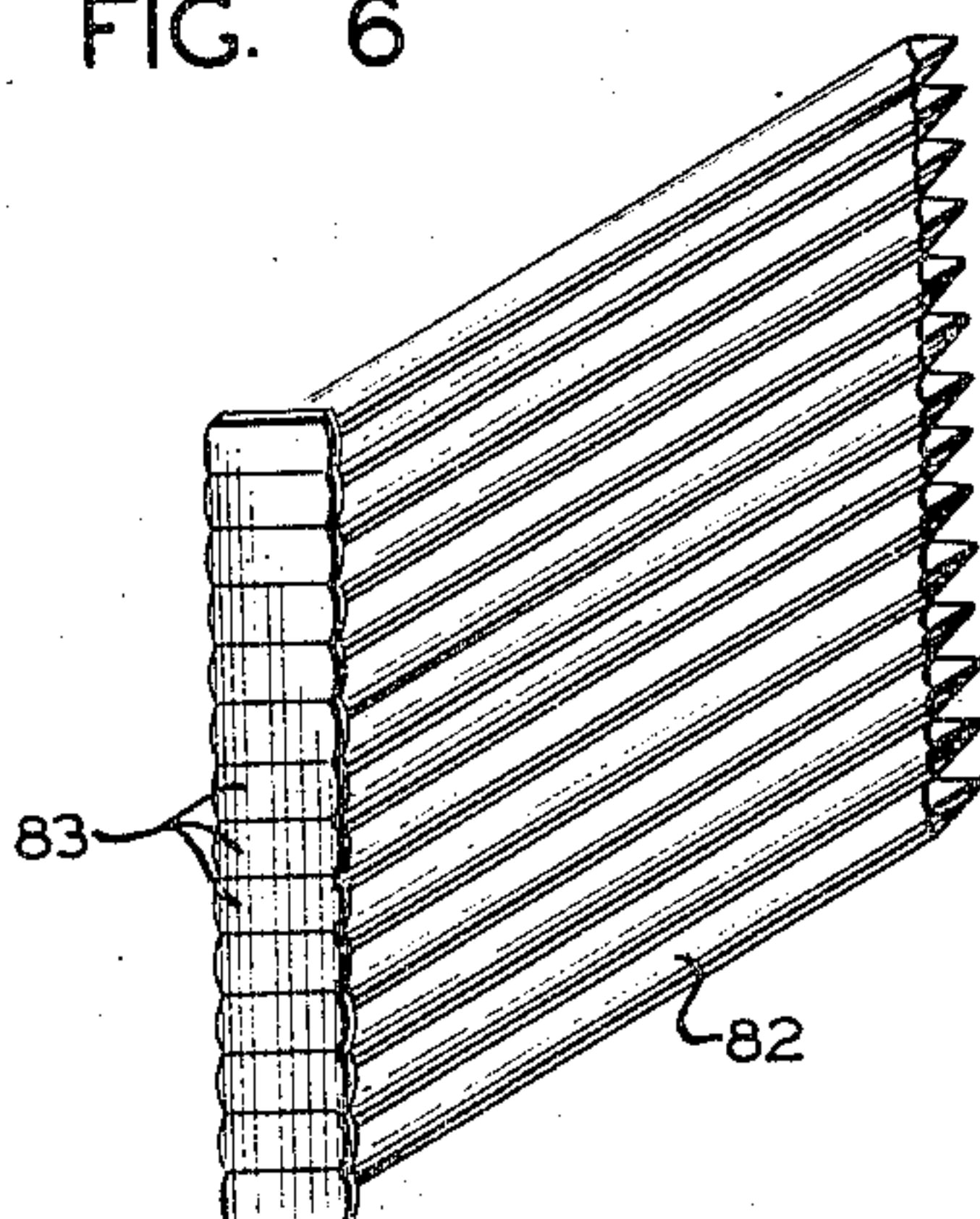


FIG. 8

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FIG. 9

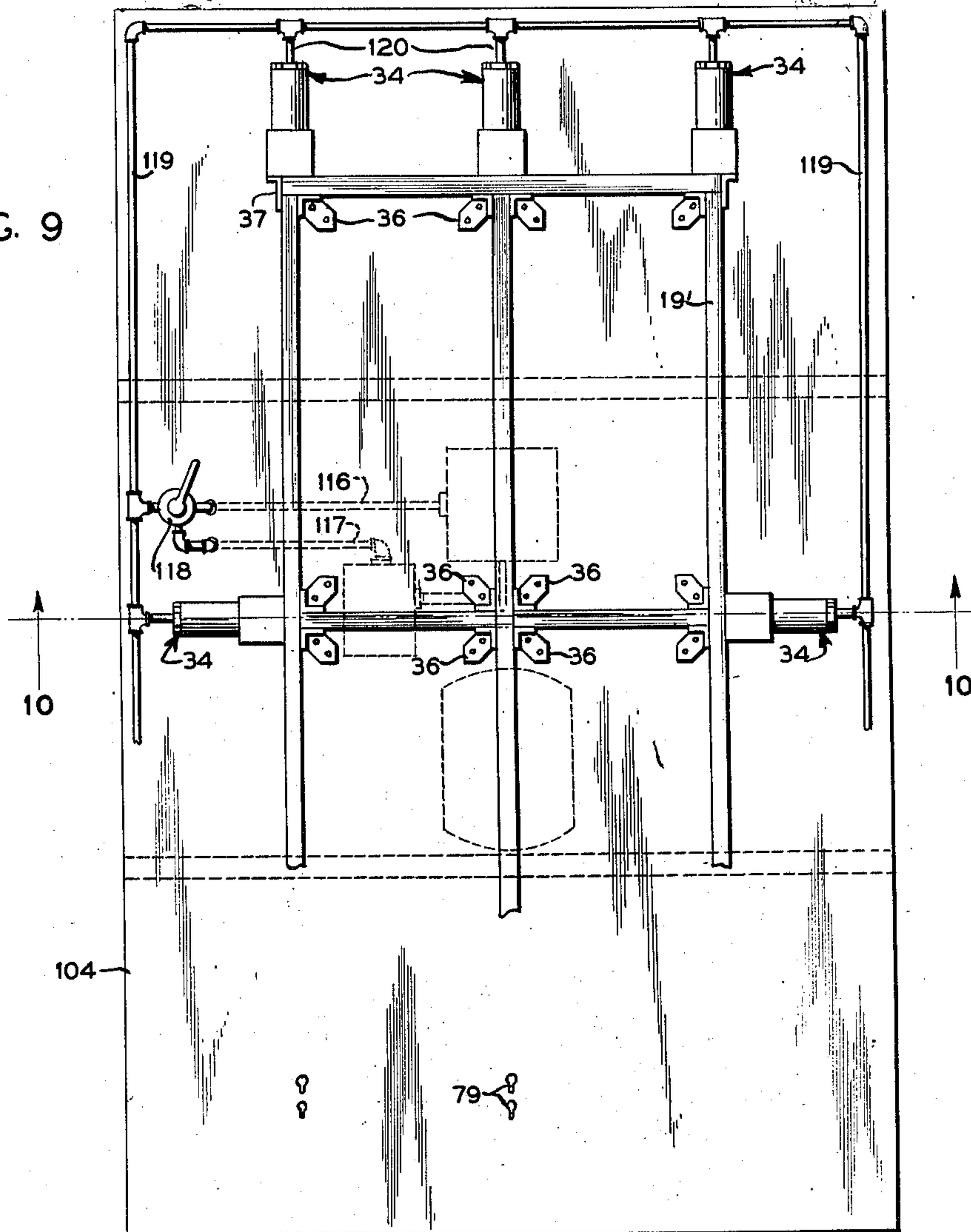
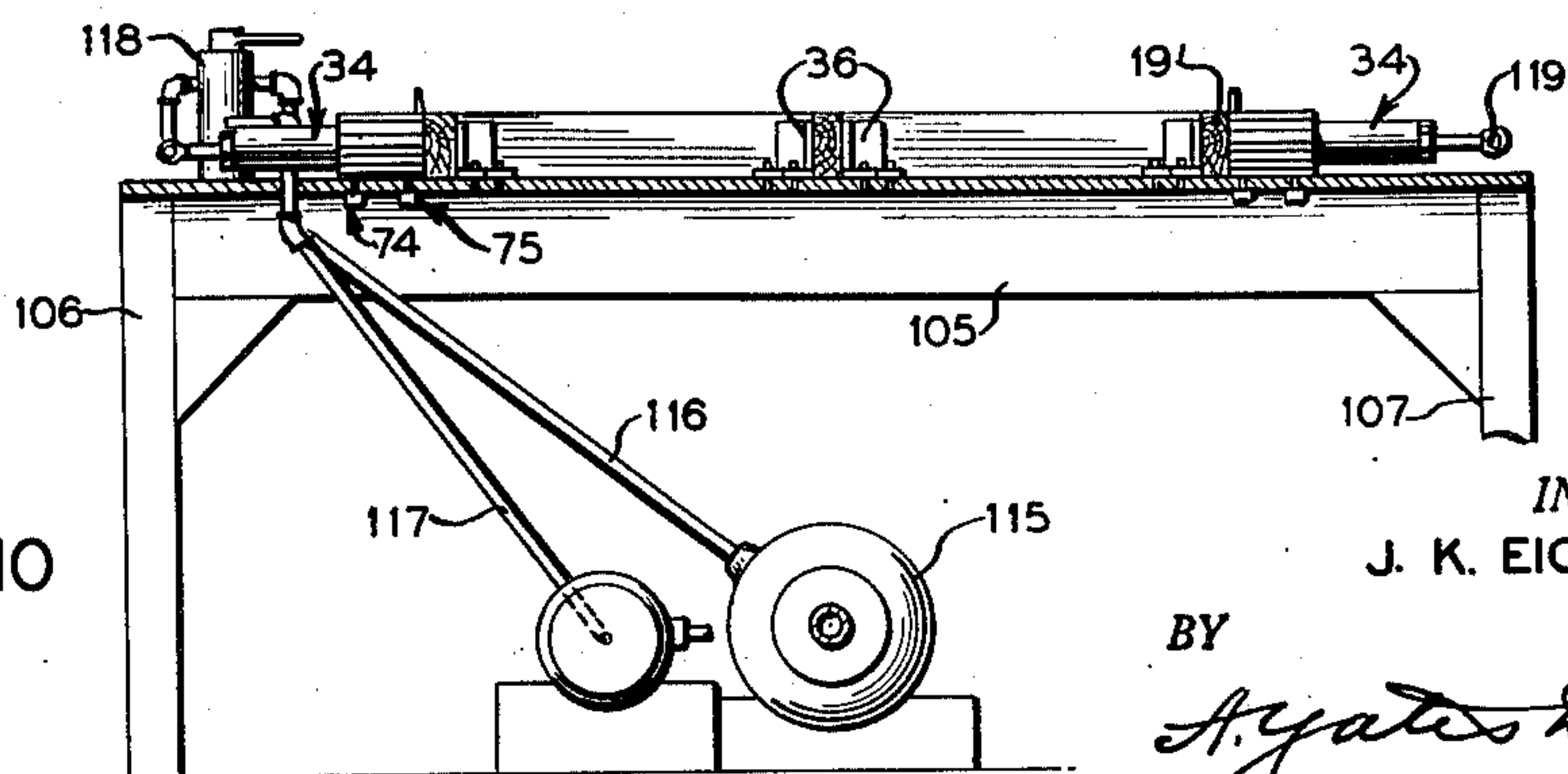


FIG. 10



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FIG. 16

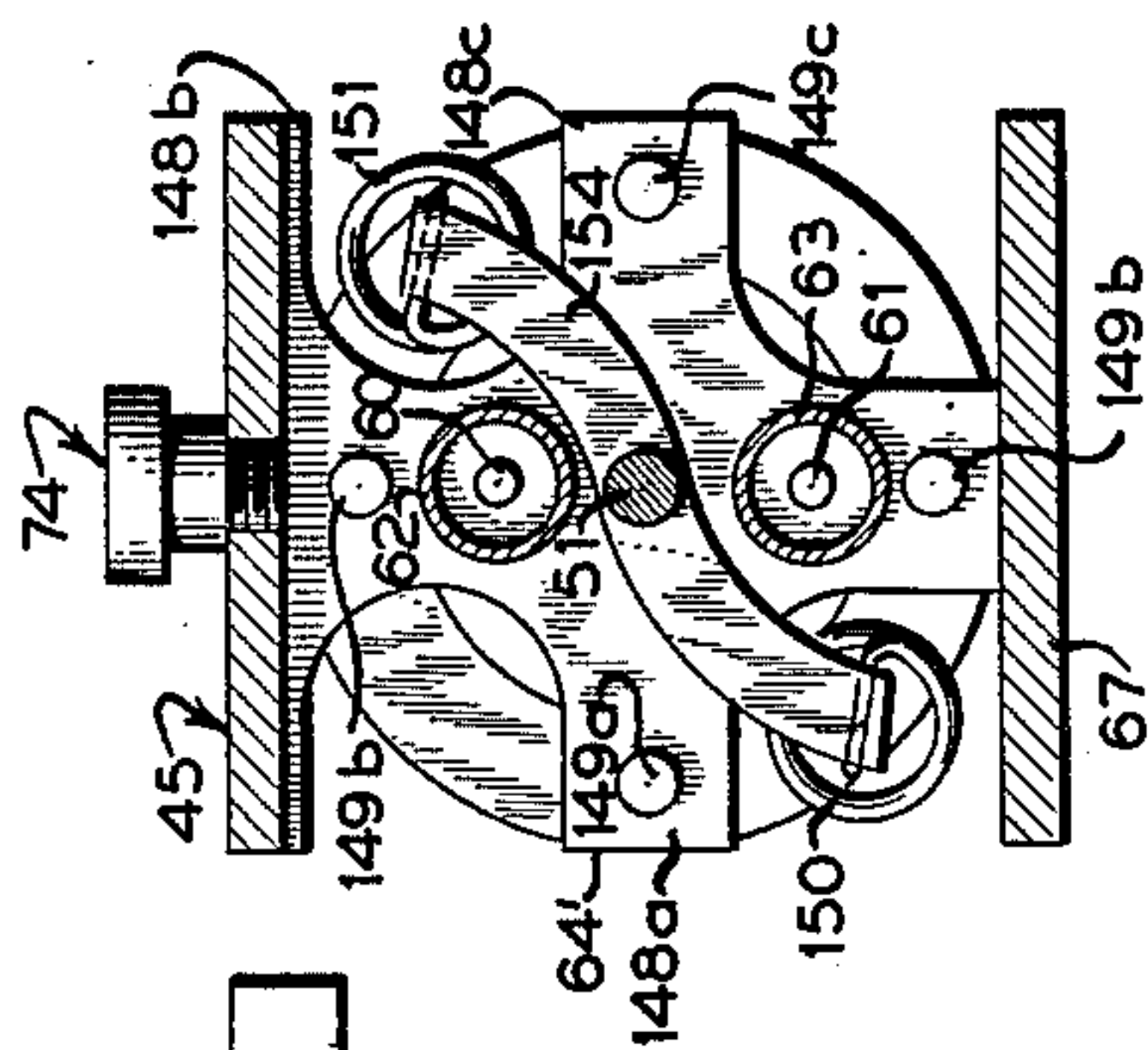


FIG. 15

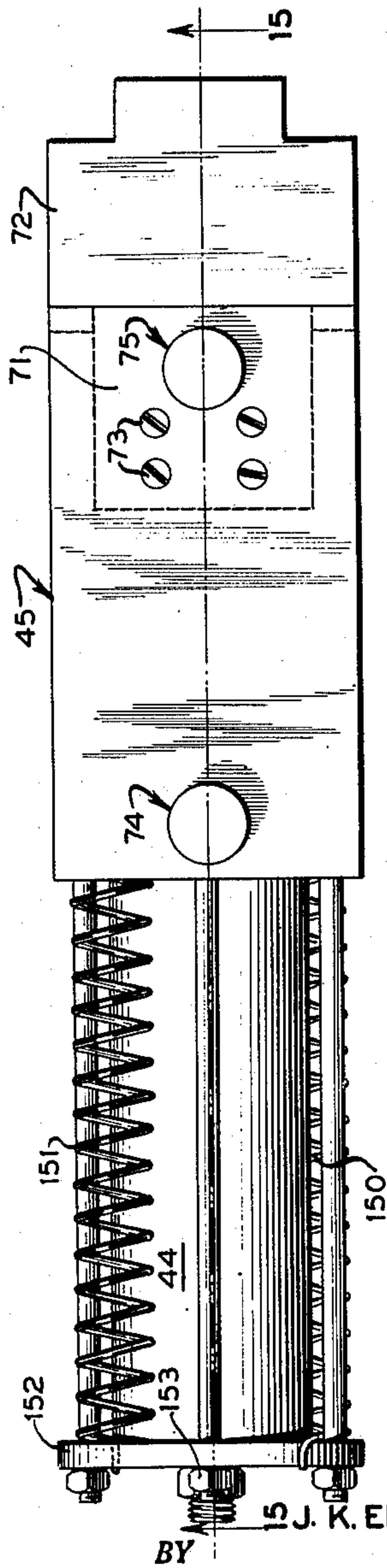
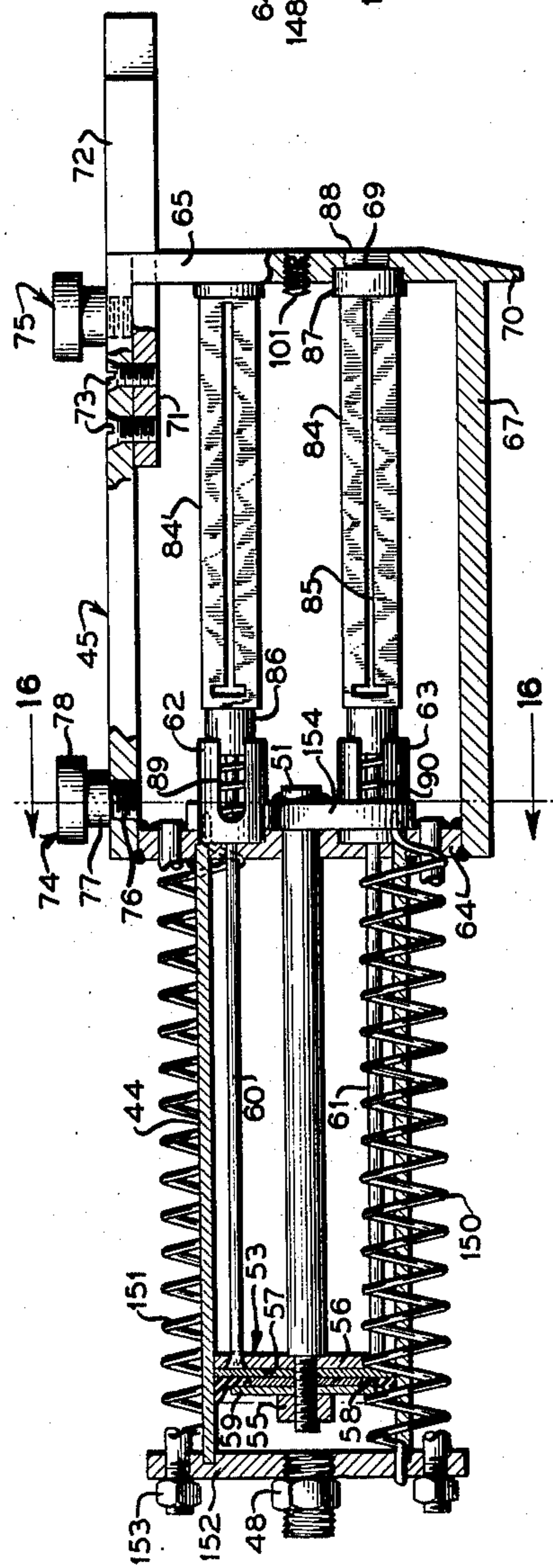


FIG. 14

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UNITED STATES PATENT OFFICE

2,540,106

NAILING MACHINE

James K. Eichelberger, Austin, Tex.

Application June 3, 1946, Serial No. 674,008

12 Claims. (Cl. 1—1)

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This invention relates to an improved method and to improved apparatus for constructing building elements such as prefabricated wall sections or panels, and particularly to an improved method and improved apparatus for securing together the various components of such sections.

A great deal of attention is being directed at present to the provision of prefabricated buildings particularly for homes and the smaller industrial and storage buildings. The building of small and medium size prefabricated homes is of major importance in view of the current national housing shortage as such homes can be assembled on location in a very short time by a small amount of skilled labor and at a cost substantially below the cost of conventional, on location construction.

In order to maintain the costs at a minimum and obtain maximum production, methods are being devised for using standardized materials for all the necessary sections and for manufacturing the sections and assembling them into completed buildings with a minimum amount of hand labor.

In my previous application Serial Number 648,149, filed February 16, 1946, now Patent Number 2,487,019, for Panel Fabrication I have disclosed an improved method and improved apparatus for securing the side or cover components to frames to provide complete building sections. The present invention deals particularly with the construction of the frames although it may be used to advantage for other purposes such, for example, as securing the side covers to the frames in those cases where it is desired to nail the covers in place.

It is therefore an object of the present invention to provide an improved method and improved apparatus for assembling and securing together the members constituting the frames of prefabricated building wall panels.

A further object resides in the provision of improved frame assembling apparatus including an assembly jig for the frame members and power operated nailing means for securing the frame members together in assembled relationship.

A still further object resides in the provision of an improved automatic nailing machine arranged to simultaneously drive nails at a plurality of different locations and having features of adjustment whereby it may be adapted to changes in the position of the nailing locations.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a side elevational view of an assembly apparatus illustrative of the invention;

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Fig. 2 is a bottom plan view of the upper member of the apparatus illustrated in Fig. 1;

Fig. 3, an elevational view of a nail driving unit constituting a component of the assembly unit shown in Fig. 1;

Fig. 4, a longitudinal sectional view of the nailing unit shown in Fig. 3, taken on the line 4—4 of Fig. 3;

Fig. 5, a detailed view of a fragmentary portion of the apparatus showing the manner of attaching the nailing units to the member on which these units are supported;

Fig. 6, a perspective view of a stack of mutually attached nails as used in the nail feeding magazine of the apparatus;

Fig. 7, a sectional view of the nail feeding magazine showing a stack of attached nails in place therein;

Fig. 8, a view similar to Fig. 7, showing the magazine after a portion of the nails in a stack have been used;

Fig. 9, a top plan view of a modified form of nailing apparatus;

Fig. 10, a view partly in section substantially on the line 10—10 of Fig. 9;

Fig. 11, a perspective view of one form of positioning element used to hold structural elements in proper position during assembly;

Fig. 12, a perspective view of a guide element for the nailing apparatus;

Fig. 13, a side elevational view of a further modified form of assembling apparatus;

Fig. 14, an elevational view of a modified form of hydraulic nail driving unit;

Fig. 15, a longitudinal sectional view of the modified unit shown in Fig. 14; and

Fig. 16, a transverse sectional view on the line 16—16 of Fig. 15.

With continued reference to the drawings and particularly to Figs. 1 and 2, the assembly apparatus comprises a movable table or platform, generally indicated at 15, supported on wheels or rollers 16. This table may conveniently comprise a top frame 17 of grid form firmly secured to the under surface of a flat plate 18 having an area greater than the platform area of a structural frame 19 the elements of which are arranged on the upper surface of the plate 18 for assembly into a completed frame or similar device. The grid frame 17 may be supported on a plurality of vertical columns, three of which are shown in Fig. 1 and indicated at 20, 21, and 22 and these columns may be braced at their lower ends by suitable longitudinal frame members as indicated at 23. The rollers or wheels 16 are journaled at or adjacent to the lower ends of the respective vertical columns and are preferably guided by a suitable track 24 so that the table with frame members to be assembled located thereon may be brought to a definite pre-

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determined position relative to a suspended nailing apparatus, generally indicated at 25.

The nailing apparatus comprises a flat plate 26, preferably of steel or other hard metal, to the upper surface of which is secured a reinforcing grid frame 27 composed of structural iron members, such as channel irons or I-beams, arranged in two sets of parallel members as indicated at 28 and 29 in Fig. 2, the members of the two sets being disposed at right angles to each other. The nailing mechanism is suspended by suitable means, such as the ring 30, from an electric or mechanical hoist by a suitable chain or cable 31. The members 32 of a sling or bridle are connected to the ring and have their ends connected at spaced apart points to the frame 27 by suitable means such as the rings or eyes 33.

A plurality of nail driving units, generally indicated at 34, and illustrated in detail in Figs. 3 and 4, are secured to the under surface of the plate 26 opposite respective nailing locations, and suitable guide and positioning means, as indicated at 35 and particularly illustrated in Fig. 12, are secured to the under surface of plate 26 and extend downwardly therefrom.

Positioning elements 36 as illustrated in Fig. 11, are secured to the plate 18 and extend upwardly from the upper surface thereof in position to provide a jig for proper assembly of the elements of frame 19. The application of these positioning elements to the plate is particularly illustrated in Fig. 9 wherein the positioning elements are shown in position at the corners where the elements of the frame come together. The outer frame corners are supported by suitable angular members 37.

When it is desired to secure the elements of a frame together, the table 15 with frame elements in position for assembly thereon is moved into proper position under the nailing device 25 and the device 25 is then lowered into operative position over the frame elements. This will bring the various nail driving units 34 into operative position opposite the nailing locations of the frame and the depending guide members 35 in position to hold the nail driving units in proper operative position and also counteract at least in part the nail driving force applied to the frame elements.

As shown in Fig. 2, there are a number of nail driving units secured to the plate 26, one unit being disposed opposite each frame joint into which nails are to be driven.

The positions of the elements of the illustrated frame are indicated by phantom lines in Fig. 2. The frame indicated is the frame of a comparatively large building wall panel having a doorway therein. The inner group of six nailing members is positioned within the doorway opening to secure the side members defining the doorway to transverse frame members, the intermediate group of two nail driving units is positioned to drive the nails securing the door lintel in place and the outer group of 14 nail driving units is positioned to secure the outer frame elements together and to the ends of the internal elements.

A pressure fluid line 39 is connected by suitable conduit means, including a main conduit 40 and individual branch conduits, with the various nail driving units. The line 39 leads from a control valve 41 which is connected by suitable conduits 42 and 43 with a source of fluid under pressure and with a fluid sump or reservoir, the valve being operative to connect the nail driving units with fluid under pressure or with exhaust as may

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be required to carry out the nail driving operation. The nailing units may be secured to the plate 26 in various operative positions, as will be later described in detail, in order to accommodate the nailing mechanism to panels or panel frames of varying size and shape.

Referring now to Figs. 3 and 4, each nailing unit 34 has a cylinder 44 connected at one end to a support, generally indicated at 45, and closed at its opposite end by a suitable end closure cap 46. The cap 46 may be provided with an internally screw threaded flange screwed upon the externally screw threaded end portion of the cylinder and suitable packing 47 may be provided between the end of the cylinder and the cap to prevent leakage of hydraulic fluid past the cylinder end closure. The cap is provided with an aperture into which is threaded a suitable fitting 48 to which the associated branch conduit is connected. The end of the cylinder secured to the support 45 is closed by a closure plate 49 having a central apertured boss 50 through which a rod 51 is slidable. This rod extends into the cylinder substantially coaxial therewith and its movement into the cylinder is limited by a stop shoulder 52 secured on the end of the rod in position to abut the end of boss 50 at the limiting position of the rod. A piston, generally indicated at 53, is secured on the opposite end of rod 51 between a shoulder 54 on the rod and a nut 55 threaded onto the reduced screw threaded end portion of the rod. This piston comprises a rigid metal plate 56 resting against the shoulder 54, a plate 57 superimposed on plate 56, a packing or washer 58 of resilient material, and a washer 59 compressing the resilient material between itself and plate 58. A pair of nail driving rods or punches 60 and 61 are disposed within the cylinder parallel to rod 51 and have enlarged end portions received in countersunk apertures in plate 56 and held therein by plate 57 so that the punches are securely connected to the piston against movement in either direction relative thereto.

The punch members 60 and 61 extend through respective apertures in closure end plate 49 and through hollow socket members 62 and 63 secured to the closure end plate.

The support member 45 comprises an end plate 64 welded or otherwise suitably secured to the cylinder at the end thereof, a second end plate 65 spaced from the plate 64 and substantially parallel thereto, an upper side plate 66 and a lower side plate 67 secured at their ends to the spaced end plates 64 and 65. The end plate 65 is provided with apertures 68 and 69 in line with the axes of the nail punch members 60 and 61 and each of these apertures 68 and 69 is squared and in its side adjacent the end plate 64, plate 65 is provided with circular counterbores which are substantially coaxial with the apertures. When the punch members 60 and 61 are fully extended their ends opposite the piston 53 extend through the apertures 68 and 69 respectively substantially to the plane of the outer surface of the plate 65. The plate 65 is provided with a tapered guide portion 70 extending beyond the side plate 67 and at the inner side of the side plate 66 is provided with an elongated rectangular aperture through which the tongue portion 71 of a guide member 72 may be inserted, the guide member being secured to the support by suitable means, such as the screws 73, extending through the side members 66 and threaded into the tongue 71 of the guide member. The guide member 72 is used for side

nailing of the frames to position the nail driving unit at the proper height relative to the frame elements and is removable when it desired to use the nail driving units on a flat surface where the guide or stop member 72 would interfere with the proper operation thereof.

Two headed lug or button members 74 and 75 are secured to the side plate 45 adjacent the end plates 64 and 65 respectively. Each of these members comprises, as indicated for the member 74, a reduced screw threaded shank 76 screw threaded into a threaded aperture in the side member 45, an intermediate cylindrical portion 77, the lower end of which abuts on the side member surrounding the aperture, and an enlarged cylindrical head portion 78 which provides an annular shoulder at the adjoining end of the intermediate cylindrical portion 77. The operation of this fastening means is particularly illustrated in Fig. 5.

The plate 26 is provided with a plurality of apertures each of which has a "key hole" shape. That is, the aperture is elongated and at one end is of circular shape of a diameter sufficient to permit the passage therethrough of the head portion 78 of the lug member. Joining this circular portion of the aperture there is a smaller, partly circular, portion which fits about the intermediate cylindrical portion 77 of the lug member. When the lug member is passed through the larger portion of the aperture and then moved relative to the plate 26 to bring its intermediate cylindrical portion into the reduced portion of the aperture, the shoulder between the head portion and the intermediate cylindrical portion will overlie the plate around the smaller part of the aperture and the member will be securely hooked in place.

The apertures are so arranged that the movement of the headed members relative to the plate to secure the nail driving unit to the plate is in the same direction as the reaction to the nail driving force exerted by the nail driving unit. The plate apertures are arranged in pairs, as indicated at 79 and 80 in Fig. 2, to receive the two spaced headed lug members of each nail driving unit. Pairs of apertures are provided at various locations on the plate, as indicated at 79a, and 79b, so that the nailing units may be moved to various positions to accommodate the mechanism to the assembly of frames or panels of different size and shape.

In operation the apparatus would be set up for a particular size and shape of panel, one or more jigs being permanently arranged for this particular panel. After a suitable number of particular panel frames had been manufactured, a different jig could be substituted providing a panel of different shape or size or both and the nail driving units could then be moved to new positions for the assembly of the new frame or panel. By this arrangement frames or panels of several different sizes and/or shapes can be manufactured using the same assembling apparatus.

A special nail particularly adapted for use in the operation and means for supplying the nails to the nail driving mechanism are particularly shown in Figs. 6, 7, and 8.

Referring to Fig. 6, a T-shaped nail having an elongated head of a width substantially the same as the diameter of the nail shank has been found particularly suitable for use with the automatic nailing device. These nails are provided in stacks as indicated at 82 which may include any

desired number of individual nails 83, 14 being shown in the drawing, and are secured together by a suitable adhesive so that they will be held in stacked condition for easy insertion in the nail feeding means and may be easily broken away from the stack when they are driven by the nail driving means.

The nail feeding magazine, as particularly illustrated in Fig. 7, comprises a hollow metallic casing 84, the internal opening of which has a size and shape corresponding to the planform size and shape of a nail to be used in the device, the opening being particularly shown at 85 in Fig. 4. At the bottom of the casing the opening is widened, as indicated at 85' in Fig. 4, to a width throughout its length at least as great as the major dimension of the nail head so that the heads of the nails may pass longitudinally through the lower part of the magazine casing. At one side of its bottom portion, the magazine is provided with a lateral cylindrical extension 86 and at its opposite side with a shorter cylindrical extension 87 at the outer end of which there is provided a non-circular, preferably square, extension 88. The extension 86 is of a size to fit into the tubular receptacles 62 and 63 mounted on the nailing unit in axial alignment with the nail driving punch members 60 and 61.

The magazine casing is mounted on the nailing unit by inserting the end of the cylindrical extension 86 of a magazine casing in one of the hollow receptacles 62 or 63 and moving the casing bodily to the left, as viewed in Fig. 4, to compress the corresponding receptacle included spring 89 and 90 until the end of the extension 88 will pass the inner side of the outer end plate 65 of the support 45. The extension 88 is then brought into alignment with the corresponding aperture 68 or 69 and the pressure is relieved permitting the receptacle spring to move the casing toward the right, as viewed in Fig. 4, to move the non-circular extension 88 into the corresponding non-circular aperture in end plate 65. When this is done the cylindrical extension 87 will enter the cylindrical counterbore surrounding the aperture at the inner side of plate 65 and abut against the shoulder between the aperture and the counter-bore. The magazine casing will then be releasably locked in operative position in which it extends substantially perpendicular to a plane including the axes of the two nail punch members 60 and 61 and will be held against rotation in the nailing unit.

The magazines may be removed and replaced by a simple operation first compressing the corresponding spring 89 or 90 and then moving the magazine out of the support 45 and, in replacing, by first compressing the corresponding receptacle spring and then moving the magazine until the extension 88 snaps into aperture in plate 65 in the manner indicated above.

In order to load the magazine, a stack 82 of mutually adhering nails is inserted into the open end of casing 84 and moved inwardly until the nail at the corresponding end of the stack is positioned at the bottom of the opening in the casing. A cap or closure member 92 is then placed upon the outer end of the casing. This closure member has a flat accordion type spring 93 secured to the inner surface thereof which spring is receivable in the opening in the case 85 and bears upon the outer end of the nail stack. The closure member is releasably locked in place by suitable means, such as the finger actuated slide members 94 and 95, which pass

through apertured blocks 96 and 97 on the outer surface of the member 92 and project at their outer ends through apertures provided in the lugs or ears 98 and 99 secured to the side of the casing and extending outwardly therefrom. The members 94 and 95 are urged apart by suitable means such as the compression spring 100.

With this arrangement the cap may be removed by compressing the outwardly turned inner ends of the members 94 and 95 against the force of spring 100 until the outer ends of these members are withdrawn from the ears 98 and 99 and may be secured to the casing by simply forcing it inwardly until the outer ends of the members 94 and 95 snap into the openings in the ears, the spring 100 being finger compressed if necessary at the beginning of the operation. As the nails are removed from the stack in the magazine the spring 93 expands, as illustrated in Fig. 8, to move the nail stack inwardly and maintain the bottom nail of the stack at the bottom of the opening in the case 84 where it will be contacted by the adjacent end of the corresponding nail punch 60 or 61.

When loaded magazines are applied to the nailing unit and fluid under pressure is admitted through the fitting 48, the piston 53 will be forced lengthwise of the cylinder 44 to the right, as viewed in Fig. 4, forcing the nail punch members 60 and 61 through the magazines 84 and 84' thereby forcing the two nails at the bottoms of the two magazines lengthwise of the magazines and through the magazine extensions 87 and 88 received in the counter-bore 68 and aperture 69 in the end plate 65 until the nail heads are moved to a position flush with the surface of a frame member in contact with the other surface of end plate 65.

An adjustable limit stop 101 is provided in the end plate 65 to contact the corresponding end of guide rod 51 to positively control the amount by which the nail heads are sunk into the wood of the frame member.

In Figs. 9 and 10 is illustrated a somewhat modified form of nailing apparatus in which the supporting plate 104 for the nail driving units constitutes the top of the table or platform supporting the frame members thereby assembled and to which the positioning members forming the assembly jig are attached. The under surface of plate 104 is secured to a supporting and reinforcing grid frame 105 carried on suitable columns or legs, as indicated at 106 and 107 in Fig. 10. Corner guide members 36 are secured to the upper surface of the plate 104 by suitable bolts or rivets passing through apertures in the plate either singly or in groups of two or four at the corners where the elements of the frame come together and side positioning members are secured to the plate singly at locations selected to hold the longer elements of the frame in proper position for assembly.

As particularly shown in Fig. 11, each corner positioning member comprises a flat base portion 108 which may be of generally hexagonal shape and one end of which is integral with an upstanding guide portion 109 having two flat leg portions disposed at right angles to each other. The portion 109 has its outer surfaces beveled at its upper end as indicated at 110 to facilitate the placing of the frame elements in the jig.

While the plate could be provided with groups of apertures so that the positioning members could be moved to vary the jig in accordance

with differences in the shape and size of the frames to be assembled, it is at present believed economically desirable to provide separate jigs for the different types of panel frames.

The plate 104 has an area greater than the planform area of the frame to be assembled by an amount sufficient to provide a margin for the support of the nailing units 34. These nailing units are the same as those illustrated in Figs. 3 and 4 and described above and are attached to the plate by the headed lug members 74 and 75 secured in keyhole shaped apertures provided in the plate.

Where the nailing units are secured directly to the frame jig as in this modified arrangement, it is not necessary to provide additional apertures for different positioning of the nailing units; if only one type of frame is assembled with this particular arrangement. The frame shown in Figs. 9 and 10 is smaller and somewhat different in shape from that indicated in Figs. 1 and 2 and is indicated by the numeral 19'.

When the nailing units are attached directly to the jig platform or plate as in Figs. 9 and 10, the depth controlling stop member 72 is removed as the jig plate then performs the functions performed by this stop member in the suspended nailing unit shown in Figs. 1 and 2.

A hydraulic pump and reservoir 115 are provided at some location convenient to the assembly and connected by suitable conduits 116 and 117 with a three-way valve 118 to which the various nail driving units are connected by a suitable main conduit 119 and branch conduits 120.

With this arrangement, when the frame elements have been properly positioned in the frame jig the valve is operated to apply fluid pressure simultaneously to all of the nail driving units, whereupon all of the joints of the frame are simultaneously nailed together. When the nails have been completely driven the valve is operated to connect the cylinders of the nail driving units with the fluid exhaust line whereupon the several return springs retract the nail driving punch members and the completed frame may then be removed from the jig and a new frame assembled therein.

In the modified arrangement shown in Fig. 13, a platform 124 is supported on vertical columns or legs as indicated at 125 and 126 with the columns at two opposite sides of the platform extending above the platform. Suitable positioning members, as indicated at 127 and 128, are secured on the upper surface of the platform to hold a panel frame such as the frame 19' and a panel cover member 129 in proper position for assembly. A transverse member 130 extends between two corresponding upright leg or column members, positioned one at each side of the platform, and to this transverse member a plurality of spaced nail driving units 34 are connected in the manner indicated above by the engagement of headed lug members on the nail driving units in key hole shaped apertures, as indicated at 131, provided in the transverse member. Suitable means as indicated at 132 and 133 are provided to adjustably and releasably connect the ends of the transverse members to the corresponding upright members such as the members 125 and 126. These means may each comprise a hydraulic expandable chamber device 134 as indicated for the unit 132, the cylinder of which rests on platform 124 and the piston of which is connected to a

latch member 135 pivoted to the transverse member 130.

The latch member 135 has a depending hook portion engageable with a projection 136 on member 125 and is urged into locking engagement with the projection by spring 137. Application of fluid pressure to the units is controlled by valve 138 and when pressure is applied the piston of each expansible chamber device is raised turning the associated latch member, such as 135, to release extension 136. When the latch member has been turned sufficiently to free it from the extension or dog 136 it comes against a stop 139 after which further extension of the piston raises the corresponding end of member 130.

By this means the transverse members may be raised to free the completed panel and remain in raised position for the insertion of an uncompleted panel. When the pressure is released the transverse members will be lowered until the latch members are engaged to releasably lock them in operative position.

Suitable hydraulic pressure and exhaust apparatus 140 and 141 is provided at a location convenient to the nailing apparatus and is connected by fluid lines 142 and 143 with a three-way valve 144 which is in turn connected by a main conduit 145 and branch conduit 146 with the several nail driving units. It is to be understood that a plurality of transverse members similar to 130 may be used extending between corresponding upright members at opposite sides of the platform and that each transverse member may carry the necessary number of nail driving units properly spaced to position them opposite the desired nailing locations. With this arrangement, when the valve 144 is operated to apply fluid pressure to the several nail driving units all of the panel cover nails will be simultaneously driven.

In the modified nailing unit shown in Figs. 14, 15 and 16, the operating principle and general construction is the same as that illustrated in Figs. 3 and 4 and described above. In the modified arrangement, however, a different spring arrangement is provided and different end plates are used to cooperate with the modified spring arrangement.

In the modified arrangement the end plate 64' of the support 45 is made cross-shaped in order to provide radially extending arms 148a, 148b, 148c and 148d apertured to receive the ends of corresponding tie rods 149a, 149b, 149c, and 149d and to provide space between adjacent arms for the external tension springs 150 and 151, and is provided with an annular groove for the reception of the corresponding end of the cylinder 44. The outer end closure member 152 may be circular in shape, has a diameter larger than the cylinder diameter in order to provide an angular overhang to which the tie rods and springs may be connected, and is also provided with a cylinder receiving annular groove.

As is particularly shown in Figs. 15 and 16, the four tie rods are substantially equally spaced around the cylinder and are passed through apertures in end plate 64' until their enlarged or upset end portions engage the plate. At their opposite ends the tie rods pass through corresponding apertures in end plate 152 and have screw threaded end portions upon which are threaded nuts as indicated at 153 which are tightened on the tie rods to compress the cylinder between the end plate 64' and the outer end closure plate 152. The coiled tension springs 150 and 151 are lo-

cated at substantially diametrically opposite positions externally of the cylinder 44 and are connected at their outer ends to the plate 152 by having hook portions extending through suitable apertures in the plate. At their inner ends these springs are connected to the corresponding ends of a cross member 154 which is connected at its center to the end of guide rod 51. The cross member 154 is made in a modified S shape to clear the magazine receptacles 62 and 63.

With this arrangement when hydraulic fluid under pressure is supplied to the cylinder through the fitting 48, the piston 53 and guide rod 51 are forced inwardly, moving the cross member 154 away from the end closure member 152 and thereby stretching the tension springs 150 and 151. When the pressure is released these springs contract and return the piston and guide rod to the retracted position. The nail punches 60 and 61 are connected to the piston in the manner indicated above in connection with Figs. 3 and 4 and pass through the support 45 and through the nail magazines 84 and 84' mounted in the support.

It has been found that in some cases the tension springs have certain advantages over the compression spring arrangement shown in Fig. 4 in that a desired portion of the spring action may be selected and less space is required, and it is not necessary to bring the springs to a substantially solid condition when retracted in order to conserve space. Otherwise the construction and operation of the modified form of nail driving unit is substantially the same as that illustrated in Figs. 3 and 4 and described above.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof and therefore the invention is not limited by that which is shown in the drawing and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. Nailing apparatus for securing together the nailable elements of a panel frame or similar structure comprising a plate having an area greater than the planar area of the frame to be assembled; positioning members fixed to said plate and extending thereabove to hold frame elements in proper position during assembly; a supporting and reinforcing structure below said plate; a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations; means securing said units to said plates; and means supplying fluid under pressure to said units.

2. Nailing apparatus for securing together the nailable elements of structural panels or similar devices comprising a platform for supporting the panel; support members extending above said platform disposed at each of two opposite sides thereof; a transverse member extending between two support members located one at each side of said platform; means releasably securing the ends of said transverse member to said support members; fluid pressure operated nail driving units spaced along said transverse member opposite respective nailing locations; and means detachably securing said units to said transverse member.

3. Nailing apparatus for securing together the nailable elements of panel frames or similar structures comprising a flat plate having an area greater than the planar area of the frame to be assembled; a reinforcing grid permanently secured to one side of said plate; means operative

to suspend said plate and grid-assembly and move it between an operative and an inoperative position; a plurality of nail driving units on the under side of said plate individually disposed opposite respective nailing locations; and means securing said units in preselected positions to said plate.

4. Nailing apparatus for securing together the nailable elements of a panel frame or similar structure comprising, a plate having an area greater than the planar area of the frame to be assembled; a supporting and reinforcing structure for said plate; a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations; means releasably securing said nail driving units to said plate; and means supplying fluid under pressure to said units.

5. Nailing apparatus for securing together the nailable elements of panel frames or similar structures comprising a flat metal plate having an area greater than the planar area of said frame; means supporting said plate in substantially horizontal position; a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations of said frame; means releasably securing said units to said plate arranged for changing the locations of said units to accommodate said apparatus to the assembly of frames of different sizes or shapes; means supplying fluid under pressure to said units; and manually operable means controlling said fluid supply; said securing means comprising spaced headed lugs on each nail driving unit receivable in plate apertures shaped to permit passage of the lug heads therethrough and to hold the lugs in restricted portions thereof upon movement of said unit in the direction of the reaction to the nail driving force exerted thereby.

6. Nailing apparatus for securing together the wooden elements of a panel frame or similar structure comprising a plate having an area greater than the planar area of said frame, means supporting said plate, a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations of said frame; means securing said units to said plate; and means supplying fluid under pressure to said units comprising a pressure fluid pump and reservoir; a control valve; a conduit connecting said valve with said reservoir; and conduit means connecting said valve with said plurality of nail driving units.

7. Nailing apparatus for securing together the nailable elements of panel frames or similar structures comprising a flat metal plate having an area greater than the planar area of said frame; means supporting said plate in substantially horizontal position; a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations of said frame; means releasably securing said units to said plate arranged for changing the locations of said units to accommodate said apparatus to the assembly of frames of different sizes or shape; means supplying fluid under pressure to said units; and manually operable means controlling said fluid supply.

8. Frame assembling and nailing apparatus comprising an assembly jig for frame elements; nailing means supported for movement toward and away from said jig; and means guiding said jig relative to said nailing means; said jig comprising a wheel supported table and a plurality of

fixed positioning members on the top surface of said table; said nailing means comprising a rigid structural grid, a plate attached to said grid and provided with keyhole shaped apertures arranged in duplicate at different positions to render said nailing means adjustable for different shapes and size of frames to be assembled thereby; and a plurality of fluid pressure operated nailing units secured to said plate in predetermined locations by means of lugs on said units received in corresponding apertures in said plate.

9. Nailing apparatus for securing together the nailable elements of a panel frame or similar structure comprising a plate having an area greater than the planar area of said frame, means supporting said plate, a plurality of fluid pressure operated nail driving units on said plate individually disposed opposite respective nailing locations of said frame; means securing said units to said plate; and means supplying fluid under pressure to said units.

10. Apparatus for assembling wooden members into a structural frame comprising fixed positioning members operative to hold the frame members in position for assembly; a plate superimposed on the area of said frame; fluid pressure operated nailing units located on said plate at the nailing locations of said frame; and means releasably securing said units to said plate.

11. Frame assembly and nailing apparatus comprising an assembly jig for frame elements; nailing means supported for movement toward and away from said jig; and means guiding said jig relative to said nailing means; said jig comprising a wheel supported table and a plurality of fixed positioning members on the top surface of said table and means to prevent transmission of nail driving impacts to said jig and said positioning members.

12. Nailing apparatus for securing together the nailable elements of a panel frame or similar structure comprising a plate having an area greater than the planar area of the frame to be assembled, a supporting and reinforcing structure for said plate, a plurality of fluid pressure operated nail driving units individually disposed opposite respective nailing locations, quick releasable means releasably securing said nail driving units in position with relation to said plate and means supplying fluid under pressure to said units.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
187,843	Goodhue	Feb. 27, 1877
243,997	Toepfer	July 5, 1831
262,305	Myers	Aug. 8, 1882
338,930	Chase	Mar. 30, 1886
408,765	Swift	Aug. 13, 1889
706,805	Dargeault	Aug. 12, 1902
1,407,295	Parker	Feb. 21, 1922
1,539,473	Ellwood	May 26, 1925
1,613,473	Miller	Jan. 4, 1927
1,618,367	Dick	Feb. 22, 1927
1,939,632	Randall	Dec. 12, 1933
1,955,467	Morgan	Apr. 17, 1934
2,008,831	Kruse	July 23, 1935
2,014,452	Riggs	Sept. 17, 1935
2,273,268	Hunter	Feb. 17, 1942
2,321,165	Stilwell	June 8, 1943
2,378,948	Paxton	June 26, 1945