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Sentourens

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[54] **SHAPING PRESSES**

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[73] Assignee: **Societe Nationale Industrielle Aerospatiale,** Paris, France

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June 8, 1972 France 72.20607

[52] **U.S. Cl.** **72/305;** 72/31; 72/307

[51] **Int. Cl.** **B21d 11/04**

[58] **Field of Search** 72/32, 31, 33, 34, 296, 72/297, 301, 302, 305, 309, 311, 456, 379, 72/307, 389

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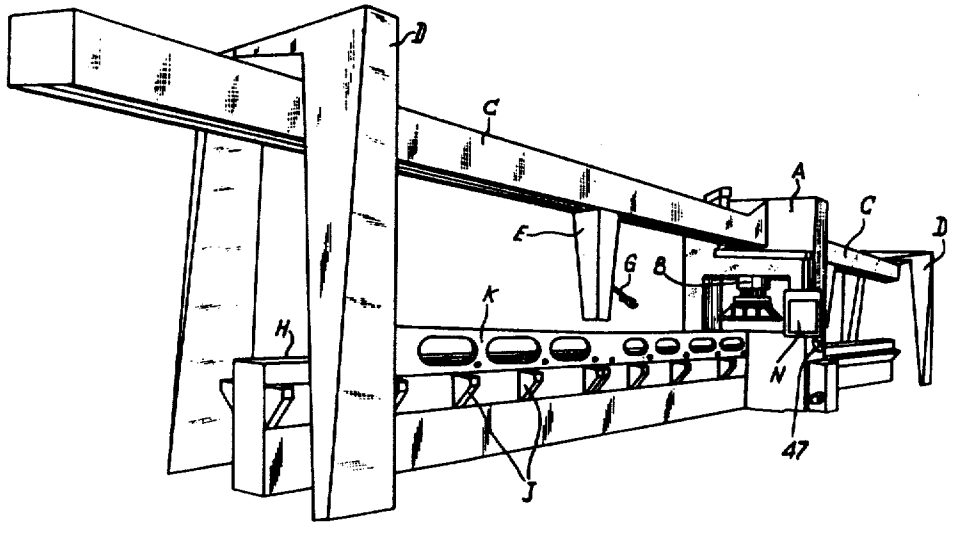
Primary Examiner—C. W. Lanham
Assistant Examiner—M. J. Keenan
Attorney, Agent, or Firm—Karl W. Flocks

[57] **ABSTRACT**

A press device for shaping or flattening a long panel by giving it, at substantially every point, a predetermined curvature either transverse or longitudinal, or both at once, or in a single direction at an angle in relation to the length of the panel. The press device has a frame press carrying a moveable punch and the frame spans a table. Above the table extending on either side of the frame press is an overhead beam supported at its extremities by two portal members, the beam carries a pair of carriages provided with depending brackets able to grip the opposed ends of the long panel as it is shaped or flattened by the punch of the said frame press. Both the punch and the table under the frame press may be provided with displaceable rails. The displacements inter alia of the panel and the punch are accurately controlled and displayed on a display board. The press is also provided with a long table beneath and in line with the said overhead beam, the table being provided with moveable rollers and gauge support means for checking the shape of the panel by metrology.

11 Claims, 19 Drawing Figures



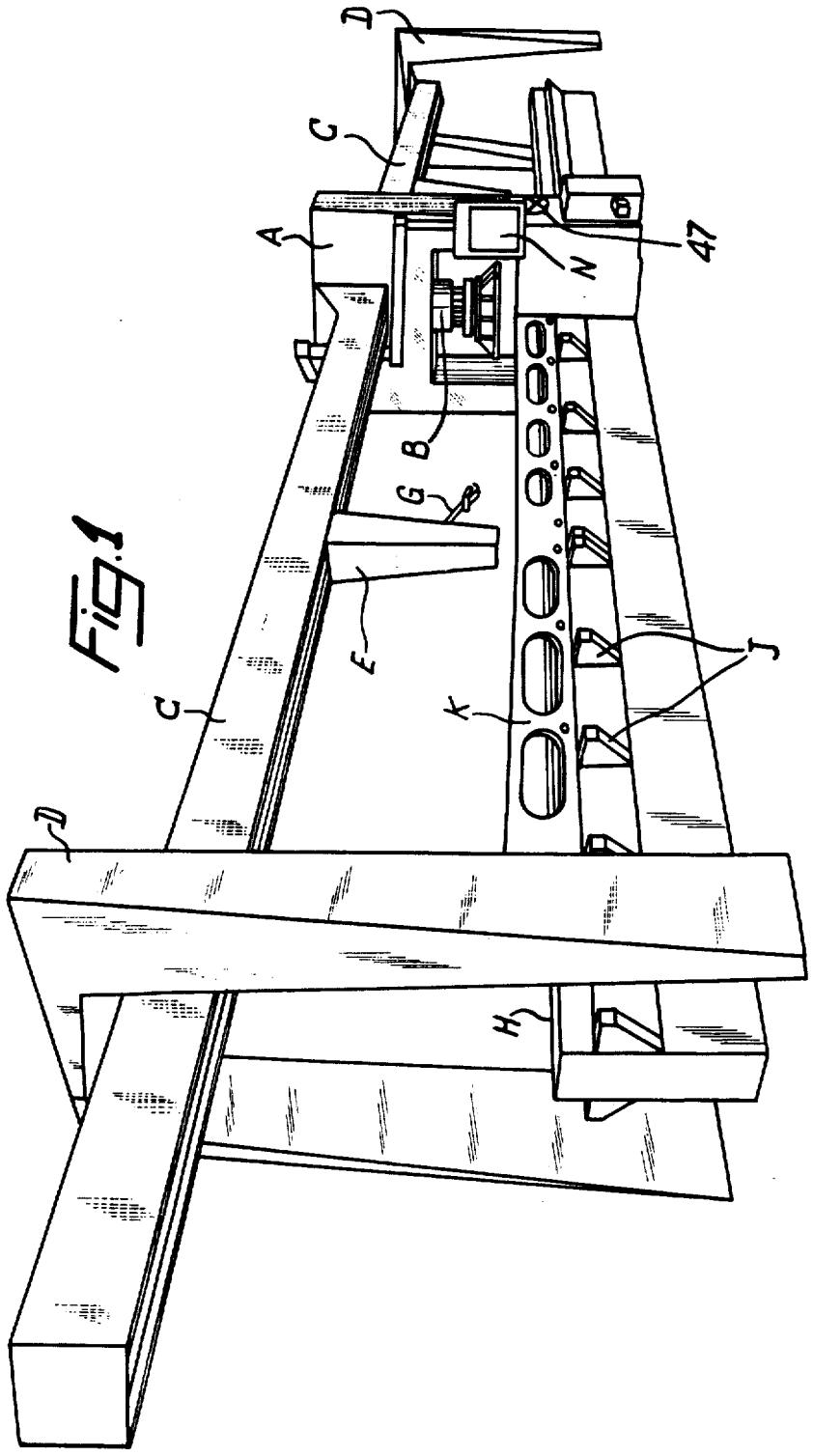


Fig.1

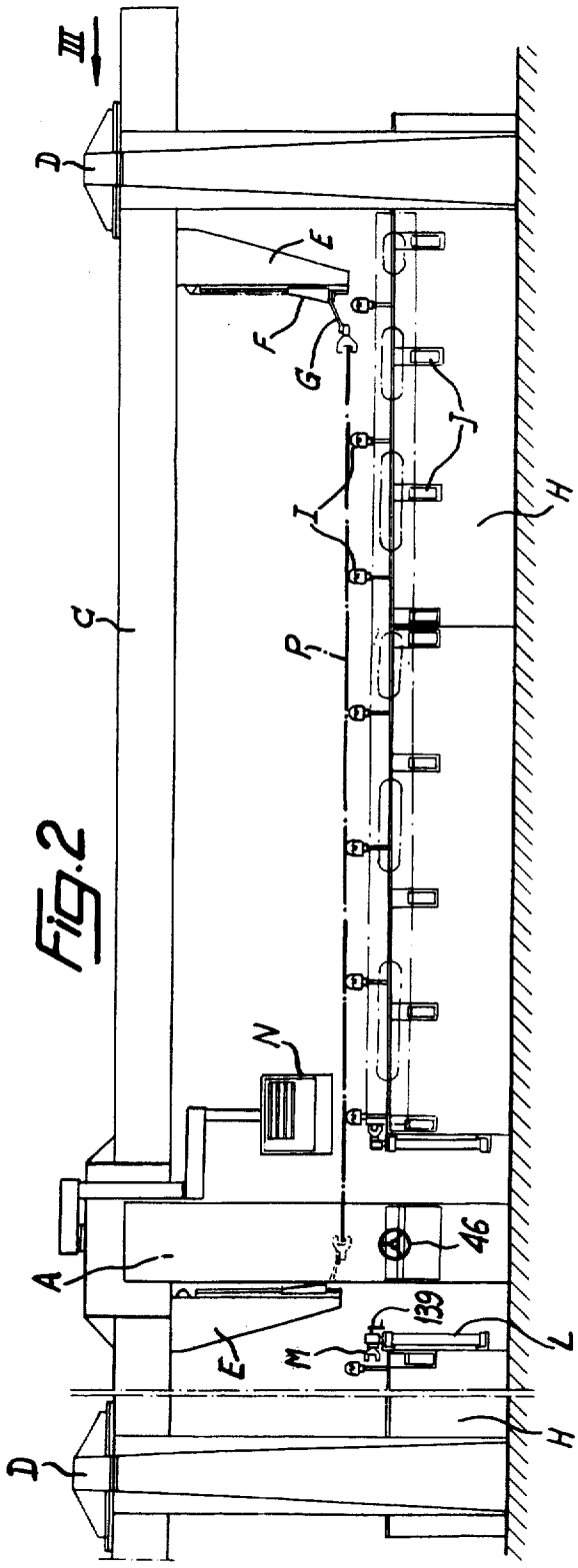


Fig.2

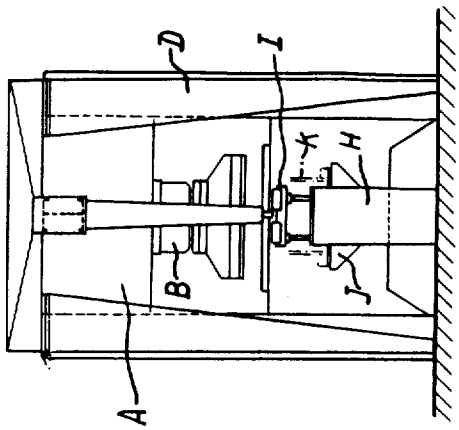
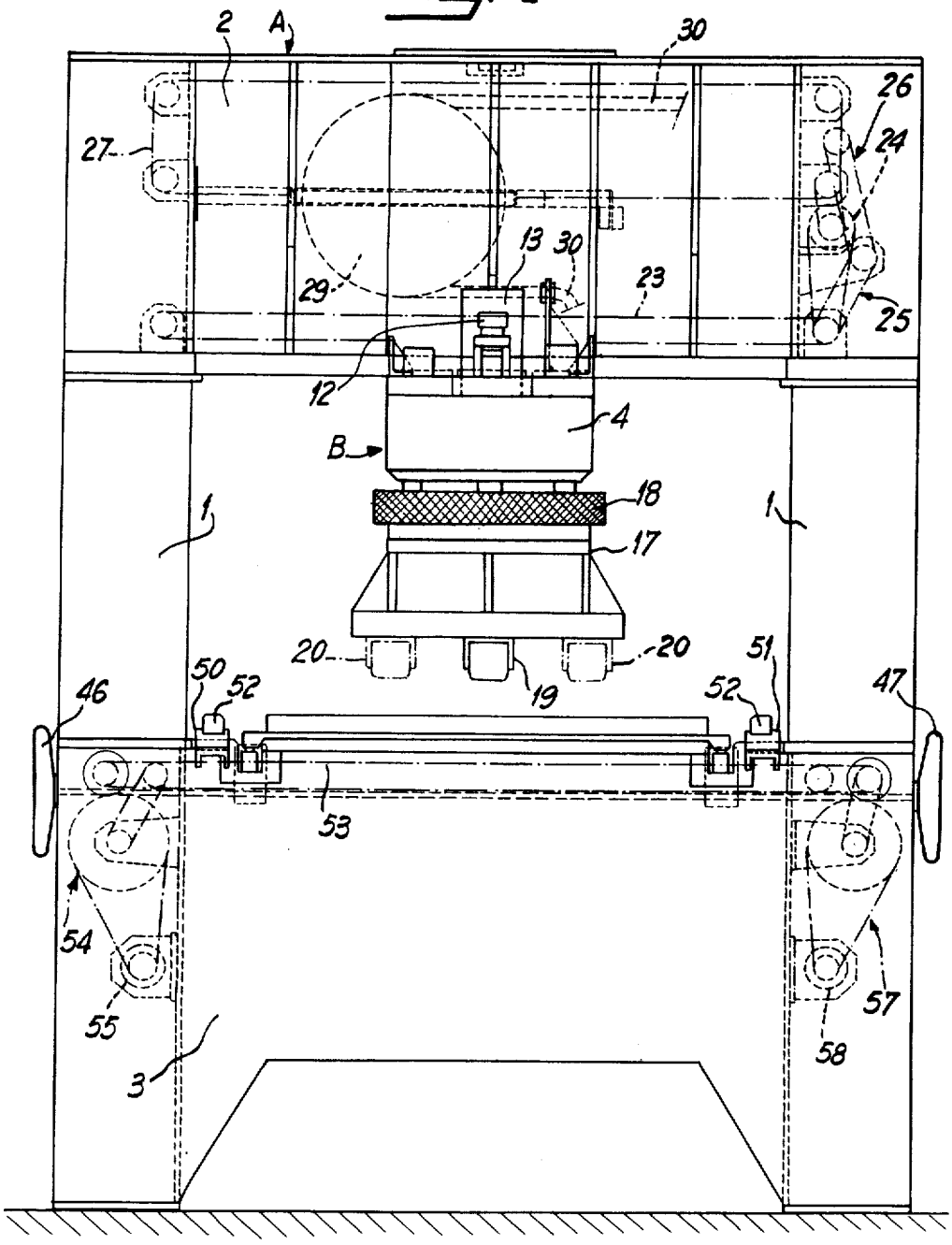


Fig.3

Fig. 4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A
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26
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24
13
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23
25
12
4
B
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3
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58

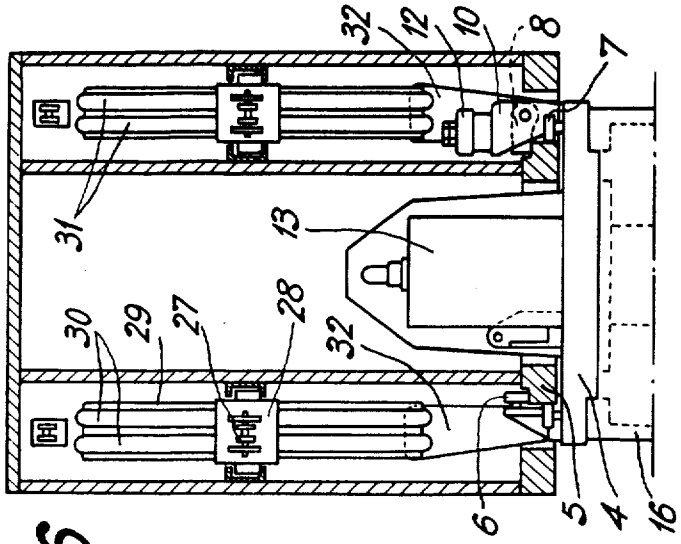


Fig.6

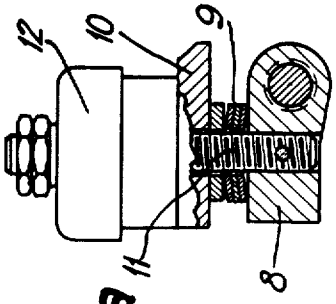


Fig.6a

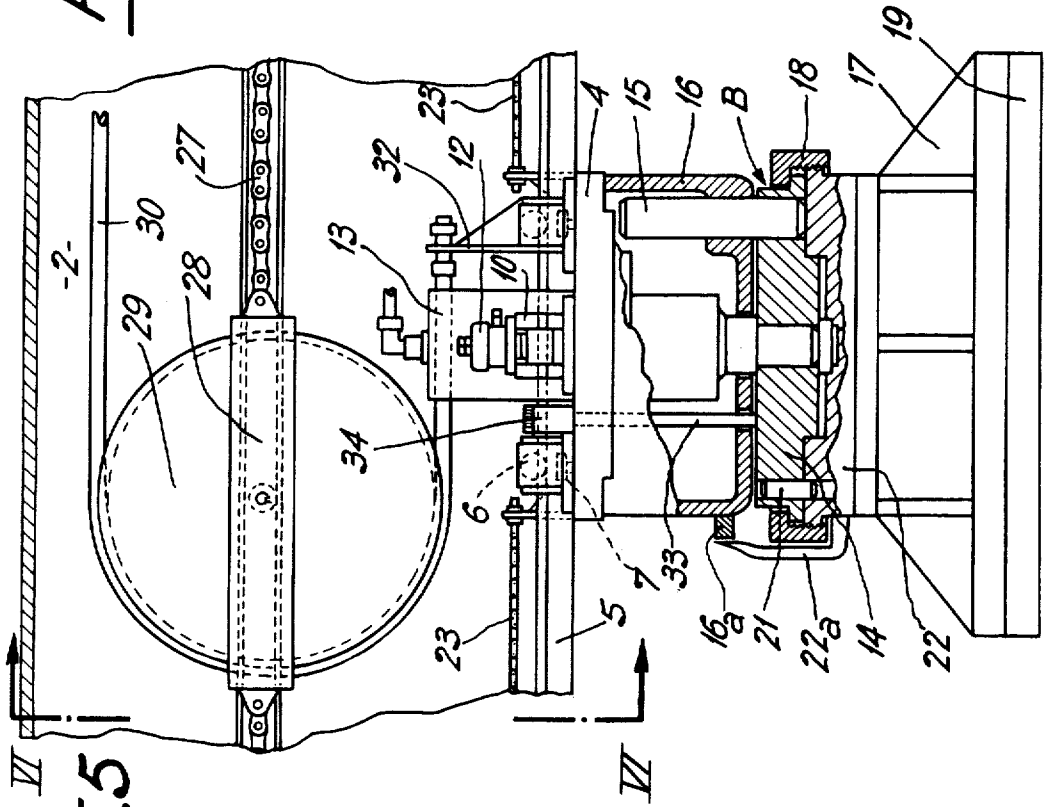


Fig.5

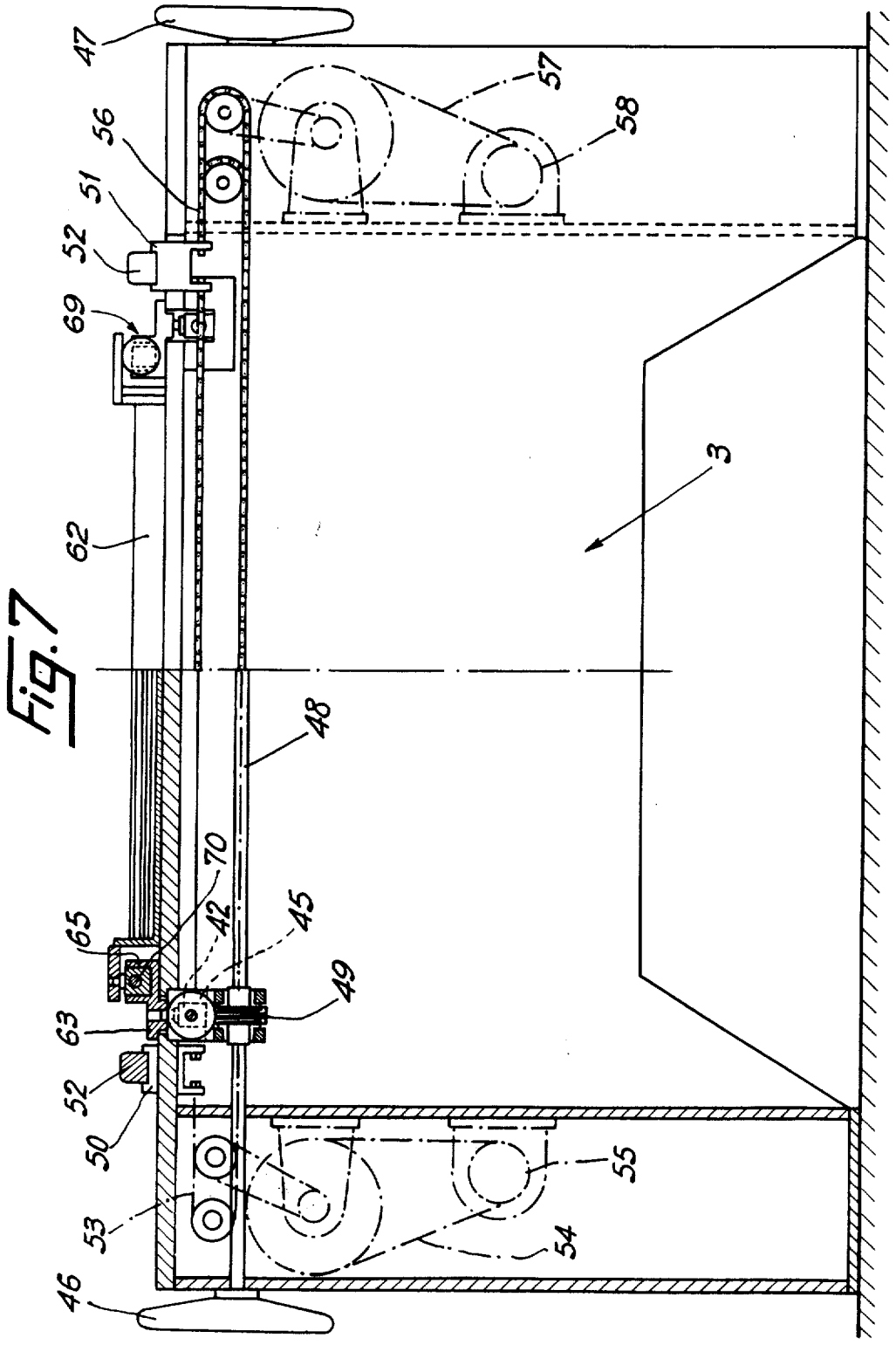


Fig. 7

Fig. 9

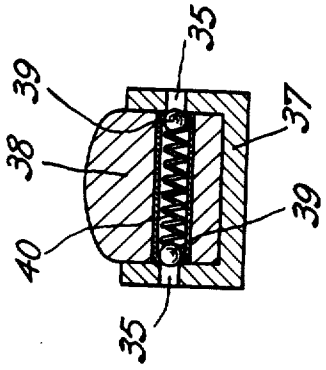
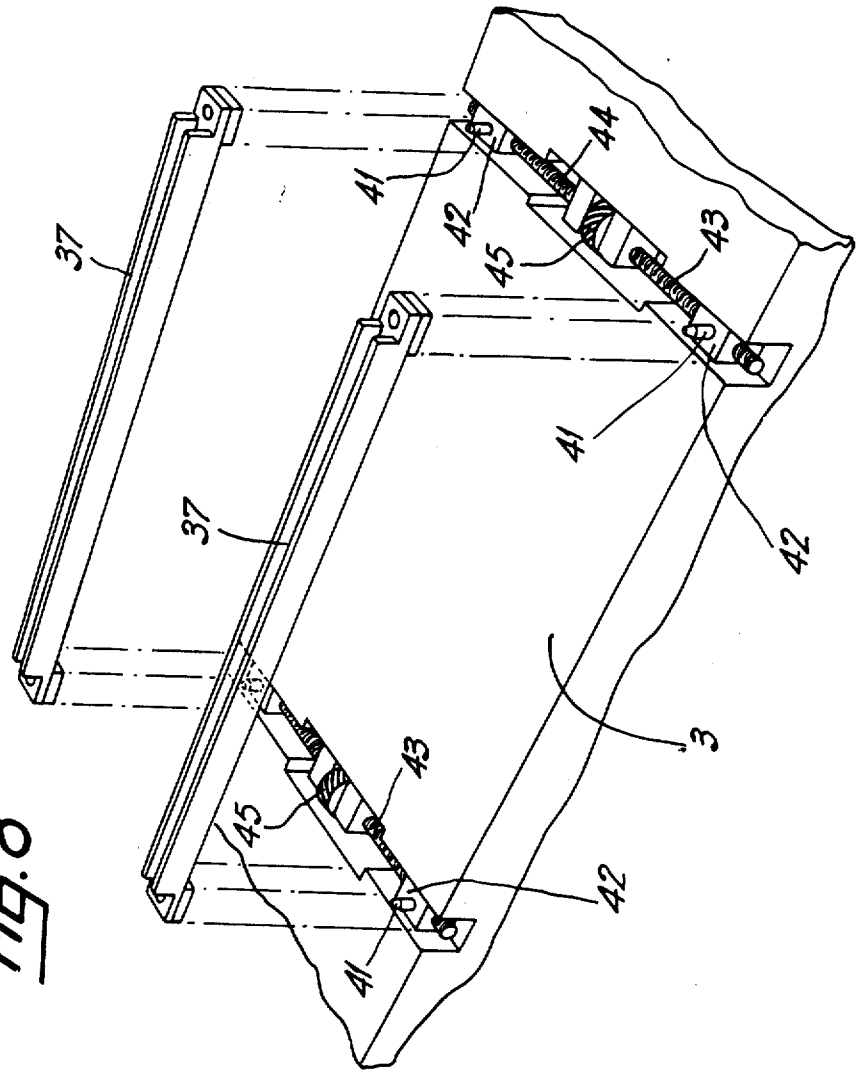


Fig. 8



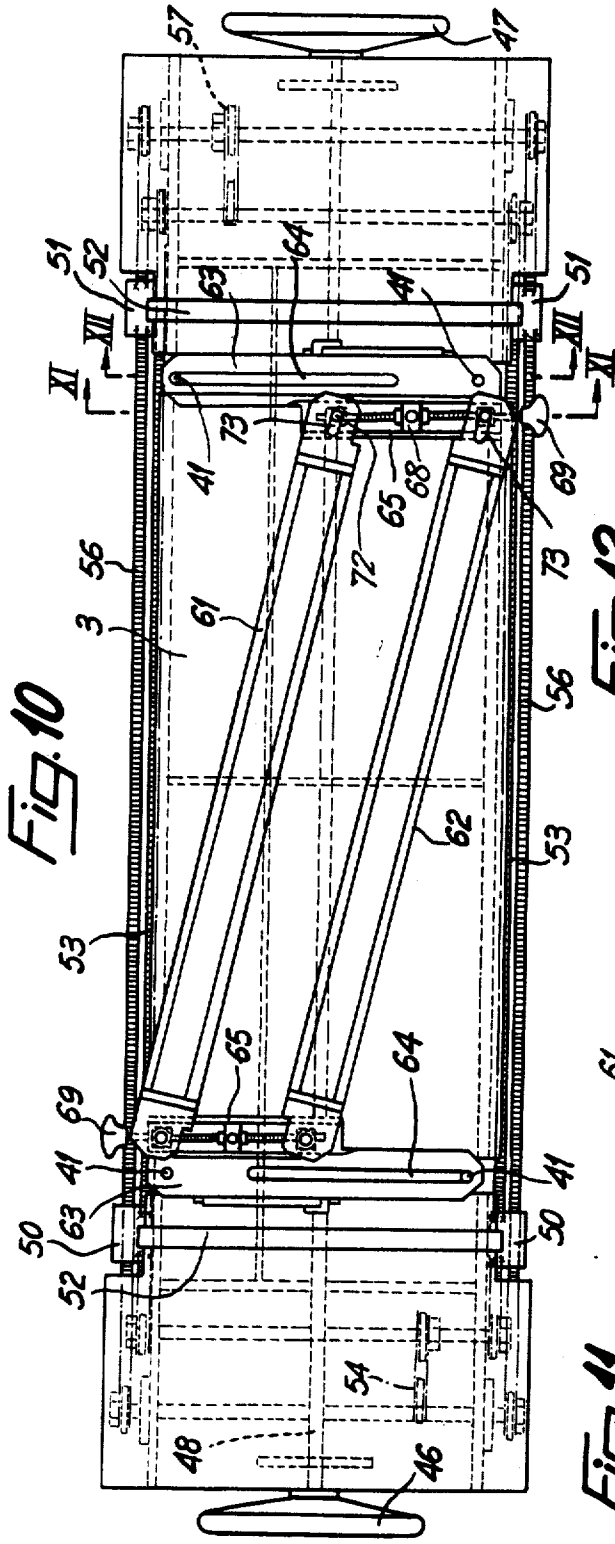


Fig. 10

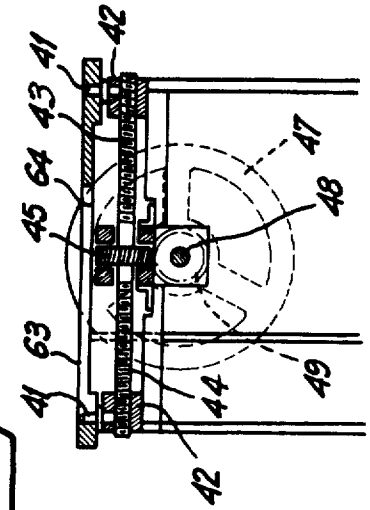


Fig. 12

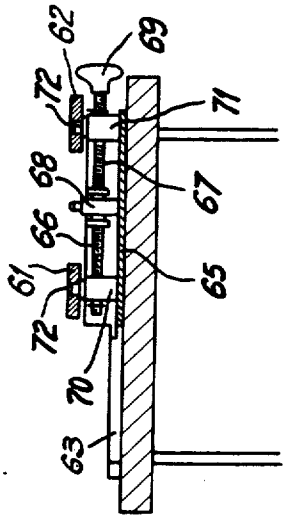
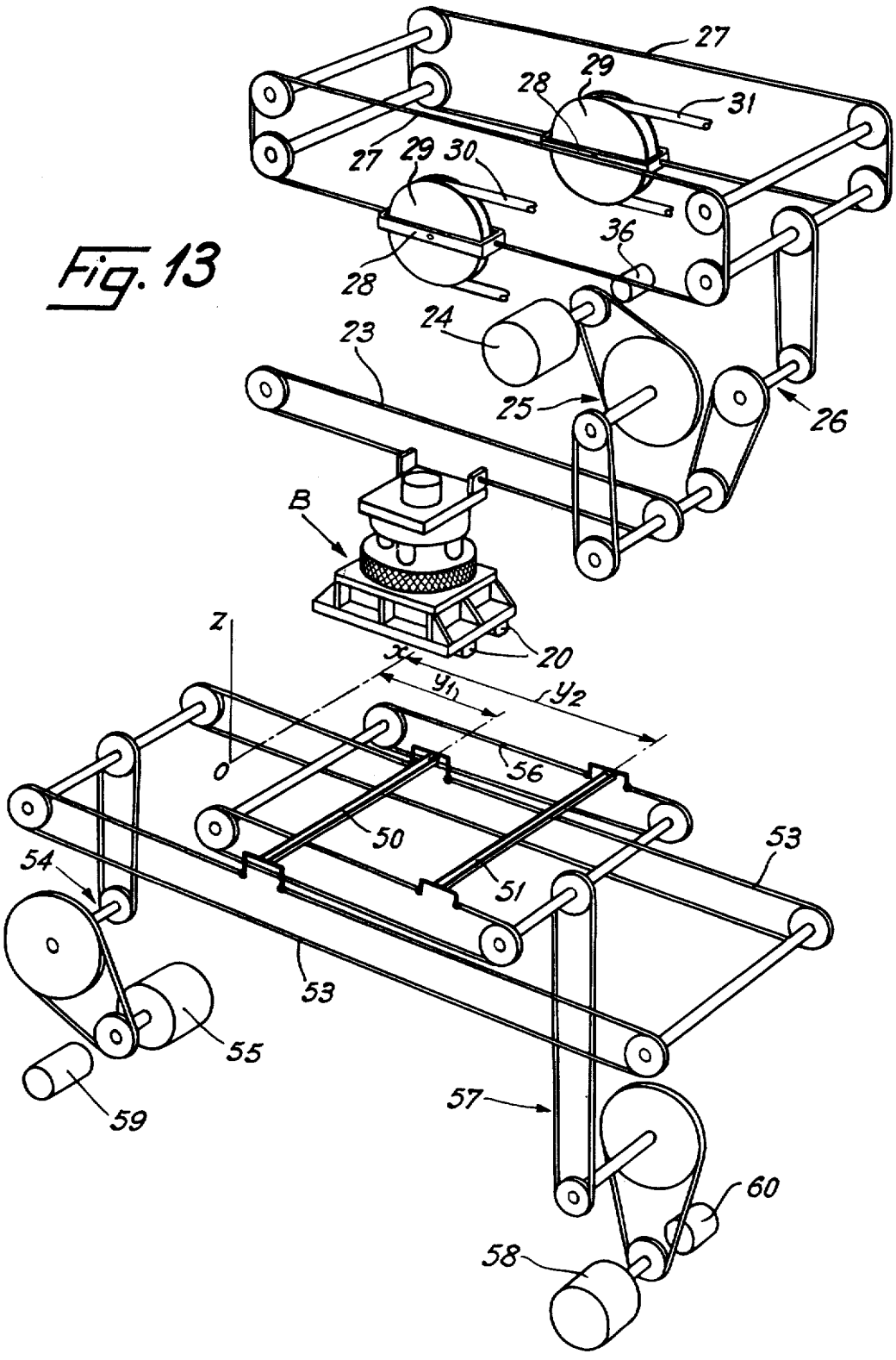


Fig. 11

Fig. 13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29
31
27
29
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36
28
24
23
25
26
B
20
Z
X
y_1
y_2
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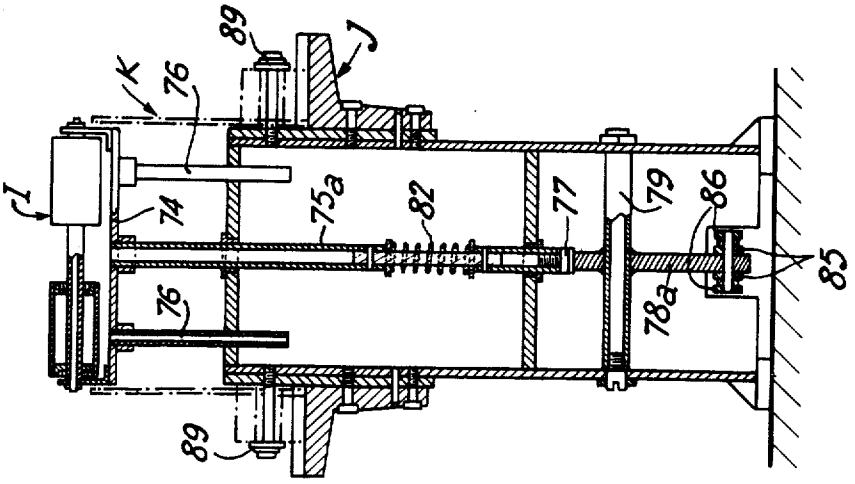
56
50
53
54
51
53
55
59
57
60
58

Fig. 15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J
K
76
1
74
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82
77
79
86
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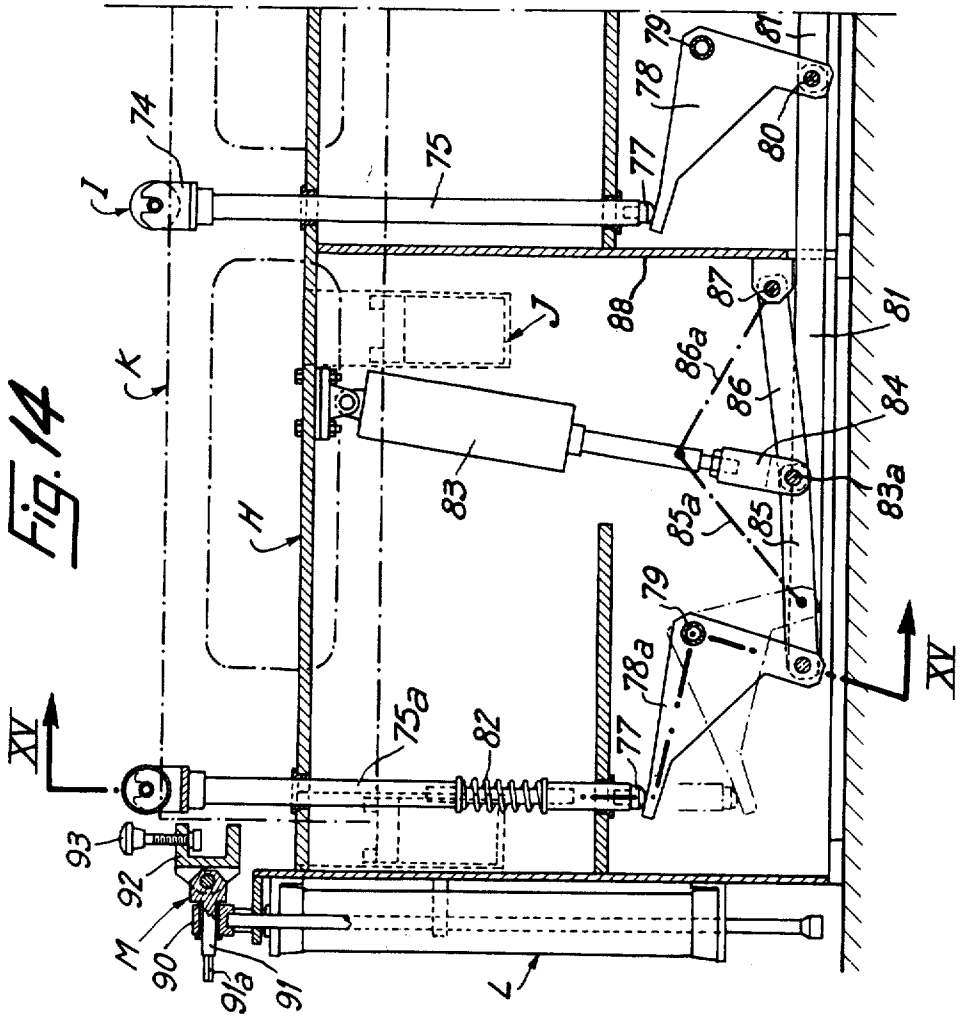
78a
76
89

Fig. 14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93
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M
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91a
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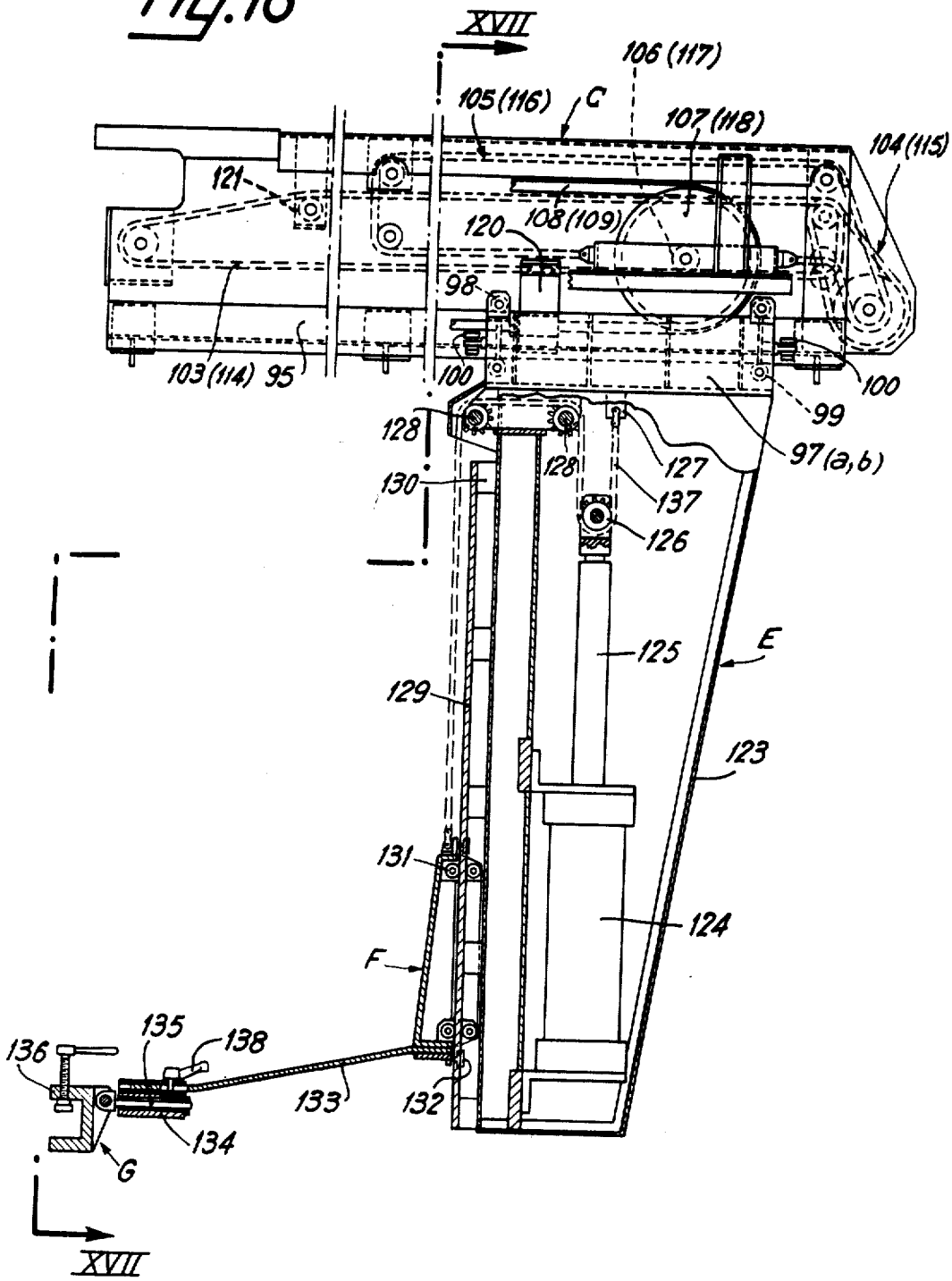
L

Fig. 16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106 (117)
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C
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97 (a, b)
128
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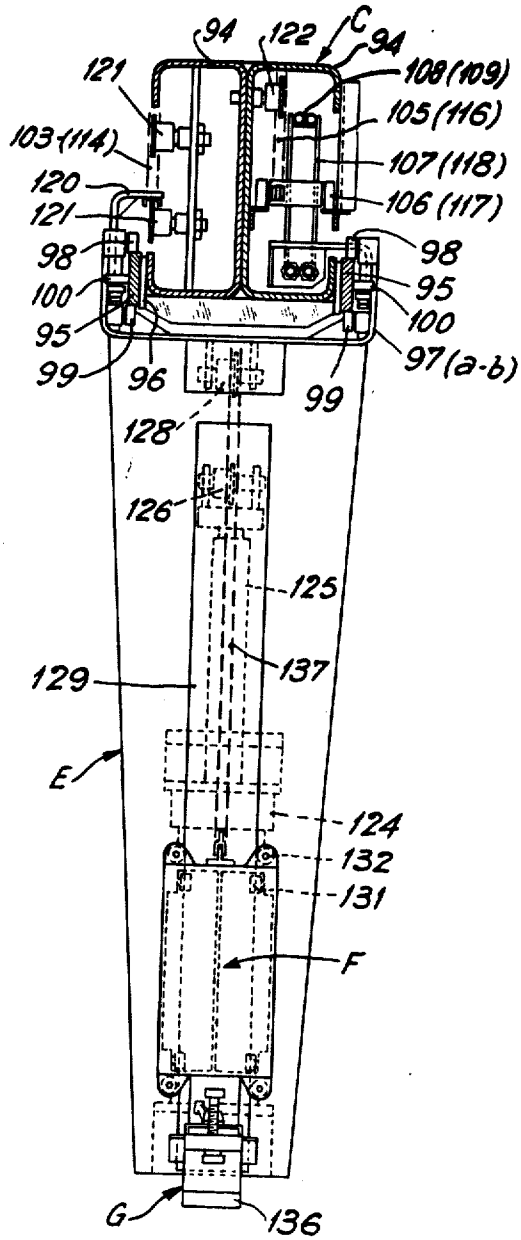
G
XVII

Fig. 17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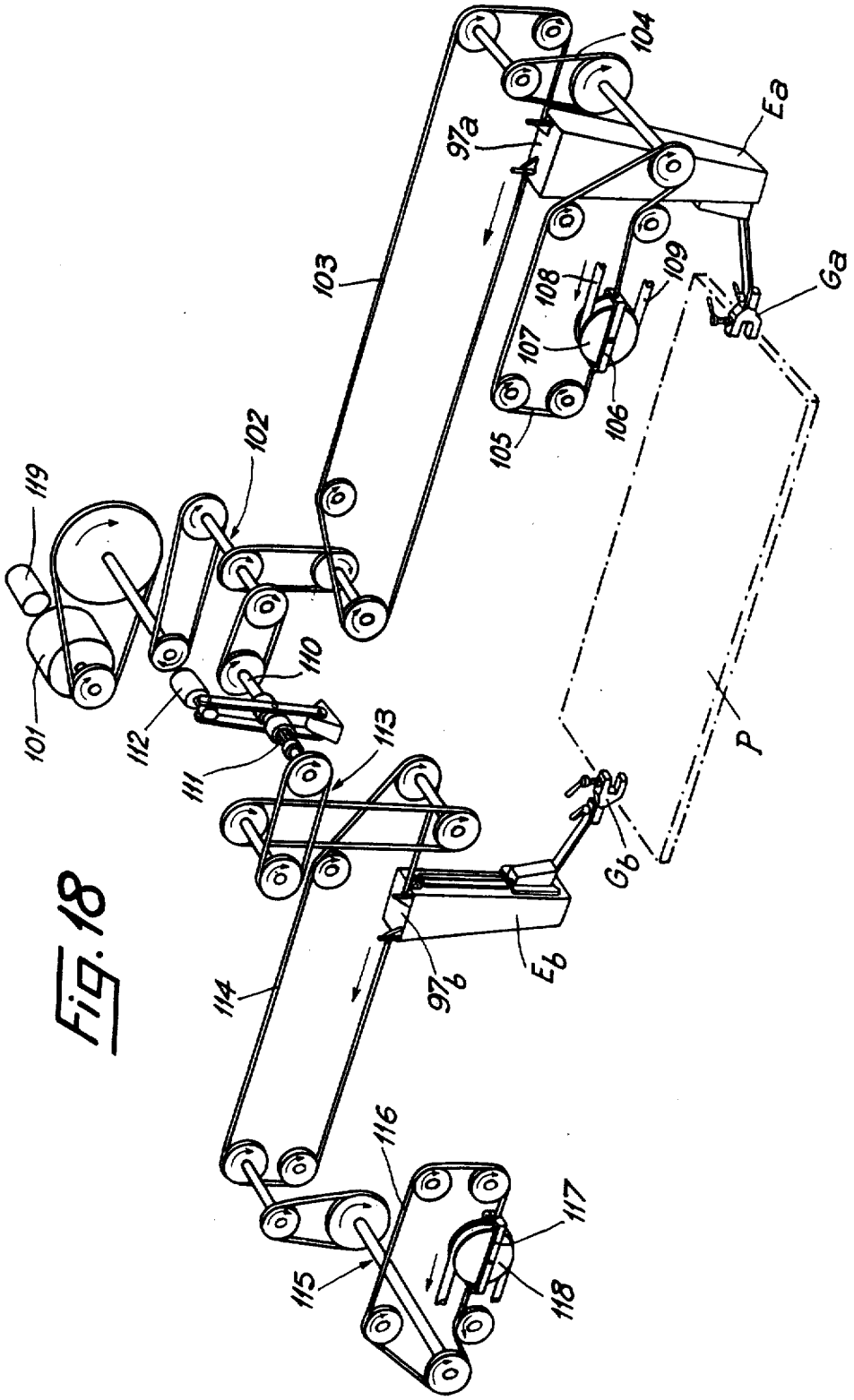
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Ga
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P
Gb
Eb
97b
114
116
117
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118

Fig. 18

SHAPING PRESSES

This invention relates to a press for shaping or flattening very long panels by giving them at substantially every point a predetermined curvature, either transverse or longitudinal, or both at once, or in a single direction at an angle in relation to the length of the panel.

A press of the kind specified also allows the straightening - i.e., flattening - of panels having any shape due inter alia to manufacturing faults or to internal stresses in the material of which they are made.

The panels to be shaped may be of aerodynamic or hydrodynamic structures or panels of constructions which have to have predetermined curvatures for utility or architectural purposes.

The invention applies more particularly to so-called integral panels - i.e., panels cut with their various reliefs, inter alia their reinforcing ribs, in thick, originally flat metal plates.

After machining, the shaped panels with one face remaining smooth can be used inter alia for making the cellules and aerofoils of transport aircraft.

At present panels of the kind specified are shaped using presses, sledge-hammers or even boilermakers' hammers, the shape obtained being checked by gauges.

The work is difficult, nor is it reproducible - i.e., each panel must be treated independently.

The invention obviates this disadvantage; it enables the operations necessary for shaping to be defined during the shaping of a first panel, whereafter such operations can readily be repeated identically during the shaping of the subsequent panels in the same series.

Accordingly we provide a press device adapted to shape panels of elongate construction, comprising a frame press adapted to act locally on each panel, and panel supports disposed on either side of the frame, characterised in that there is associated with the frame press on each side a supporting beam for a carriage having a hanging bracket and bearing each of the ends of the panel, the displacements of the two carriages being conjugate and measured when they are bearing the same panel.

Preferably, the conjugate displacements of the carriages are controlled by a known numerical control - i.e., the carriages can be automatically displaced to take up a position displayed in advance.

Similar places on each of the identical panels can thus be moved beneath the frame press, procedure then continuing bit by bit, in a reproducible manner, for shaping the panels.

Advantageously, there is disposed beneath each beam a set of rollers transverse of the beam which facilitate the conveying of panel and prevent friction at the passage of the transverse press frame against the panel - shaping tools.

On at least one side the rollers can be associated with a table adapted to bear the gauges for checking the shaping work performed; the rollers can in that case be retractable in relation to the table and therefore the gauge, to ensure that the panel is resting on the gauge at the right moment.

Small carriages each bearing one panel end support can be displaced at long brackets hanging from the carriages movable along the beams.

To facilitate handling of the panel, such support can pivot around the horizontal axis parallel with the panel supporting beam, to enable the panel to be turned over.

The support can also be resilient and light-weight so as not to impose on the end of the panel parasitic forces affecting its shaping.

To enable a panel to be completely turned over, an auxiliary lifting device having a panel end rotating support can be disposed on the end nearest the frame press of a gauge-carrying table, to co-operate, in order to turn a panel over completely, with the mobile support associated with the chariot having a hanging bracket disposed on the same side of the press.

In known manner the frame press comprises a punch which can move in the frame transversely of the panel to be shaped.

According to one feature of the invention such displacement can be measured and is preferably also performed by a numerical control; this allows, in each transverse zone of a panel determined longitudinally by the location of the carriages with hanging brackets containing the panel, the punch tool to act exactly at the required place, due to the selection of location in such zone.

A shaping matrix and punch of any kind, inter alia a cylindrical punch and matrix, can be used for shaping the panels.

According to one feature of the invention the shaping tools are curved parallel rails of adjustable distance borne both by the punch and the table of the press. Two rails can be disposed on one side of the panel and a single rail, disposed between the two first-mentioned ones, on the other side.

Use can also be made on each side of the panel of two rails distributed symmetrically in relation to the median plane of the gap between the two rails on the same side of the panel.

Preferably, the rails having a cylindrical surface; however, their curved surfaces can be inwardly curved. In an advantageous embodiment, the tool-carrier of the punch and the press table have rectilinear sectional members whose distance can be adjusted and into which the rails fit, being retained by locking, for instance, by sprung catches.

By using rails of the kind specified and arranging them in a suitable manner the panel can be bent in a direction longitudinal or transverse, or even inclined in relation to the panel.

In another feature of the invention, to obtain a reproducible shaping effect the vertical displacement of the punch is measured and reproduced with extreme precision, higher, for instance, than one-tenth of a millimetre. Both resilient and plastic deformation cambers can therefore be obtained which are identical in the successive portions of the panel.

Experience has shown that, independently of the force required from the press, an identical total deformation camber is distributed in the same fashion in resilient camber and permanent camber.

Finally, at a point on the panel defined by its abscissa, in the direction of the length of the panel, and its ordinate, in the direction of the width of the panel, it is possible to impose a predetermined deformation whose characteristics are defined essentially by the course of the press punch, independently of the force required from the press.

Moreover, the reproducible selection of the arrangement of the shaping rails for action at a predetermined place on the panel enables the curvature given to the

panel at that place to be varied if required using the same rails.

The accompanying drawings show clearly by way of example only how the invention can be put into effect.

FIG. 1 is a perspective view of the assembly of a device according to the invention;

FIG. 2 is a side elevation of the device;

FIG. 3 is an end elevation, taken in the direction of the arrow 111 of FIG. 2.

FIG. 4 is an end elevation of the frame press of the device.

FIG. 5 shows partly in section the punch mechanism of the frame press;

FIG. 6 is a scrap section taken on the line VI — VI of FIG. 5;

FIG. 6*a* is a detail of FIG. 6;

FIG. 7 is a part-elevation and a part-section of the table of the frame press;

FIG. 8 is a perspective plan view of the table showing its operation and the position of the shaping rails.

FIG. 9 is a cross-section of a shaping rail;

FIG. 10 is a plan view of the same table adapted to receive inclined shaping rails;

FIG. 11 and 12 are sections taken on the lines XI — XI and XII — XII of FIG. 10 respectively;

FIG. 13 is a diagrammatic perspective view of the kinematic chains ensuring the displacement of the rails and the punch-carrying carriage under the press frame;

FIG. 14 is an axially sectioned view of one of the two tables disposed on either side of the press frame;

FIG. 15 is a section taken along the line XV — XV in FIG. 14;

FIG. 16 is a side elevation, partly cut-away, of a carriage with hanging brackets;

FIG. 17 is a section, taken on the line XVII — XVII, in FIG. 16 of a supporting beam for a hanging bracket and a front view of such bracket taken on the line XVII — XVII in the same FIG. 16, and

FIG. 18 is a diagrammatic perspective view of the kinematic chains for displacing the two hanging brackets.

Referring to FIGS. 1 – 3, the device has at its centre a press frame A having a punch carrying carriage B which can move in the opening in the frame. On either side of the press and bearing against the top of the frame and perpendicular therewith are disposed horizontal beams C supported by portals D at their ends opposite from the press.

Movable along each of the beams is a carriage 97 (FIG. 17) with hanging brackets E_a, E_b, a carriage F bearing a gripping member G for one end of the panel to be shaped being movable along each of the beams.

In line with each of the beams there rests on the ground a table H having rollers I whose supports can move in the vertical direction, and brackets J on which gauges K for checking the shaping of the panels can be disposed.

Attached to each end of the table turned towards the press is a lifting device L, for instance a jack, comprising at its end a gripping member M adapted to be combined with the member G disposed on the same side to enable a panel to be turned over in the way described hereinafter.

The arrangement also has a display board N which can display the numerical data determining the position of each of the active members of the arrangement and at the same time recording the actual positions of the members, so that the displacement thereof is in known manner automatic and stopped when the values displayed coincide with the actual values.

The framepress (FIG. 4) is formed by two uprights 1, a caisson-shaped top 2 and a table 3. A carriage 4 of the punch carrying carriage B rolls on solid rails 5 (FIGS. 5 and 6) forming the lower part of the top, via rollers 6, and is centred on such rails by lateral rollers 7. Lastly, the carriage 4 bears against the rails with an increasing force when the press is operating.

When the carriage 4 has reached the required position it is immobilized and pressed against the lower face of the rails 5 by tilting bolt S 8 each impelled by the resilient force of a stack of washers 9 (cf. FIG. 6*a*) each stack bearing againt a stirrup 10 unitary with a lateral edge of the carriage 4. To release the carriage 4, each bolt 8 is lifted by a rod 11 via the action of an hydraulic jack 12.

The punch press can move vertically in relation to the carriage 4 as a result of a jack 13 operating on the centre of supporting plate 14 of the punch tools. The supporting plate 14 is prevented from rotating by four pins 15 vertically engaging in a bell-shaped member 16 forming the lower part of the carriage 4.

The tool-carrier 17 is attached to the circular plate 14 by a ring nut 18. In its lower portion the tool-carrier 17 has at least one U-shaped sectional member 19 disposed in its median plane, and also preferably a pair of sectional members 20 (shown in chain-dotted lines in FIG. 4) disposed symmetrically in relation to the central sectional member.

To enable the sectional members 19, 20 to be oriented perpendicularly to the frame, as shown in FIG. 4 or parallel therewith, as shown in FIG. 5, the supporting plate 14 has an indexing finger 21 which can engage in two holes disposed in the base 22 of the tool-carrier 90° one from the other. The finger 22 can also be completely retracted to enable the sectional members 19 or 20 to be orientated obliquely in relation to the frame so as to co-operate with rails also disposed obliquely on the table 3, as shown in FIG. 10.

To determine the orientation the base 22 can bear, an index 22*a* co-operates with a graduated angle unit borne by a sector 16*a* attached to the lower portion of the bell-shaped member 16.

The punch carrying carriage B bearing the tools forming the punch is displaced as a whole (FIGS. 4 and 5) along the rails 5 by the chain 23 attached to the said carriage by its two ends, the chain 23 being driven by a motor 24 via an intermediate transmission 25 (FIG. 13). The said intermediate transmissions illustrated in FIGS. 13 or 18 utilise complex pinion means and are required to obtain predetermined step-down ratios with pinions having a standardized number of teeth.

The motor 24 also drives, via intermediate transmission 26, the chains 27 in a displacement which at any moment is one-half that of the chain 23. The chains 27 are attached by their two ends to frames 28 acting as supports for pulleys 29 on which the supply tubes 30 and 31 for the jack 13 displacing the punch and jacks 12 controlling the brakes respectively are wound.

The ends of the tubes can therefore be attached on the one hand to the top 2 and on the other to plates 32 unitary with the punch carriage B, the tubes 30, 31 remaining constantly tensioned.

The vertical displacement of the tool carrier 17 (FIG. 5) is measured by a senser 33 which transmits such in-

formation to a coding device 34 whose result is displayed on the board N opposite the required value for the displacement punch. The measuring and coding device (known per se) is one of the precise type adapted, for instance, to evaluate displacements to about one hundreth of a millimetre.

Similarly, the displacement of the carriage B along the frame A is evaluated by a coder 36 (cf. FIG. 13) which is advantageously of the rotary type and can be disposed in front of the output shaft of the drive motor 24 to evaluate the turns and fractions of a turn thereof, so as to indicate at any moment the location of the punch in the carriage B and enable a precise predetermined position to be given thereto.

The U-shaped sectional members 19 and 20 (FIG. 4) of the punch are adapted to receive, in the manner illustrated in FIG. 9 for a U-shaped sectional member 37 adapted to be borne by the table 3, detachable rails 38 whose outer surface is curved and which are adapted locally to shape the panel treated in the press.

To shape lightweight alloy panels, the rails 38 can be made of reinforced plastics, for instance, polyester or phenoplastic resin reinforced with cotton fabrics or glass fibres.

The various rails are retained in the U-shaped sectional members 37 by detent balls 39 urged by a spring 40, the balls entering lateral drillings 35 in such sectional members.

To actuate the rail 38 mounted in the sectional member 19 there is provided as illustrated in FIG. 8, two sectional members 37 having holes at their ends which engage with dowels 41 integral with nuts 42. The two nuts 42 disposed towards the same upright of the press have a right-hand and left-hand threading respectively, so that the two screws 43, 44 of contrary pitch connected by the intermediate helical pinion 45 can bring the sectional members 37 towards or away from one another when the two screws 43, 44 are driven by the rotation of the helical pinion 45.

The rotation of the two pinions 45 (FIGS. 7 and 12) is obtained by the rotation of one or the other of the handwheels 46, 47 unitary with the same shaft 48 extending through the table 3 and bearing two helical pinions 49 which mate and co-operating with the two helical pinions respectively.

When the sectional members 19, or 20 are placed as shown in FIG. 4 and equipped with rails 38, they can co-operate with rails 52 mounted in sectional members 50, 51. Each of the ends of the sectional member 50 is connected to the two ends of an identical chain 53 which can be driven by a motor 55 via a transmission 54. Similarly, each of the ends of the sectional member 51 is connected to the two ends of a chain 56 which can be driven by a motor 58 via a transmission 57.

The motor 24, for driving the punch in its carriage and for driving the rails 52 in the table 3 the motors 55, 58 are associated with rotary type coders 59, 60 respectively. The coders enable the positions (FIG. 13) Y_1 of the guide bar 50 and Y_2 of the guide bar 51 to be determined in relation to a reference plane o, x, z; and such positions can be displayed on the display board N.

The motor 24 and the coder 36 can be controlled automatically to give to the punch carrying carriage B the ordinate y where $y = y_1 + y_2/2$
thereby to ensure that sectional member 19 is exactly in the middle between the sectional members 50 and 51, (FIG. 13 FIG. 2) or to force the sectional member 20 to be symmetrical in relation to the sectional members 50, 51.

Another pair of rail-carrying sectional members 61, 62 (FIG. 10) can if necessary be used in the plane of the table 3 but an inclination to a line perpendicular to the line of the beams C, when the sectional members 19, or 20 have already been given such oblique orientation in the way already explained.

To obtain this result, a plate 63 is placed on each of the pairs of dowels 41 disposed towards the same upright of the frame. The plates 63 are mounted head-to-tail and each comprise spigott holes engaging with two of the dowels 41 and an elongated slot 64 engaging with the other two dowels 41. Each of the plates 63 is connected (FIG. 11) to a U-shaped sectional member 65 having a screw with two opposite handed screwthread 66, 67, the screw is adapted to rotate in a median bearing 68 and being operable by means of a thumbscrew 69. Engaging with the screwthreads 66, 67 are nuts 70, 71 whose dowels 72 engage in elongated holes 73 in the sectional members 61, 62.

Clearly (FIG. 8), the operation of one of the handwheels 46, or 47 determines the oblique position of the sectional members 61, 62 and their distance apart can be adjusted by operating the thumbscrew 69.

FIGS. 14 and 15 show in detail the embodiment of each of the tables H disposed on either side of the press frame A of FIG. 1.

The rollers 1 are mounted in U-shaped supports 74 each of which is borne by vertical uprights 75, 75*a* prevented from turning by small columns 76. The base of each of the uprights, terminating in abutment 77, bears against the end of the substantially horizontal arm of a bellcrank angle plate 78, 78*a* pivoting around a pivot 79, 79*a*. The other end of each of the angle plates 78, 78*a* is articulated via a pivot 80 80*a*, to a chain of connecting rods 81 extending over the whole length of the table H. The upright 75*a*, closest to the frame press A is telescopic and comprises a shock absorbing spring 82. This upright 75*a* is shown in the active position and its roller 1_1 is seen to be somewhat higher than the others, so that the rollers 1 which it bears act as shock absorbers for the panel as it enters or leaves the press.

The chain of connecting rods 81 can be actuated by a jack having a piston 83_1 and rod 83_{11} shown generally at 83 oscillating around a pivot 83*a* whose clevis 84, terminating the piston rod, is articulated to the centre of the knee-joint formed by the two opposite ends of crank-arms 85, 86. The crank-arm 86 is pivotted at point 87 which is carried by a partition 88 forming part of the table H. The other end of the crank-arm 85 is directly connected to the substantially vertical arm of the bell crank angle plate 78*a*.

In the position illustrated, the thrust of the piston rod 83_{11} of jack 83 has aligned the crank-arms 85, 86 and made the arm of the angle plate 178*a* tilt in the direction for lifting the abutment 77. In the position illustrated, in which the two crankarms have slightly moved beyond alignment, the rollers 1 are therefore in the raised position and retaining fixed, except for the first roller 1_1 which due to its shock-absorbing spring 82, can tolerate certain variations in level.

When the piston rod 83_{11} of jack 83 is retracted, the crank-arms 85, 86 take up the position shown diagrammatically by 85*a*, 86*a*, respectively, the angle plates are retracted and the uprights bearing the rollers are lowered. A panel carried by the rollers 1, 1_1 etc. will there-

fore tend to rest on the upper edge of the gauges K, (see FIG. 15) so that its shape can be controlled.

The gauges K shown dotted in FIG. 15 rest on the brackets J and are retained in position by locking screws 89.

At the end of each of the roller tables H adjacent the frame press A, the rod L_1 of the jack L terminates in a bush 90 in which a shaft 91 can rotate which terminates in a square end 91*a*, and carries via a clevis a clamp 92 having a screw 93.

The screw 93 enables one end of the panel to be gripped, and by rotating the indexing finger 21 through one half turn by a suitable crank, the panel can be turned over when it is engaged at its other end by the rotary gripping member G of the carriage F of the hanging bracket.

Each of the horizontal beams C (FIG. 17) which enable the hanging brackets to be displaced is mainly formed by two C-shaped sectional members 94 which have their backs juxtaposed and whose opposed lower ends bear flat rails 95 viaa struts 96.

Carriage 97 supporting a hanging bracket E, comprises rollers 98 resting on rails 95, rollers 99 disposed below such rails and, at the front and rear, pairs of rollers 100 applied against the flat flanks of the rails 95.

The two carriages 97*a*, 97*b*, supporting the two hanging brackets E disposed on each side of the frame press A are driven by a single motor 101 in the manner shown diagrammatically in FIG. 18.

Similarly to what was described concerning the punch carriage, via transmission 102 the motor 101 directly drives on one side of the press a chain 103 which is mounted in one of the beams C and whose two ends are attached to the carriage 97*a*. Via intermediate transmission 104, the chain 105 is also driven, its ends being unitary with frame 106 acting as a upport for the shaft of pulley 107 bearing channels 108, 109 for supplying the jack (described hereinafter) mounted in the hanging bracket.

End shaft 110 of the transmission 102 bears a dog-type clutch 111 adapted to be controlled by the hydraulic jack 112. Thus it is possible when required to drive on the other side of the press frame, by the transmission 113, a chain 114 which extends along the other beam C and whose two ends are attached to the carriage 97*b* bearing the second hanging bracket.

As on the other side, via transmission 115, the chain 116 is driven which bears fram 117 supporting a pulley 118 for supplying the hydropneumatic apparatuses of the hanging bracket disposed on the corresponding side.

To use the assembly illustrated in FIG. 18, when a panel P has been placed on the rollers 1 of one of the two tables H_1, as illustrated in FIG. 2, the dog-type clutch 111 is first actuated to enable the motor 101 to engage the gripping member G*b* of the bracket E*b* to engage with one end of the panel.

The clutch is then released and the bracket E*a* is then displaced on its own by the motor 101 until its gripping member G*a* can engage the other end of the panel P.

At that moment the clutch is then again activated and, the two brackets moving simultaneously in the same direction and at the same speed, the panel P as a whole is displaced in relation to the frame press A.

As previously, a rotary coder 119 associated with the motor 101 allows the determination of the abscissa *x* of any point on the panel - i.e., the determination at any moment of the abscissa of the point which is in the axis of the frame press A.

The required abscissa for each point on the panel P where the press is to be used is displayed on the display board N and the panel is displaced along the beams C until the actual position of the panel as determined by the coder 119 coincides with the abscissa displayed.

FIGS. 16 and 17 show the embodiment of a hanging bracket E, its displacement mechanism, and its accompanying mechanism enabling hydraulic power to be transmitted for the jack associated with such bracket.

The ends of each of the chains 103 and 114 are attached to an angle plate 120 attached to the carriage 97 (*a* or *b*) and such chains, due to the great length of the beam C, and are supported at places by pairs of superimposed pinions 121, one of which receives the upper run, and the other the lower run of the chain. Since the angle plates 120 pass just above the lower pinions 121, there is no resulting disturbance to the displacement of each carriage 97. Similarly, the chains 105 (116) are supported in the same conditions by stepped pinions 122.

The intermediate transmissions of the pulleys 104 or 115 are grouped in the hollow ends of the beams C furthest away from the frame press A.

Each hanging bracket E is a trapezoidal caisson 123 having inside it a jack 124 whose rod 125 bears, via a clevis, a pinion 126 over which there passes a chain 137 one end of which is attached to a foot 127 unitary with the carriage 97. The chain then extends over two intermediate transmission pinions 128 and is attached by its other end to the carriage F for the operation of the latter. The carriage F can move along two flat rails 129 disposed on the facade of the bracket and borne by supports 130.

So that the carriage F can move along the rails, it comprises on either side of the rails pairs of rollers 131, and, for guiding transversely of the rails, rollers 132 bearing against the edge of the rails.

The gripping member G is borne by the end of a resilient strip 133 attached to the base of the carriage F. At its free end the resilient strip has a bush 134 parallel with the beam C, and there engages in the bush a shaft 135 to which iss articulated, via a clevis, the press 136 forming the active part of the gripping member.

When the two ends of the panel P are attached to the gripping members G and the panel P is displaced in accordance with the axis of the abscissas along the beam C, as the panel is formed with its concavity turned upwards, the carriages F spontaneously tend to be raised. Action is then taken on the jacks 124 to keep the chains 137 just stressed and prevent abnormal forces in the panels.

When the press has acted at all points on the panel with the force necessary to shape it, the panel is placed on the gauges K. When it is a first shaping operation and the shape of the panel is not perfect, the panel may have to be returned.

To this end, as already partly explained, the gripping members G of one of the hanging brackets and the gripping member M associated with the jack L are attached to the same panel which at the moment is completely situated on one of the sides of the press frame.

To allow the attachment of the gripping members M and G, the jacks L and 124 are individually operated to bring such members to the suitable level for attachment to the same panel. The two jacks are then simulta-

neously actuated to lift the panel above the table. When the height is adequate, the panel is made to turn around its axis by one-half turn by means of a crank 139, engaging with a square 91*a*.

During the making if a first panel, data which will enable the following similar panels to be shaped identically can be recorded due to the precision of the following displacements: of the panel in the longitudinal direction; of the punch in the transverse direction; of the rails borne by the press frame in both the longitudinal and transverse directions; and of the punch itself in the vertical direction.

Moreover, by using rails perpendicular to the general direction of the panel, the latter can be bent in accordance with its length, while with longitudinal rails the panel can be bent in accordance with its width. With rails of a predetermined inclination (if necessary evolutive) the panel can be spiralled and given a helicoidal.

Shaping obtained with three rails, for instance, two on the table H and one on the punch B, has the disadvantage of causing a central rounded fold framed by two flat portions. By using two rails both on the punch B and the press table H the four rails being parallel with one another and symmetrical in relation to their central plane, a circular bending is obtained (constant bending force from one of the end rails to the other) i.e., a continuous inward curving of the panel surface can be obtained by exceeding the limit of elasticity.

Successive inward curves, some longitudinal and the other transverse may enable panels with double curvature to be obtained. Use can also be made of rails whose surface is inwardly curved in the direction of bending.

The invention applies to the shaping of very long panels intended for naval or aeronautical construction or for the building of complex architectural structures. It is more particularly suited for the shaping of integral panels for supersonic aircraft, such panels being made from a metal plate suitably mechined to remove from it all excess material.

I claim:

1. A press device for stepwise curve shaping panels of elongate construction comprising

a vertical substantially rectangular press frame,

punch means displaceable in said frame for acting locally on the panel,

two beams extending perpendicularly on one side and on the other side of said press frame, respectively, at the level of the higher side of said frame, each beam being provided with a primary carriage supporting a rigid hanging bracket adapted to bear one of the opposed ends of the panel, displacements of said primary carriages being conjugated and measured when carrying the same panel.

2. A press device according to claim **1**, wherein said hanging bracket is provided with a vertically movable secondary carriage facing said press frame and resiliently supporting means for gripping one end of said panel, said supporting means comprising a resilient strip directed towards said press frame and being adapted to pivot about a substantially horizontal axis.

3. A press device according to claim **1**, further characterized by a table below each of said beams and coextensive therewith, and by at least one upwardly extensible lifting member, attached to the end of one of said tables, which is turned towards said press frame, the upper part of said lifting member being povided with means for gripping one panel end, said latter means being adapted to be pivoted about a substantially horizontal axis, and means for pivoting said gripping means.

4. A press device according to claim **1**, wherein each of said primary carriages is fixed to the two ends of a chain looped over pinions located at the two ends of each of said beams, further comprising a single motor for driving one of the chains directly and the other chain by means of a controlled dog-type clutch.

5. A press device according to claim **1**, wherein said punch has a vertical movement which is measurable with a precision substantially higher than the measuring of the displacements of the punch carrying carriage or the primary carriages.

6. A press device according to claim **1**, further characterized by

a table below each of said beams and coextensive therewith, said table being provided with a plurality of spaced apart vertically retractable rollers and with panel checking gauges operative in the retracted position of said rollers.

7. A press device as defined in claim **1** wherein said punch means includes a punch carrying carriage comprising a tool carrier adapted to move around a median vertical axis of said tool carrying carriage and adapted to be locked in two positions orthogonal to one another and immobolised in any intermediate position between said two end positions.

8. A press device as defined in claim **1** wherein a table is below each of said beams and coextensive therewith and the panel is shaped by means of curved parallel rails borne both by said punch means and said press table, the distance between at least one pair of said rails being adjustable, said rails having a rectangular base and fitted and resiliently snapped into sectional members attached to said punch means and said press table.

9. A press device as defined in claim **8** wherein said sectional members of said press table are perpendicular to the plane of the said press frame and are adapted to be displaceable individually, said punch means having a carrying carriage the axis of which is automatically retained in the centre of the gap between said sectional members.

10. A press device as defined in claim **9** wherein said sectional members of said press table are disposed parallel with the plane of said frame thereof and are adapted to be displaced simultaneously by the same amount in opposite directions in relation to the plane of symmetry of the said frame.

11. A press device as defined in claim **10** wherein a mechanism for displacing the sectional members comprises two screws each having in opposite directions two equal screw threads of contrary pitch each of such screw threads being adapted to co-operate with a nut comprising a vertical articulating finger and the fingers corresponding to the same screw being engaged in apertures, one circular aperture and one elongate aperture in two self-supporting plates disposed head to tail by two screws each comprising two screw threads in opposite directions, two pairs of nuts being provided to which a pair of said rail carrying sectional members are articulated.

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