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(54) Improvements relating to jigs for framed wooden panels.

(57) A jig for making fence and other framed wooden panels has two lower portions in which the panel components (B,T,L and S) are laid up horizontally, and a common upper portion up against which each lower portion is brought in alternation for the components to be firmly located and nailed. A nail gun assembly (8) is traversed over the jig for this, and nails can be driven according to a pre-set program and/or according to the slat edges, the overlap between slats being detected by sensing means (64). In the lower portions of the jig, battens (B1,T1,L1) are located by lugs (27), the slats (S) are laid across them, and then further battens (B2,T2, L2) are laid on top. These can be automatically pinched into position as the jig portions are brought together by engaging pivoting elements (29,43) on the upper portion of the jig.

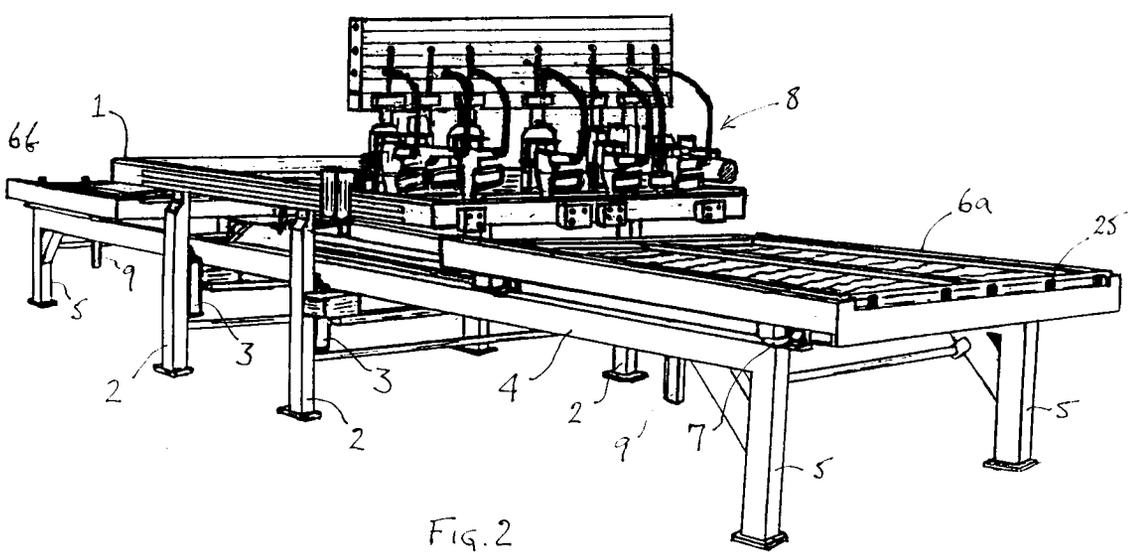

Fig. 2

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This invention relates to jigs for framed wooden panels. It is concerned primarily with the construction of fence panels, but it may be adopted for other uses, such as making parts of wooden sheds, for example.

The main problem with fence panels is that, for reasonable economy, they must be made with inferior wood which is very prone to warping and twisting. Therefore, if a jig is provided with exact, fixed abutments the operator will have difficulty in inserting the battens for the framing. Also, the slats that are laid across them will probably undulate, and further battens laid across them will not lie properly, as well as likely being warped and twisted themselves. For speedy construction, nail guns are used, and these cannot work properly unless the components they are nailing together are securely clamped in the first place. There is therefore a need to provide a jig which can accommodate distorted battens and slats, straighten them up, hold them together firmly, allow paths for nail guns, and permit quick and easy release.

Some possible solutions to these problems were been proposed in my European Patents Nos. 0082730 and 0130685 but these had drawbacks particularly in that to automate them as much as possible so many pneumatic actuators were required that the expense was becoming prohibitive.

It is the aim of this invention to provide a jig where the straightening and clamping of the components of the panel is achieved in an easier and more economical way.

According to the present invention there is provided apparatus for constructing framed wooden structures, such as fence panels, in which there is framing on at least one side of slats, the apparatus comprising a jig having upper and lower portions having guide means enabling panel components to be laid up free of the upper portion, means for locating the lower portion below the upper portion, and means for bringing both portions together and thereby holding the slats tightly sandwiched between the portions while leaving the panel partially exposed at least at points for nailing the slats to the battens.

In the preferred form the upper portion of the jig has batten locating means arranged to engage battens above the slats and to locate and straighten them as the upper and lower portions of the jig are brought together. These batten locating means may comprise pivoted members freely swingable between upward and downward positions about axes parallel to but laterally offset from the battens on the lower part of the jig that they are to locate, the pivoted members in the downward position presenting downwardly concave angled formations to the upper edges of said battens. The bringing together of the jig portions causes the battens to engage the locating means and each such locating means to be swung to the upward position in which one part of the angled formation provides an upper limit stop to the batten and the other part of the angled formation provides a lateral confinement to the batten.

For automatic operation, the jig is straddled by a nail gun assembly and the jig and said assembly are mutually traversable for guns on the assembly to fire nails into the panel framing.

These nail guns can be arranged to fire nails according to a predetermined program through battens on top of the slats into battens lying below.

The slats will normally extend transversely to the direction of traverse. Means may then be provided for sensing slat edges during the mutual traverse along the lines at least of those battens underlying the slats and extending in the traverse direction without corresponding battens above. The nail guns adjacent the sensing means will then be fired so that each nail therefrom is driven into an underlying batten a predetermined distance from a sensed slat edge.

The lower portion of the jig conveniently provides a horizontal frame for surrounding the components of a panel laid up therein, the frame being adjustable to an enlarged form for the laying up operation and there being means for contracting it to confine the panel components during the nailing operation.

The contracting means can include a spring biased member which is normally urged inwardly of the frame to act on the panel components. Means will then be provided to cooperate with this member when the lower part of the jig is shifted to a position clear of the upper portion to overcome the spring bias and retract said member outwardly with respect to the frame.

Means may further be provided for lifting a completed panel above the lower portion of the jig when the latter is returned to its laying up position.

To speed operations, there will preferably be two lower portions of the jig workable in alternation so that while one is co-operating with the upper portion for the nailing operation the other is shifted clear to one side for removal of a completed panel and the laying up of the components of another.

For a better understanding of the invention some embodiments will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows three fence panels which can be constructed in the apparatus of the invention,

Figure 2 is a general perspective view of apparatus for making fence panels,

Figure 3 is a detail of a nail gun carriage forming part of the apparatus and showing its mounting arrangement at one end,

Figure 4 is a plan view of a lower portion of a jig forming part of the apparatus with some components of a fence panel laid up in it.

Figure 5 is a plan view of an upper portion of the jig with a completed fence panel therein,

Figure 6 is a vertical section on the line VI-VI of Figure 5, to a larger scale,

Figure 7 is a vertical section on the line VII-VII of Figure 5, to a larger scale,

Figure 8 is a plan view of part of an alternative upper portion of the jig,

Figure 9 is a vertical section on the line IX-IX of Figure 5, to a larger scale,

Figure 10 is a perspective detail of part of the lower portion of the jig,

Figure 11 is a vertical cross section of part of an alternative lower portion of the jig,

Figure 12 is a vertical cross section of part of a lower portion of the jig showing the arrangement for small panels,

Figure 13 is a front elevation of part of a nail gun assembly showing a slat sensing device,

Figure 14 is a cross-section on the line XIV-XIV of Figure 13, and

Figure 15 is similar to Figure 14 but shows an alternative slat sensing device.

In Figure 1(a) a fence panel has on one side five upright battens B1 (only two of which can be shown in outline) at an even spacing and top and lower rails not shown but referred to as T1 and L1. Across these are laid slats S. Then a further set of three upright battens B2 are laid opposite the outer and central one of the battens B1 and to complete the framing of this side of the panel a top rail T2 and a lower rail L2 are placed along the longitudinal edges over the rails T1 and L1 but sandwiching slats S between them. This assembly is firmly held together in a horizontal plane while nailing is carried out through the battens B2 into the opposite ones B1, through the rails L2 and T2 into the rails L1 and T1, and through the slats S into the two unpaired battens B1. The nail points are indicated at N. A cap C may subsequently be nailed along the top, although it may be preferred to make the cap C integral with one of the rails T1 or T2, either by rebating and moulding a piece of wood to the appropriate shape or by pre-nailing a strip of wood to form the cap to the rail T1 or T2 before the latter is laid up and nailed into the panel.

In Figure 1(b) generally the same procedure is followed, although here there are four upright battens B on each side, all paired. It may have the same dimensions as the panel of Figure 1(a), and the jig to be described may be made adjustable to cater for such variations.

It would also be possible to make a panel with different rail arrangements such as:

a) one top rail, no bottom rails,

b) two top rails, one on each side, no bottom rails,

c) two top rails, one on each side, one bottom rail,

d) no top or bottom rails (as in Figure 1(c) - where a cap C is nailed into the ends of battens B).

Different batten arrangements are also possible.

Referring now to Figure 2, apparatus for constructing such fence panels has a horizontal floor based rectangular frame 1 with four legs 2 providing the supports. Each leg carries, on the inside, a vertical jack 3 whose purpose will be described later.

Running horizontally below the frame 1 and extending beyond it the same distance at opposite ends are two parallel rails 4 supported on legs 5, and on these rails carriages 6a and 6b run by means of wheels 7. Each carriage 6 forms the lower portion of a jig, the upper portion being provided by the frame 1. As shown, both carriages 6a and 6b are run out to respective ends of the rails 4 where they are clear of the frame 1, and in those positions a fence panel can be laid up in either lower portion of the jig, preparatory to nailing. For nailing, the carriage 6a or 6b is centred below the frame 1 where, as described below, the fence panel can be compacted and held while it is traversed by a nail gun assembly 8. When this has been carried out, the completed panel is taken away on the carriage 6a or 6b, moving to its initial position as shown, while it is replaced in the central position by the other carriage 6b or 6a. The removal of the fence panel from each carriage is effected by hydraulic jacks 9, which lift the panel clear of the jig and enable it to be removed manually or by a mechanical stacker.

One nail gun of the assembly 8 is illustrated diagrammatically by the broken line rectangle in Figure 3. It is carried on a traversing carriage 10 and the arrows indicate that it can have adjustment, within limits, horizontally along and vertically transverse to the carriage. The later straddles the jig and runs on two parallel beams 11 which form opposite sides of the frame 1. At each end the carriage 10 is mounted on a trolley 12 with rollers 13 which run either side of a locating rib 14 along the top of the beam 11. Low down on the outside of the beam 11 there is another rib 15 engaged by rollers 16 well spaced in the longitudinal direction of the beam 11 to give stability to the nail gun carriage 10 and to prevent it tilting about its longitudinal axis. At the end shown in Figure 3, an electric motor 17 is mounted on the trolley 12 and drives through a toothed pulley 18 and a toothed belt 19 another pulley 20 at the end of a rod 21 journalled in and extending through the carriage 10,

which is of hollow box section. At each extremity of the rod 21 there is a pinion 22 which engages a rack 23 mounted on the inside of the associated beam 11. The electric motor 17, energised through a trailing cable (not shown), will thus drive the carriage 10 transverse to its length, and the positive engagement of the pinions 22 with the racks 23 will prevent slewing or "crabbing".

Also shown in Figure 3 are studs 24 on the outside of the beam 11. These represent contact points with which sensing means (not shown) on the trolley 12 co-operate as the carriage 10 moves. They are part of the firing circuit for the nail guns (there will usually be at least five on the carriage) and as each stud is reached, so the associated gun(s) will fire. They can of course be adjusted.

Referring now to Figure 4, each carriage 6 is a rectangular frame which can encompass a maximum size fence panel. It may be made of substantial box-section steel. Along the side remote from the frame 1 the frame member is lower than the other (as can be seen in Figure 1), but with upstanding lugs 25 at intervals. It is along this side that the top or capping of a fence panel is laid, the lugs 25 confining the panel while allowing horizontal nailing through the capping.

Each carriage 6 is spanned in the direction parallel to the rails 4 by substantial bars 26. There are two permanent ones (which could be flanges fixed to the inside of the lateral box-sections) adjacent the carriage sides, while the others will be distributed according to the intended batten spacing. They will therefore be adjustable. At intervals along each bar, on the upper side, there are pairs of lugs 27 which are clamped by set screws 28 to form locating means for the battens B1 and, at the ends, for the rails T1 and L1. For simplicity, only a few are shown. They are normally set so that they form tapering gaps, the narrow end towards the frame 1. Those narrow ends correspond to the width of a batten B1, and the technique of laying up involves pushing each batten longitudinally of its bar 26 through the locators from the outer end. The tapers guide the battens into alignment, and they are then held straight. The height of the lugs 27 is less than the depth of the battens so that the latter are proud of them and slats S laid across rest only on the wooden framing. The battens B1 and rails T1 and L1 may have vertical distortion when so laid up, but this will be flattened out as described below.

The internal dimensions of the frame of each carriage 6 may exactly correspond to the maximum size of a panel. But wood can seldom be cut consistently to precise lengths. Therefore, to ease laying up the framing by giving some tolerance, the carriage frame may be slightly oversize particularly in the lengthwise direction of the apparatus in which the battens are laid. Transversely this has been found to be not so important and the dimension of the carriage in this direction can be exact. An arrangement for closing the lower part of the jig around the laid up panel, and for catering for less than maximum sized panels, will be described later with reference to Figures 10, 11 and 12.

Referring now to Figure 5, the ends of the nail gun carriage 10 can again be seen, with the trolleys 12 running on the beams 11, both of which have sensing studs 24 on the outside. A completed fence panel is shown in the jig, but not in a position yet to be released.

The panel is located within one of the carriages 6 invisible beneath the frame 1 whose transverse members are L-section beams 28 attached to the beams 11 near the ends of the latter. Between these beams 28 there are pairs of L-section spars 29 parallel to the beams 11. The spars of each pair are arranged with horizontal flanges projecting towards each other and closely spaced at a distance slightly greater than the width of one of the upright battens B2. The other flanges extend upwardly. They are carried by an arrangement as shown in Figure 6, each spar 29 having its vertical flange cut away at both ends to accommodate the horizontal flanges of the beams 28, leaving its horizontal flange to extend below those of the beams 28. The spars 29 are pivotally supported by blocks 30 secured to the outside of the frame 1 by bolts 31 engaged in the upwardly projecting flanges of the beams 28. These blocks are drilled horizontally below the level of the other flanges of the beams 28 to receive studs 32 welded to the ends of the spars 29 in alignment with the corner of the L-section. There may be alternative threaded holes in the beams 28 for the bolts 31, allowing the blocks 30, and thus the spars 29, to be set in different positions to cater for different arrangements and spacing of battens B2. In any event, the studs 32 allow pivoting of each spar 29 about its longitudinal axis, for reasons explained below.

Also, near the sides of the frame 1 there are single spars 29 similarly carried by blocks 30 and set slightly more than a batten width inside the line of the side walls 33 of the carriage 6 forming the lower portion of the jig.

The spars 29 carry fingers 34, only a few of which are shown, secured to their horizontal flanges and projecting over the gap between the spars of each pair and outwardly from the single end spars. These fingers are for holding down the battens B2, and they are arranged not to interfere with the nailing at points N.

Along the underside of their horizontal flanges the spars 29 are provided with downwardly projecting coned studs 35. When the flanges are actually horizontal, these studs 35 are spaced apart by a

distance corresponding to the width of the batten B2. But initially, before the lower portion of the jig is raised, the spars 29 tilt and rest on abutments 36 projecting in from the blocks 30 so that those flanges slope down towards each other widening the distance between the rows of studs 35. This is the position shown in Figure 7. As the lower portion of the jig (the carriage 6a or 6b) is raised, the battens B2 meet the fingers 34 and tilt the spars so that the fingers and the flanges to which they are attached regain the horizontal. This tilting is terminated when the horizontal flanges of the members 28 and 29, where they overlap, meet face to face. At the same time, the rows of studs 35 converge, and thus any lateral warping in the batten B2 is corrected. By the time the lower portion of the jig is fully raised, any vertical warping is also corrected by the battens and slats being firmly sandwiched between the fingers 34 and the bars 26. The section of Figure 7 is taken where two slats overlap.

The gaps between the spars 29 is sufficient to allow nailing along the centre line of each batten B2 and through the rails T2 and L2. Once that is done and the completed fence panel lowered for removal, the release from the spars 23 is automatic.

An alternative to the arrangement of Figures 6 and 7 is shown in Figure 8. One of the spars 29 of each pair is fixed at each end to the beams 28. The other spar 29 of each pair (and the single ones at each side) is mounted between slide members 37 which run on guides 38 mounted longitudinally of the beams 28. Initially, as shown, this spar is well spaced from the fixed one, but for batten straightening pneumatic actuators 39 urge it towards the fixed spar. The limit is determined by adjustable stops 40. The fingers 34 from opposite spars always overlap and they have studs 35 as before projecting downwards to confine the battens B2 laterally.

Reverting to Figure 5, in between these pairs of spars 29 there are further beams 41 whose ends are secured to the horizontal flanges of the beams 28. Each beam 41 has a series of spaced holes 42, and these are used to secure clamping devices, one of which is shown in Figure 9. Depending on the height of the panel being constructed, such a device is attached to each beam 41 at the appropriate hole. But there will always be one at each lowermost hole, to cooperate with the bottom rail L2, and there may be a permanent one at each uppermost or "six foot" hole where it will either cooperate with the top rail T2 or will be redundant and non-interfering when a smaller fence panel is being made.

Each device consists of a cranked member 43 pivoted to a bracket 44 secured beneath the beam 41 by a bolt 45 through one of the holes 42. The horizontal pivot axis is transverse to the beam 41. The free end configuration of the member 43 consists of a finger 46 and a thumb 47 mutually at right angles, and in the initial state both point downwardly, the finger at only a slight angle, away from the pivot, the member being held in this attitude by a projection 48 which co-operates with the underside of the beam 41. In operation, the made up but unsecured fence panel is raised up against the frame 1 and, as it rises, the rails L2 and T2 engage these members 43 by the fingers 46, as shown in Figure 9. As the rails are forced further up, so each member 43 is pivoted, and this brings the thumb 47 against the inside of the adjacent rail, which is thereby firmly located against the outside of the jig or a spacer as described below. The cap C, which may be pre-nailed to the rail T1, is securely sandwiched between the top rails T1 and T2 and the lugs 25. If the rail is bowed horizontally, some of the thumbs 47 will engage earlier than others and straighten it up. Any vertical bowing will be cured by engagement with the spars 29.

The firm location of the panel within the lower part of the jig in its vertical direction is achieved by the arrangement of Figure 10. The side of the carriage 6 nearest the frame 1 is capped by an inverted channel section member 49. It is urged inwardly of the frame by coil springs 50 reacting against brackets 51 secured to the outside of the frame. The springs 50 surround guide pins 52 which extend through flanges of the member 49 and the carriage 6. For laying out and removing a panel the member 49 is held against the springs 50 in an outwardly retracted position by a lever system co-operating with a fixed abutment 53. As the carriage 6 reaches its extreme outer position, this abutment 53 strikes one end of a horizontal lever 54 pivoted below the centre of the side of the carriage carrying the member 49. This lever 54 operates a second, vertical lever 55 pivoted to the outside of the carriage and whose other end is coupled to the centre of the member 49. It will be seen that engagement with the abutment 53 causes the member 49 to be drawn outwardly of the carriage, against the spring-loading, thus enlarging the frame provided by the carriage. But as soon as the latter moves back towards the frame 1, the springs 50 reassert themselves and the member 49 is shifted to clamp a panel laid out within the carriage.

An alternative arrangement is shown in Figure 11 where the inverted channel member 49 is shifted by a lever 56 mounted externally of the carriage 6 coupled to a pneumatic actuator 57 pivotally carried below the carriage (to keep it from projecting dangerously). There may be two or more of these along the outer end of the carriage.

To cater for less than full-size panels, the ar-

rangement of Figure 12 may be adopted. Spacer bars 58 are laid along the bars 26 and located between the lugs 27 that normally locate the battens B1. They are secured by a strap and stud assembly 59 to the inverted channel member 49. As the latter is shifted on movement of the carriage or by the pneumatic system, so the spacer bars 58 are urged against the bottom edge of the panel. These bars 58 may be spanned by a rigid cross member at their inner ends so that the entire length of that panel edge is acted upon and not just a few discrete points.

When nailing a fence panel with battens on top as well as below, it does not particularly matter where the slats, which are sandwiched between them, are pierced. Of course the nail guns must be prevented from firing into the fingers 34 and 46, but this can be arranged by suitable setting of the firing studs 24 and beams 41 in relation to the nail guns. However, when there are no battens on the top, or at least when perhaps there are only ones at the edges or when the arrangement of Figure 1-(a) is adopted, it is desirable that the nails should be fired through the slats near their edges so that each nail pierces two slats at their overlap before entering the batten B1 below.

If the slats were perfectly straight and not prone to warping, and if they could be laid up with great accuracy, it would be possible to use the firing studs 24 or some other pre-set program. But in practice, this does not work. Therefore, it is necessary to sense the slat edges as the carriage 10 is traversed and fire the nail guns at the appropriate moments. For most operations, it is necessary to have an individual sensor for each gun.

Figures 13 and 14 show a gun mounted on the traversing carriage 10. It is actually carried by a pneumatic actuator 61 mounted in a vertical attitude on a projecting bracket 62. The gun can slide on a guide system 63. For firing a nail, the nose of the gun should be held against the workpiece, but obviously while the carriage 10 is traversing it is desirable that it should be held clear. The actuator 61 is operated in response to the associated sensor to lower the gun for a brief instant at every firing.

The sensor itself may take various forms, but the one illustrated in Figure 13 and 14 is an air sensor 64 which directs a jet downwardly a short distance in front of the slats immediately beside a roller 65 mounted on a downwardly biassed vertical shaft 66. The roller 65 keeps the nose of the sensor 64 just clear of the slats, and the bias urges the roller into contact and ensures that it snaps down as each slat edge is reached. A momentary change in the back pressure from the sensor 64 indicates this transition. The speed of traverse is correlated with the distance between the sensor and the gun so that the latter is fired at an appropriate interval after the sensing signal is generated.

The whole sensor assembly can be raised and lowered. Conveniently the shaft 66 is biased by a pneumatic actuator 67 and the pressure in that can be reversed to draw up the roller 65 and the sensor 64. As explained above, with certain types of fence panel such sensing is not needed, in which case the sensor assembly is so raised clear. Also, while slats may be laid up in one way, as shown in Figure 14, on one lower part of the jig, it will generally be convenient to lay them up in the opposite way on the other lower part of the jig. Then, nailing will proceed in the opposite direction, and a sensing assembly will be needed on the other side of the nail gun 60. It is indicated in Figure 14 in the retracted position. When that is in operation, the other one shown lowered will be raised and out of use. It will be necessary to have both assemblies raised as the carriage 6a or 6b moves into place below and shifts away from the frame 1 so as not to be fouled by the cap C and top and bottom rails T2 and L2.

Instead of the air sensor 64, there could be the arrangement of Figure 15 where a small traveller wheel 69 runs on the slats and operates a microswitch device 70. Alternatively, the roller 65 could be reduced in size to give a more pronounced sudden shift of the shaft 66, and this could directly generate an electromagnetic pulse.

Although it was said above that with battens B2 the nailing positions were not critical, it might still be desired to have the nails going through the slat overlaps. In that case, the sensing device must be set to one side of the associated batten B2 and nail gun path and lowered. This could be done by adjustment of the bracket 68 which holds the sensor 64.

When there are no battens B2, the slats need to be held down firmly, but clear of the nailing path. This may be done by the rollers 65.

Thus, to summarise the operation of this jig, first the battens, rails and slats are laid up in the lower portion of the carriage 6 which is at one end of the rails 4. This is then shifted below the frame 1 (this movement causing the panel to be compacted in the direction of the battens B by the device of Figure 10) and raised off the rails by the jacks 3. The framing on top of the panel then engages the devices of Figures 7 and 9. The top and bottom rails T2 and L2 are straightened out by the members 43, while the battens B2 are correctly aligned by the fingers 34 and studs 35. At the same time, the slats S are firmly sandwiched and the battens B and rails T and L are flattened out.

With everything then held firmly, and with nailing points exposed, the nail gun carriage 10 is traversed, the nail guns firing at the appropriate

instants as controlled by the studs 24 or the sensors 64. When that has been done, the jacks 3 lower the carriage 6 back on to the rails 4 and it is then returned to the loading/unloading position. The jacks 9 are then actuated to raise horizontal members (not shown) between the bars 26 to lift the completed panel completely clear above the carriage 6. The panel can then easily be removed. Finally, the jacks 9 are retracted so that the next fence panel can be laid up.

The jig described above has its upper portion at a fixed station and two mobile lower portions brought alternately into co-operation.

The mobility of this arrangement can be reversed, with the two lower jig portions static and the upper portion on an overhead carriage which can be shifted horizontally to register over one and then the other lower portion, in alternation. This enables the length of the apparatus to be substantially reduced.

It is also possible to reverse the vertical movements; that is where a part is described above as being raised, it could remain fixed while the previously fixed part with which it co-operates could be lowered.

Finally, it would also be possible to use the apparatus on panels where the frame members are on one side only of the slats (underneath on the jig).

Claims

1. Apparatus for constructing framed wooden structures, such as fence panels, in which there is framing on at least one side of slats, the apparatus comprising a jig having upper and lower portions, the lower portions having guide means enabling panel components to be laid up free of the upper portion, means for locating the lower portion below the upper portion, and means for bringing both portions together and thereby holding the slats tightly sandwiched between the portions while leaving the panel partially exposed at least at points for nailing the slats to the battens.

2. Apparatus as claimed in Claim 1, wherein the the jig has batten locating means arranged to engage battens above the slats and to locate and straighten them as the upper and lower portions of the jig are brought together.

3. Apparatus as claimed in Claim 2, wherein the batten locating means comprise pivoted members freely swingable between upward and downward positions about axes parallel to but laterally offset from the battens on the lower part of the jig that they are to locate, the pivoted members in the downward position presenting downwardly concave angled formations to the upper edges of said battens, and wherein the bringing together of the jig portions causes the battens to engage the locating means and each such locating means to be swung to the upward position in which one part of the angled formation provides an upper limit stop to the batten and the other part of the angled formation provides a lateral confinement to the batten.

4. Apparatus as claimed in Claim 1, 2 or 3, wherein the jig is straddled by a nail gun assembly and the jig and said assembly are mutually traversable for guns on the assembly to fire nails into the panel framing.

5. Apparatus as claimed in Claim 4, wherein nail guns are arranged to fire nails according to a predetermined program through battens on top of the slats into battens lying below.

6. Apparatus as claimed in Claim 4, wherein the slats extend transversely to the direction of traverse and means are provided for sensing slat edges during the mutual traverse along the lines at least of those battens underlying the slats and extending in the traverse direction without corresponding battens above, and wherein means are provided for firing nail guns adjacent the sensing means so that each nail therefrom is driven into an underlying batten a predetermined distance from a sensed slat edge.

7. Apparatus as claimed in any preceding Claim, wherein the lower portion of the jig provides a horizontal frame for surrounding the components of a panel laid up therein, the frame being adjustable to an enlarged form for the laying up operation and there being means for contracting it to confine the panel components during the nailing operation.

8. Apparatus as claimed in Claim 7, wherein the contracting means include a spring biased member which is normally urged inwardly of the frame to act on the panel components, and wherein means are provided to co-operate with this member when the lower part of the jig is shifted to a position clear of the upper portion to overcome the spring bias and retract said member outwardly with respect to the frame.

9. Apparatus as claimed in any preceding claim, wherein means are provided for lifting a completed panel above the lower portion of the jig

when the latter is returned to its laying up position.

10. Apparatus as claimed in any preceding Claim, wherein there are two lower portions of the jig workable in alternation so that while one is co-operating with the upper portion for the nailing operation the other is shifted clear to one side for removal of a completed panel and the laying up of the components of another.

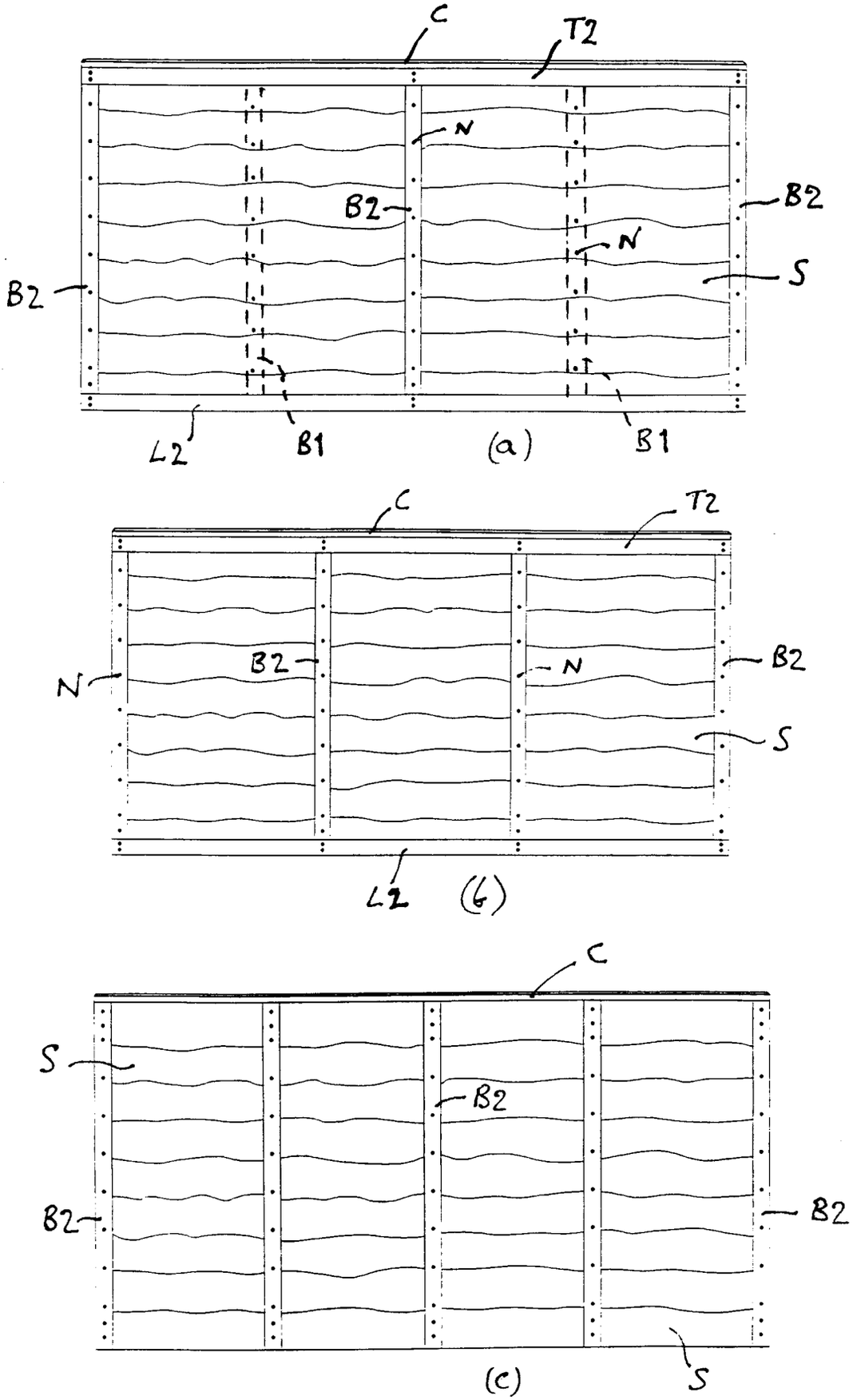

FIG. 1

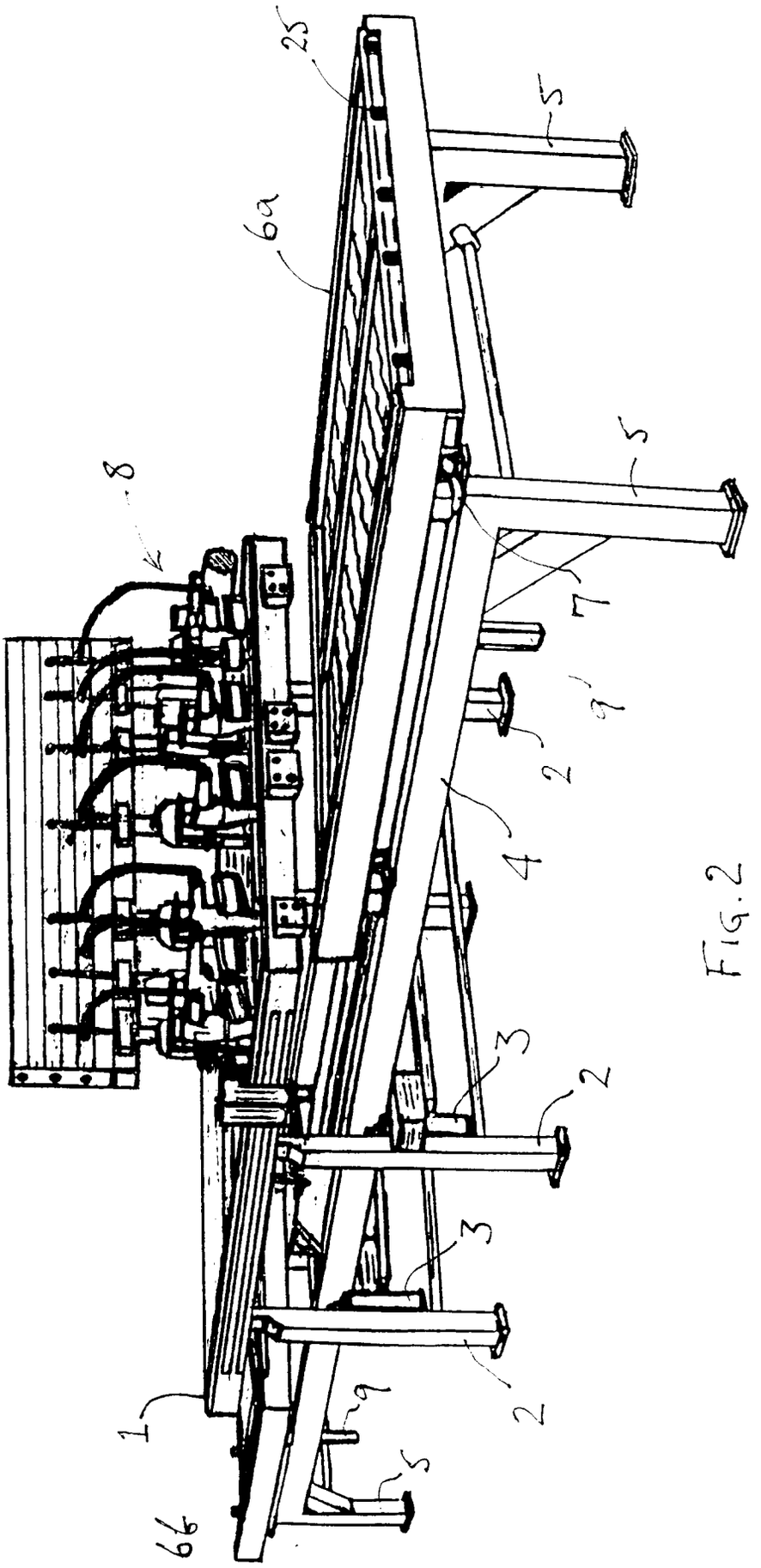

FIG.2

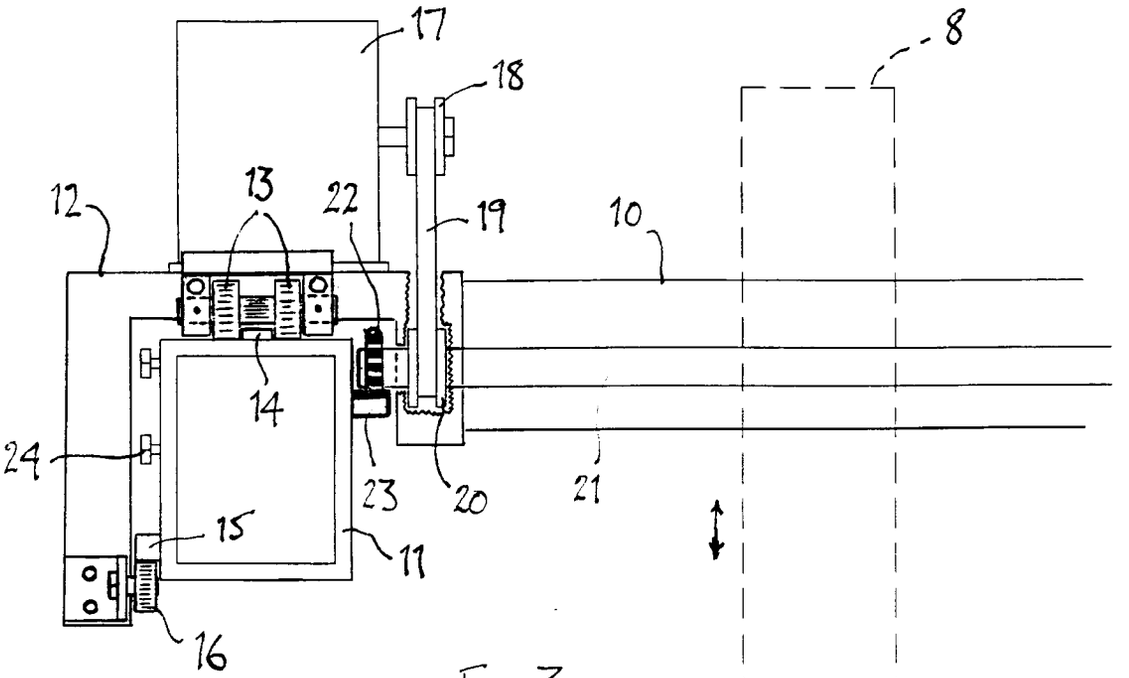

FIG. 3

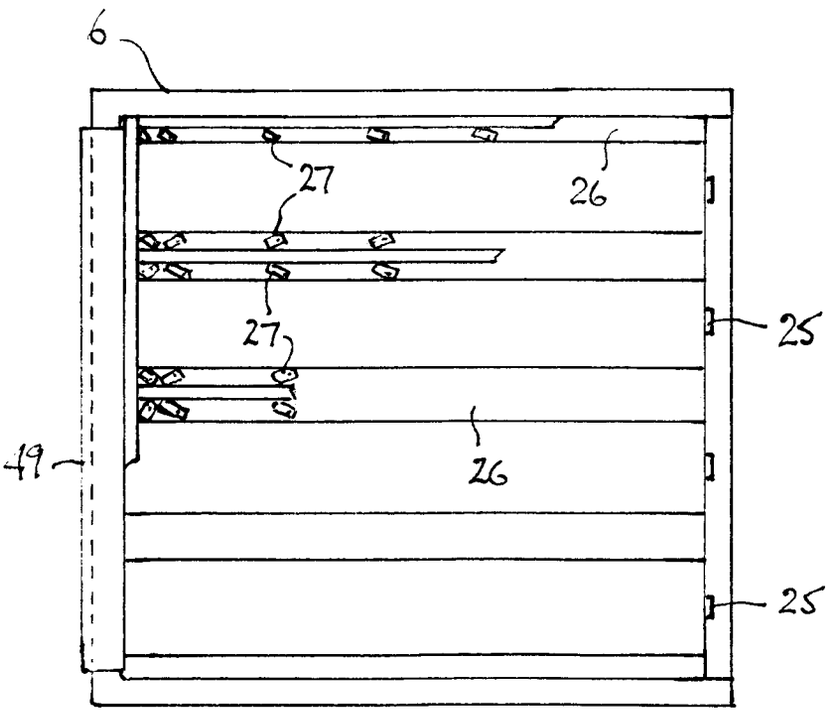

FIG. 4

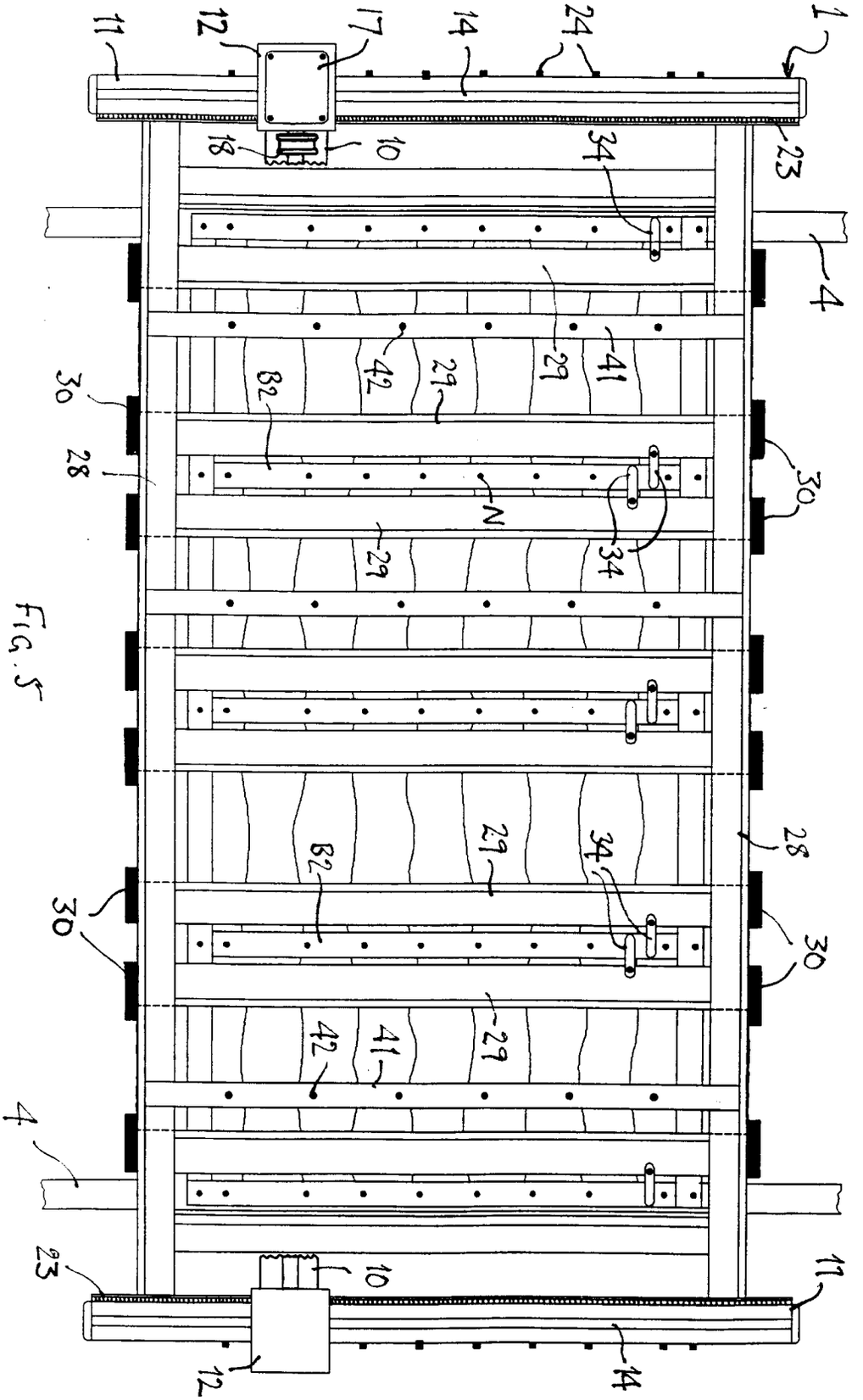
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FIG. 5

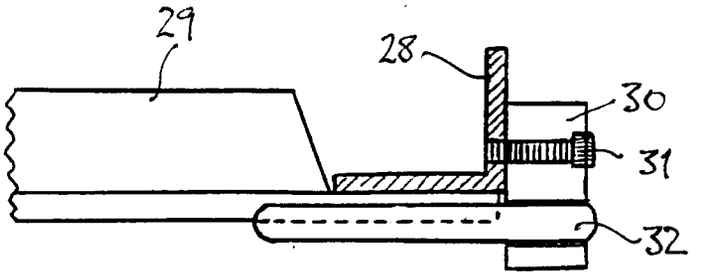

FIG. 6

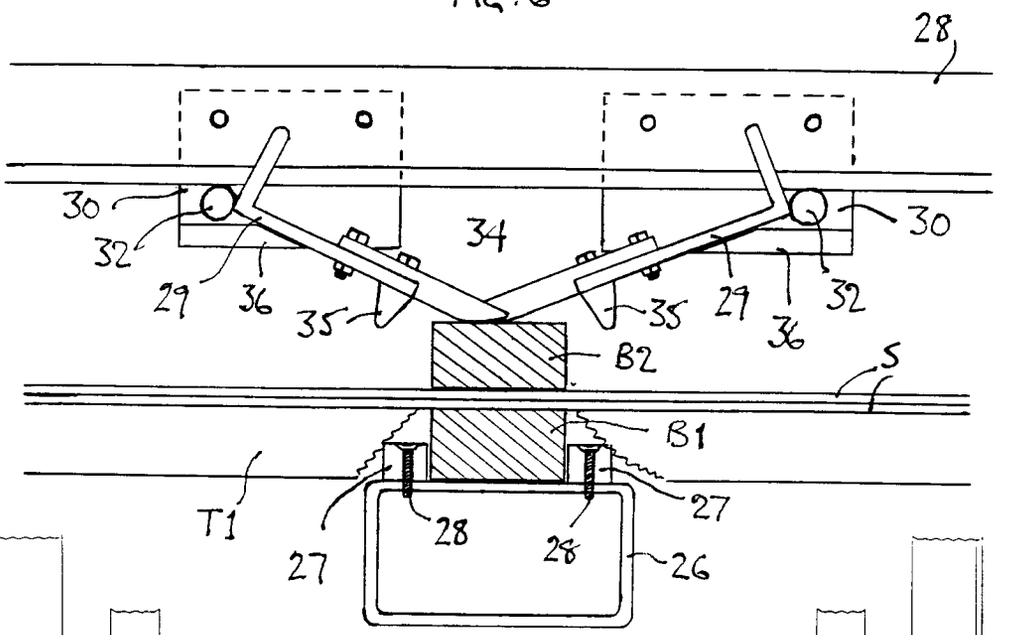

FIG. 7

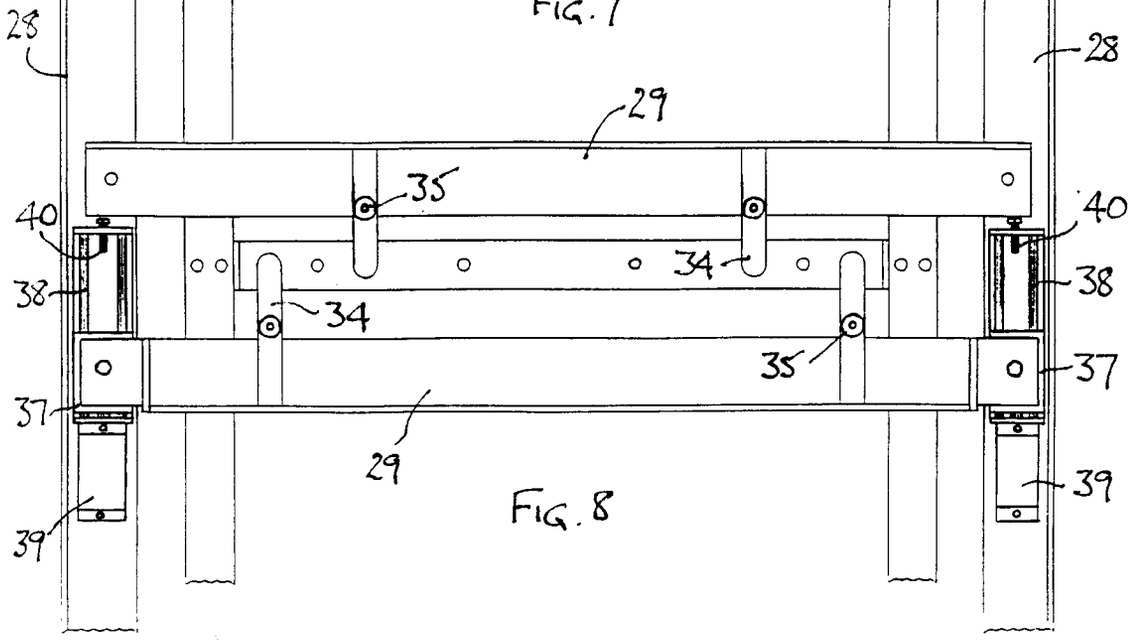

FIG. 8

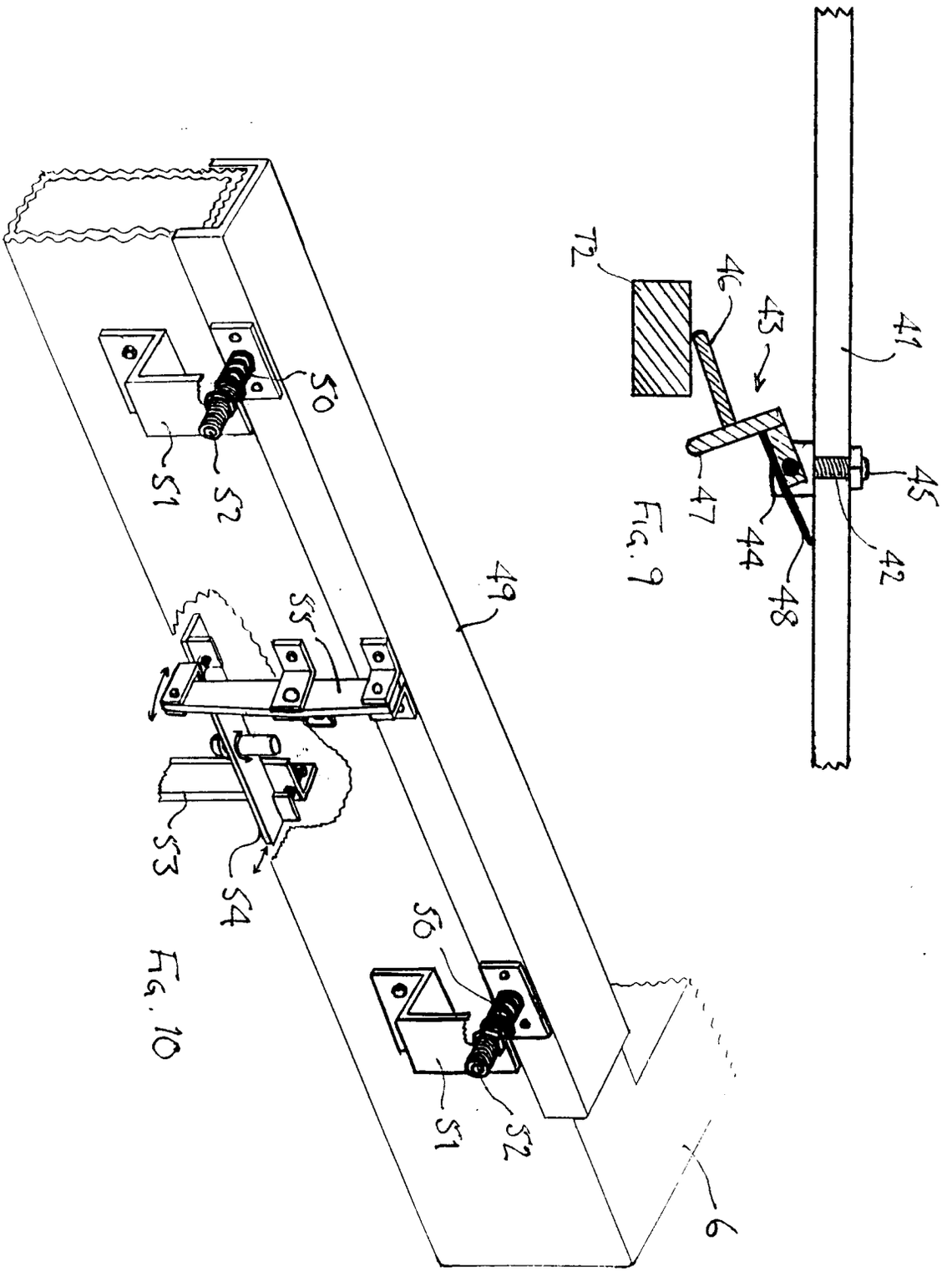

Fig. 9

Fig. 10

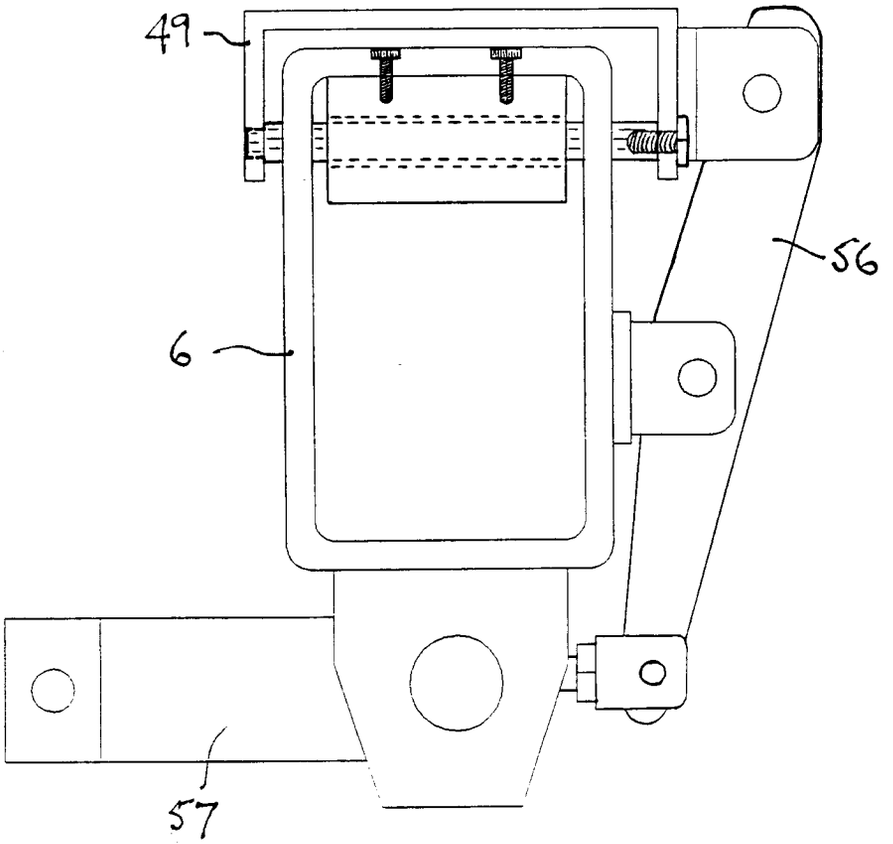

FIG. 11

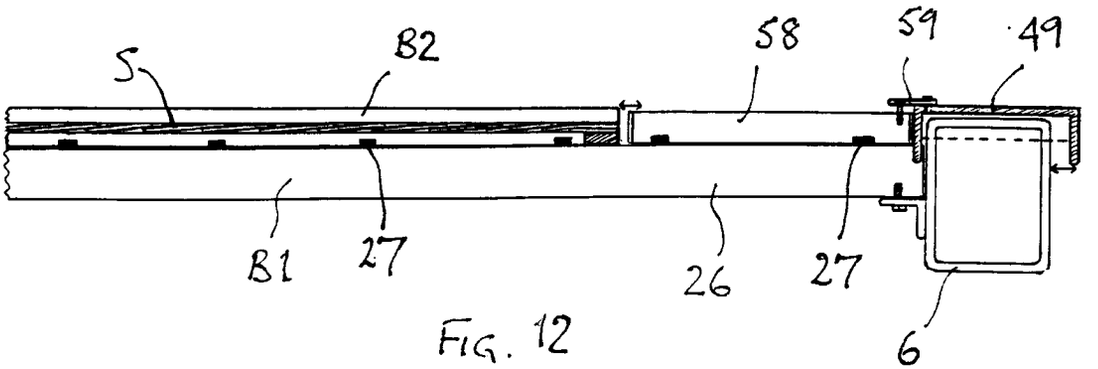

FIG. 12

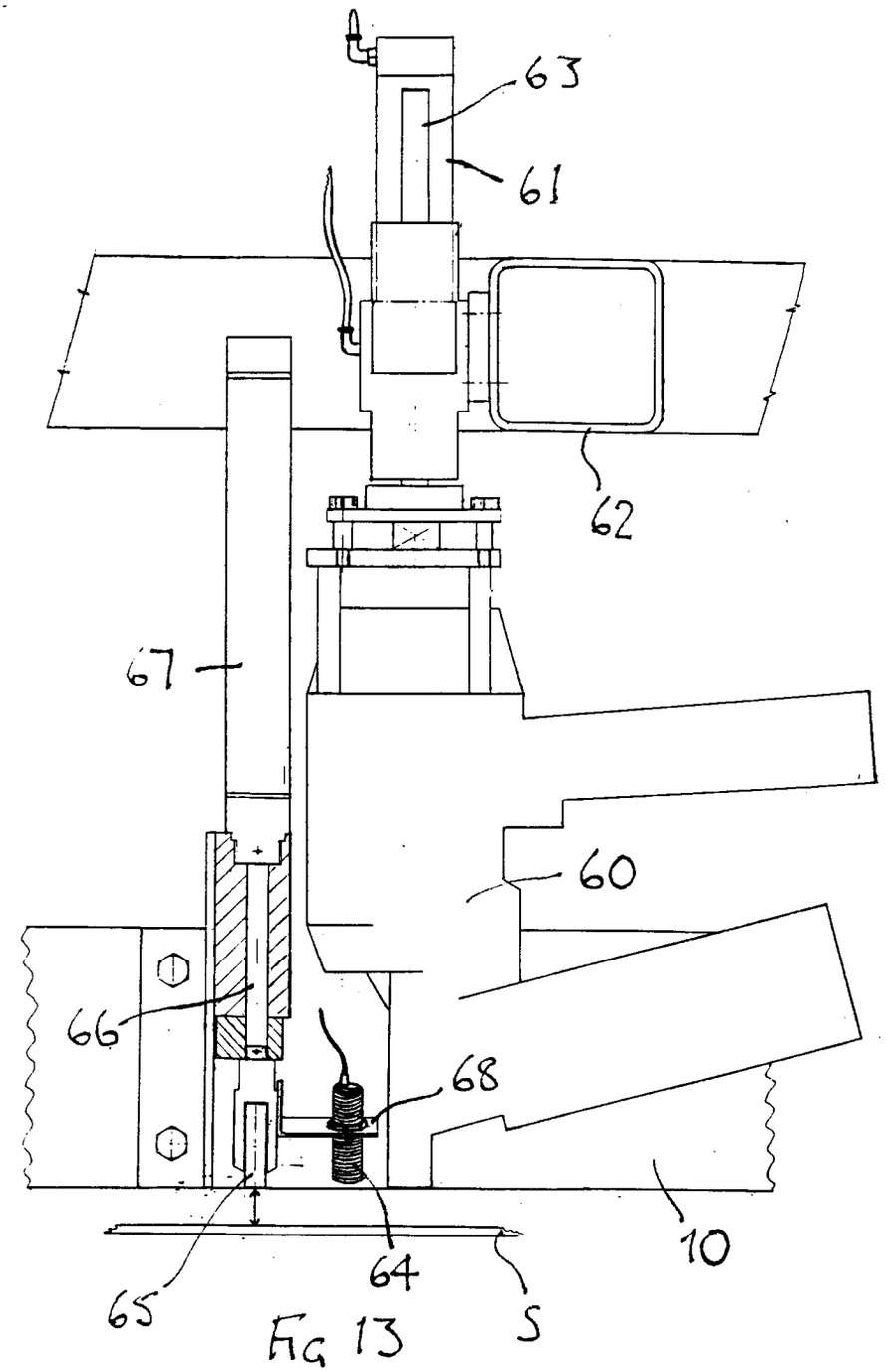

Fig 13

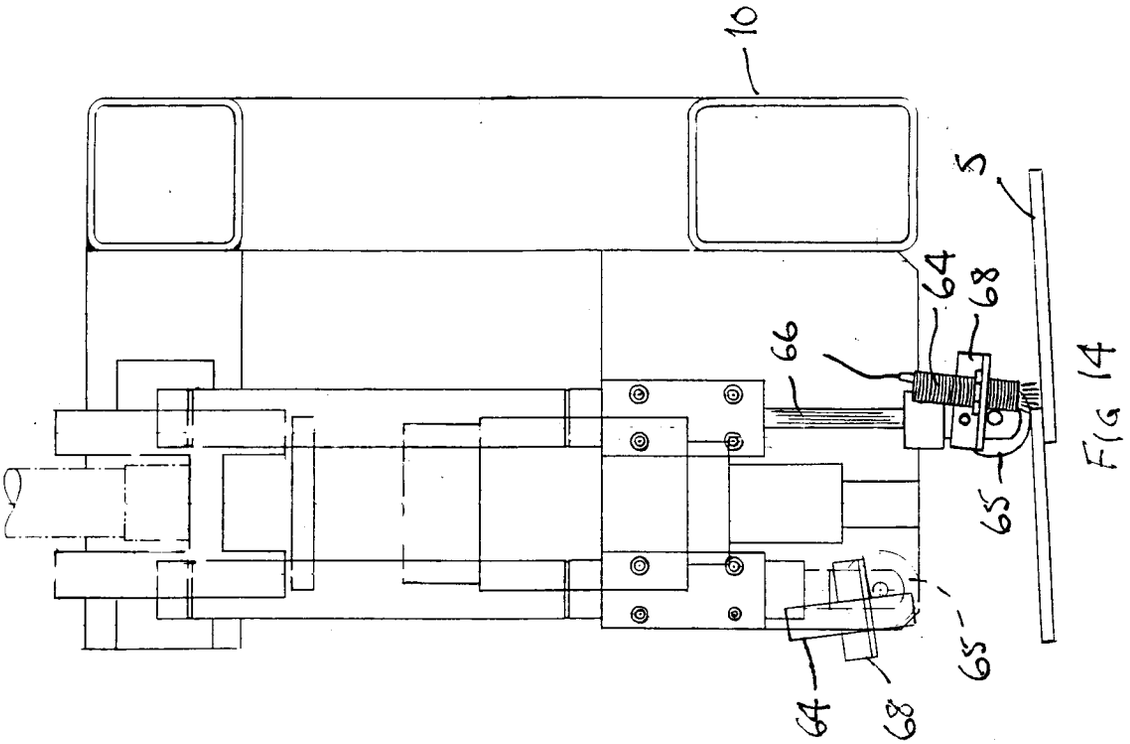

FIG 14

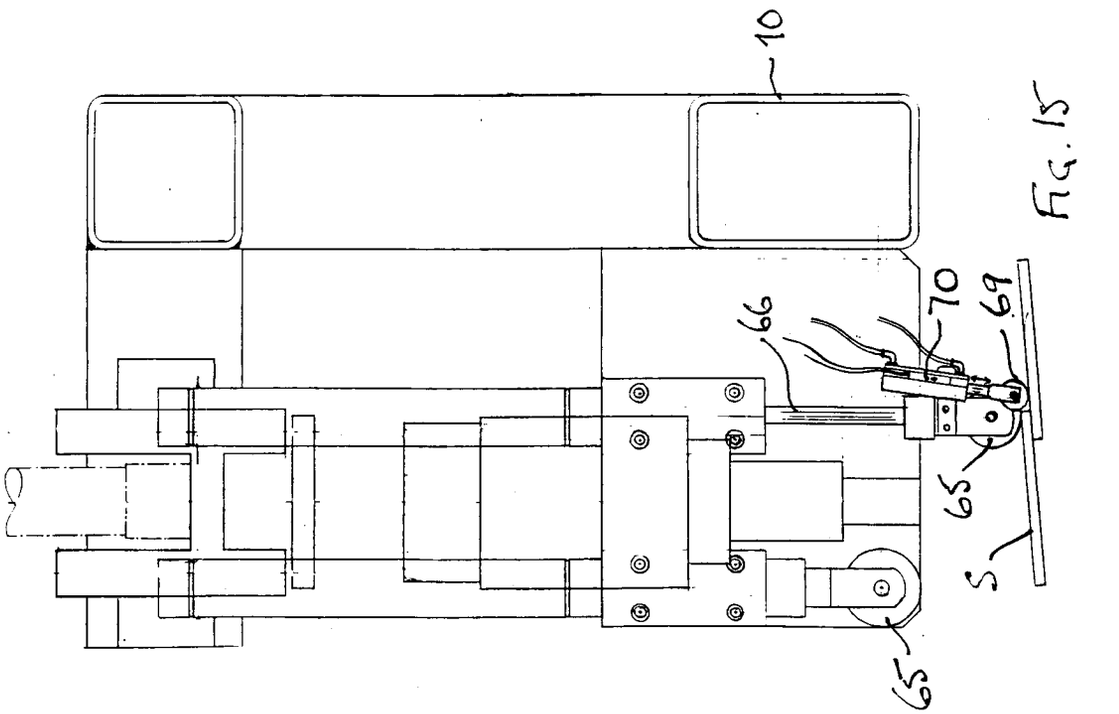

FIG. 15