May 6, 1941. R. W. DINZL 2,240,926

HYDRAULIC PRESS

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Fig. 1.

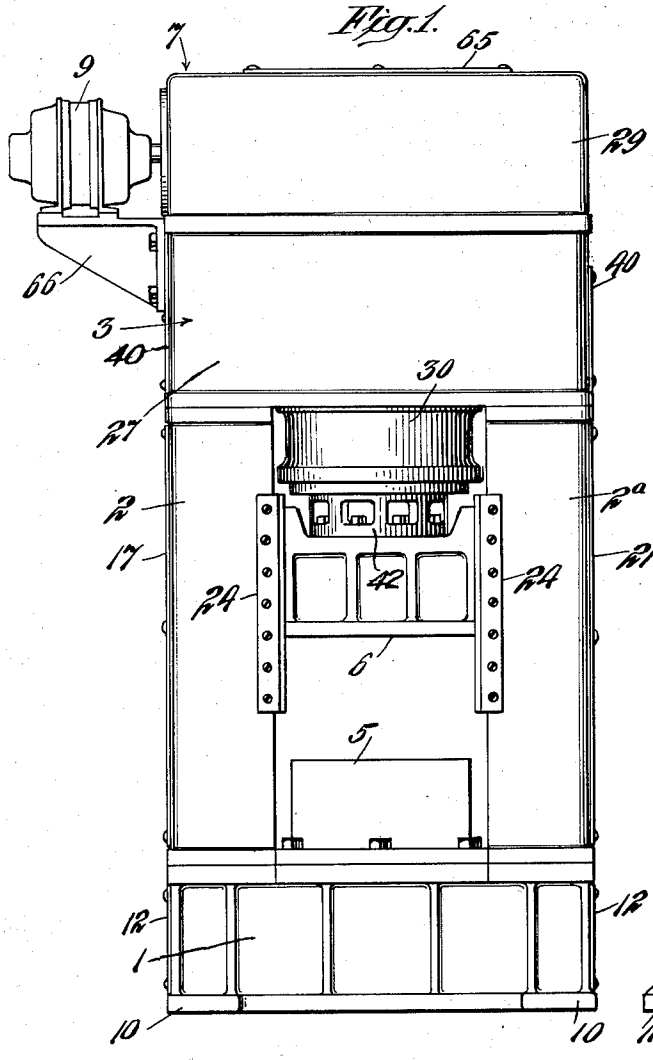
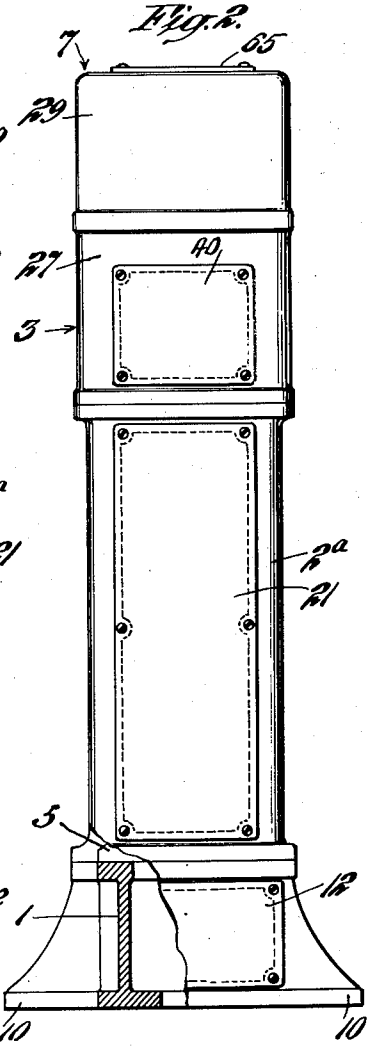



Fig. 2.



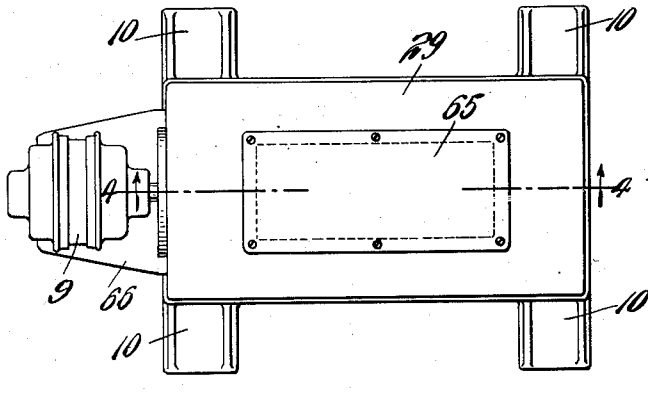




Fig. 3.

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Fig. 4.

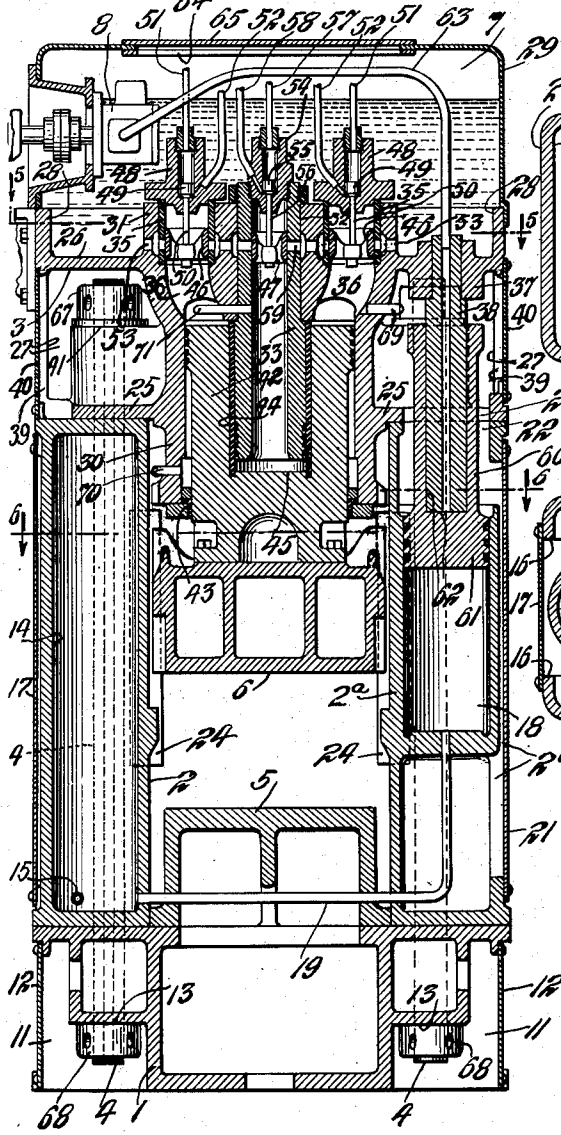


Fig. 5.

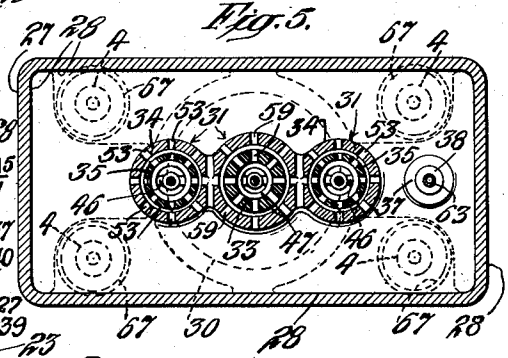


Fig. 6.

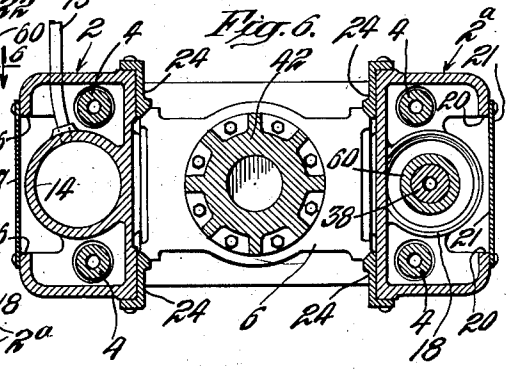
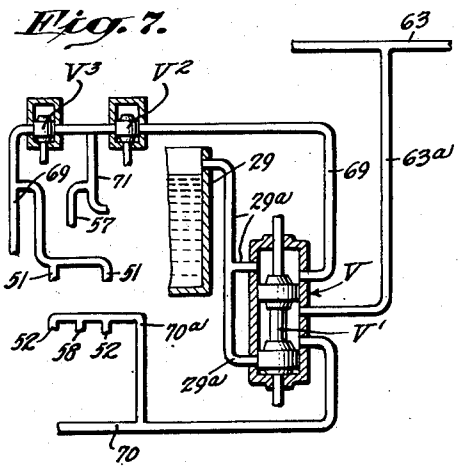


Fig. 7.



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# UNITED STATES PATENT OFFICE

2,240,926

## HYDRAULIC PRESS

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Application April 1, 1938, Serial No. 199,430

4 Claims. (Cl. 100—50)

An important object of the present invention is to provide an improved design and arrangement of the parts of a hydraulic press apparatus.

Other objects of the invention will appear hereinafter.

In the drawings,

Fig. 1 is a front view of a press apparatus embodying the invention;

Fig. 2 is a side view of the press apparatus, partly in section;

Fig. 3 is a top plan view of the apparatus;

Fig. 4 is a vertical section on the line 4—4 of Fig. 3 and upon a slightly larger scale;

Fig. 5 is a horizontal section on the line 5—5 of Fig. 4;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 4; and

Fig. 7 is a diagrammatic view of a portion of a hydraulic control system for the press.

The invention is illustrated as embodied in a press apparatus of a well known oil circuit type having a surge tank in valved communication with the main press cylinder, for pre-filling and discharging the cylinder. The oil circuit itself forms no part of the present invention and so only a portion of a conventional control system is shown in Fig. 7.

The apparatus includes a press frame comprising a lower transverse frame member or base 1, a pair of laterally spaced side columns 2 and 2a borne by opposite end portions of the base, an upper transverse frame member 3 borne by the columns, and vertical resistance rods 4 extending between the base and the upper frame member and anchored to both to resist the pressing reaction. A fixed lower press head 5 is borne by the base, between the columns, and an upper press head 6 is vertically reciprocable between the columns by hydraulic pressure operated mechanism. A surge tank 7, a hydraulic pump 8 and an electric motor 9 for driving the pump are borne by the press frame. A hydraulic pressure accumulator is also embodied in the apparatus.

The base 1, in the present instance, comprises a single hollow casting with flat top and bottom surfaces and integral foot extensions 10 projecting laterally from its ends. Recesses 11 are formed in the opposite ends of the base casting. These recesses open laterally and are normally closed by cover plates 12 detachably secured to the casting. Within each recess the casting is formed with a downwardly facing abutment 13 spaced above the bottom surface of the base for anchorage of the resistance rods thereto.

Column 2 comprises a single casting formed to define a vertically elongated, cylindrical tank 14 to contain compressed air. This tank is an adjunct of the hydraulic pressure accumulator. It is charged through a delivery pipe 15 leading from an air compressor, not shown. In cross section the casting 2 extends beyond said tank to form enclosures at opposite sides of the tank. A pair of the resistance rods 4 are arranged in said enclosures. At its outer side the casting has an opening 16 extending most of the height of the casting and of liberal width. A plate 17 normally closes said opening and is detachably secured to the casting. The casting has a flat bottom surface bearing upon the upper surface of the base 1, and a flat top surface upon which an end portion of the upper frame member 3 bears.

Column 2a also comprises a single casting having the same cross sectional contour as column 2. An intermediate portion of the casting forms a vertical cylinder 18 closed at its lower end and open at its upper end. This cylinder forms part of the hydraulic pressure accumulator. A pipe 19 leads from the tank 14 to the lower end of cylinder 18 to supply the latter with compressed air. In cross section the casting extends beyond the opposite sides of the cylinder to form enclosures in which another pair of the resistance rods 4 are arranged. At its outer side the casting has an opening 20 similar to that of the column 2 and normally closed by a plate 21 detachably secured to the casting. The upper and lower ends of the casting are flat and abut the under surface of the frame member 3 and the upper surface of the base 1, respectively. At its upper end the casting has an aperture 22 registering with the cylinder 18 and with an aperture 23 in the under portion of frame member 3, to afford clearance for part of the pressure accumulator. The columns 2 and 2a bear four vertical guide strips 24 on their opposed faces. These strips are engaged by four corners of the press head 6 to guide the latter in its vertical reciprocation.

Frame member 3 comprises a single hollow casting substantially rectangular in plan. It has a flat bottom portion 25 bearing upon the upper ends of the columns, a flat upper portion 26 and vertical side walls 27 connecting said portions. The upper portion 26 forms the bottom of the surge tank and has an upstanding flange 28 around its contour and forming a portion of the side walls of the surge tank. A hood-like casing 29 has its lower margin fitted and sealed over the upper edge of flange 28 and forms the remainder of the surge tank. The central portion of the casting 3 is formed to define a large vertical cylin-

der 30 which is the main press cylinder. Directly over the latter the casting has its upper portion thickened to provide a raised portion or boss 31 protruding into the surge tank. Said boss has a vertical bore 32 in axial alinement with the cylinder, and a tubular member 33 has its upper portion secured in said bore and its lower portion protruding into the cylinder for a major portion of the depth of the latter.

At opposite sides of the bore 32 the boss 31 forms a pair of small vertical surge valve cylinders 34 lined with bushings 35. Fluid passages 36 connect the lower ends of these cylinders with the upper end of cylinder 30. The casting 3 is formed also with another boss 37 in vertical alinement with the air cylinder 18 and having a bore in which is secured the upper end portion of a tubular member 38. The latter extends downward to a point near the upper end of cylinder 18. At its opposite ends the casting 3 has recesses between its upper and lower portions 26 and 25, and end apertures 39 give access to said recesses. Cover plates 40 normally close the apertures and are detachably secured to the casting. Within the recesses the casting is formed with upwardly facing abutments 41 intermediate the portions 25 and 26, for anchorage of the resistance rods 4 to the casting.

A ram 42 is reciprocable within cylinder 30. At its upper end the ram is enlarged to form a piston head and is provided with piston rings. The press head 6 is secured to the lower end of the ram for reciprocation thereby. At the lower end of the cylinder packing 43 closes the annular space between the reduced portion of the ram and the cylinder. The ram is formed with an axial, cylindrical recess extending downward from its upper end and lined with a bushing 44. The tubular member 33 protrudes into the bushing and has a close sliding fit therein. Preferably said member is provided with piston rings, as shown. The tubular member conducts oil into the ram recess for exertion of hydraulic pressure upon the bottom surface 45 of the recess.

Two surge valves in the form of pistons 46 control communication between the surge tank and the upper end of cylinder 30. These valves are fitted to reciprocate within the bushings 35. A similar surge valve 47 is fitted to reciprocate in the bore of tubular member 33 and control communication between the surge tank and the ram recess. Secured to the upper end of each cylinder 34 there is a head forming a small vertical cylinder 48 closed at both ends. A piston 49 is reciprocable in said cylinder and has a stem 50 connecting it to the valve 46. A pipe 51 leads to the upper end of the small cylinder to deliver fluid pressure for forcing the piston and valve downward, and a pipe 52 leads to the lower end of the cylinder to deliver fluid pressure for forcing the piston and valve upward. When the valves 46 are down they close communication through ports 53 from the surge tank to cylinders 34 and passages 36. A small cylinder 54 is secured to the upper end of tubular member 33 and has a piston 55 reciprocable therein and connected to valve 47 by a stem 56. Fluid pressure is conducted by a pipe 57 to the upper end of cylinder 54 to force the piston and valve downward, and a pipe 58 conducts fluid pressure to the lower end of the cylinder to force the piston and valve upward. When the valve is down it closes communication between the surge tank and the bore of tubular member 33 through ports 59.

The aforementioned hydraulic pressure accumulator includes a plunger 60 formed at its lower end with a piston head 61 fitted to reciprocate in the air cylinder 18. The plunger has a cylindrical chamber 62 extending downward from its upper end approximately to the piston head 61. The fixed tubular member 38 extends into said chamber and has a close sliding fit therein. A hydraulic delivery pipe 63 leads from the pump 8 to the upper end of the bore of said tubular member. Delivery of hydraulic pressure from the pump through pipe 63 and tubular member 38 to the bottom of recess 62 forces the plunger downward against the resistance of air pressure in the cylinder. As the plunger is moved downward along the tubular member the capacity of recess 62 is increased and the recess is charged with oil under pressure for use in advancing the ram 42 and press head 6 downward on a working stroke.

In the present instance the oil pump 8 is located within the hood 29 and supported upon an end wall of the hood. At its top the hood has an aperture 64 of liberal size affording access to the pump, the surge valve devices and associated parts. A cover plate 65 normally closes said aperture and is detachably secured to the hood. The motor 9 for driving the oil pump is mounted upon a bracket 66 secured to the press frame member 3.

The resistance rods 4 extend through registering bores in the base casting, the column castings and the castings 3. Their upper and lower ends are screw-threaded and bear nuts 67 and 68. The nuts 67 are opposed to the abutments 41, and the nuts 68 are opposed to the abutments 13 so that by tightening the nuts against said abutments the columns 2 and $2^a$ are clamped between the base 1 and the upper frame member 3.

There are indicated, in Fig. 4, a hydraulic delivery pipe 69 leading to the upper end of the main press cylinder 30, a hydraulic delivery pipe 70 leading to the lower end of said cylinder, and a hydraulic delivery pipe 71 leading to the bore of the tubular member 33 at a point below the surge valve 47. Fig. 7 shows diagrammatically a portion of a hydraulic system for controlling flow through said pipes and for controlling pressures in the surge valve cylinders for operation of the surge valve. This system forms no part of the present invention and its disclosure is purely illustrative. It includes a control valve device V having a valve element V' reciprocable by any suitable means, not shown. A branch pipe $63^a$ leads from the accumulator pipe 63 to said valve device. Pipe 70 leads from said device and has a branch pipe $70^a$ leading to the surge valve cylinder piping 57. Pipe 69 also leads from the device and has two valves $V^2$ and $V^3$ operable by any suitable means, not shown. Pipe 71 branches from pipe 69 at a point between valves $V^2$ and $V^3$ and surge valve pipe 58 is a branch thereof. Beyond the valve $V^3$ the surge valve piping 52 leads from pipe 69. Piping $29^a$ leads from the control valve device to the surge tank 29. When the valve V' is in the position shown it shuts off flow from pipe 63 to pipes 69 and $29^a$ but connects pipe 63 to pipe 70 and its branches. When valve V' is shifted upwardly it places pipe 70 in communication with piping $29^a$ leading to the surge tank and also places pipe $63^a$ in communication with pipe 69. Opening of valve $V^2$ then permits flow to pipe 71 and the smaller area 45 of the ram. Subsequent opening of valve $V^3$ permits flow through pipe 69 to the larger area of the ram.

The press head 6 is sustained in elevated position by hydraulic pressure delivered through the

pipe 70 to cylinder 30 and acting upon the under side of the ram head. The surge valves are held open by fluid pressure delivered through the pipes 52 and 58 to the under sides of the respective pistons for operating the surge valves. Upon relief of pressure upon the under face of the ram head the ram and press head gravitate downward. Surge valve 47 is closed by admission of fluid pressure through pipe 57 and relief of pressure through pipe 58. Admission of hydraulic pressure through pipe 71 then acts upon the ram surface 45 to positively force the press head on its working stroke. In the course of the pressing operation the pressure upon surface 45 is augmented by hydraulic pressure upon the upper end of the ram and admitted through the pipe 69. In order to trap this pressure in the main cylinder the surge valves 46 are closed by fluid pressure admission through pipes 51 and fluid pressure relief through pipes 52. The press head is retracted by opening the three surge valves, through their fluid pressure operated means and by admitting hydraulic pressure through the pipe 70 to act upon the under side of the ram head.

It will be seen that I have provided, in a hydraulic press of the type described, an improved design and organization of the parts contributing materially to compactness, convenience and good appearance. The columns are designed to form parts of the hydraulic pressure accumulator mechanism, the upper frame member is designed to form much of the press head operating mechanism and also parts of the surge valve devices and part of the surge tank, and provision is made in a simple manner for maintaining the frame parts clamped together while the press is in service.

What I claim is:

1. A hydraulic press structure comprising a transverse base member; two laterally spaced vertical columns mounted on said base member, each column being formed with a substantially flat inner face and a housing portion extending outwardly from said substantially flat face, one of said columns being formed with a vertical closed tank within the housing, the other of said columns being formed within the housing with a cylinder open at its upper end and connected at its lower end to the tank by a pipe; a transverse upper frame member mounted on the tops of said columns and formed with an opening registering with the open upper end of the cylinder within one of said columns, and with a vertical cylinder open at its lower end and disposed between the columns, the upper portion of said frame member forming the bottom of a surge tank; a ram operable in said cylinder and extending below the lower end thereof; a press head carried by the said ram at the lower end thereof; vertical guides on the inner flat faces of the columns; guides on the press head engaging the guides on the columns; a press head borne by the base member between the columns; a pair of strain rods extending vertically within each of the columns and anchored to the base member and the upper frame member, one of said pairs extending along and outside of the said column tank, the other of said pairs extending along and outside of the said column cylinder; means associated with said column cylinder to form therewith a hydraulic pressure accumulator; and means to deliver hydraulic pressure from said accumulator for movement of said ram.

2. A hydraulic press structure comprising a transverse base member; two laterally spaced vertical columns mounted upon said base member and each formed with a substantially flat inner face and a housing extending outwardly from said face, one of said columns being formed with a vertical closed air tank within the housing, the other of said columns being formed within the housing with a cylinder open at its upper end; a connection between said tank and cylinder to supply the latter with air, a transverse upper frame member mounted on the tops of said columns and formed with an opening registering with the open upper end of the cylinder within one of said columns and formed with a vertical press cylinder centrally disposed with reference to said columns; a ram operable in said central cylinder and reciprocable through the lower end thereof; a press head carried by the said ram at the lower end thereof; vertical guides on said inner faces of the columns; guides on said press head engaging said guides on the columns; a press head borne by the base member between the guides; a pair of strain rods extending vertically within each of the columns and anchored at their upper and lower ends to said frame member and base member respectively, one of said pairs extending along and outside of said column tank and the other pair extending along and outside of said column cylinder; a tubular cylindrical member borne by and extending downwardly from said upper frame member in axial alinement with said column cylinder; a plunger reciprocable within said column cylinder and having an axial bore to receive said tubular member, said column cylinder, tubular member and plunger together forming a hydraulic pressure accumulator; and means to deliver hydraulic pressure from said accumulator for moving said ram.

3. A press frame structure comprising a hollow transverse base member, two laterally spaced hollow vertical columns mounted on said base member, each column being formed with an inner vertical face and a housing portion extending outwardly from said inner face, one of said columns being formed with a vertical closed chamber within the housing and the other of said columns being formed within the housing with a chamber open at its upper end and closed at its lower end, a transverse upper hollow frame member mounted on the tops of said columns and formed with an opening registering with the open upper end of the chamber in one column, the upper portion of said upper frame member forming a tank bottom extending outwardly over the columns, and a pair of strain rods extending vertically within each of the columns and into and terminating within the base member and into and terminating within the upper frame member below the tank bottom and anchored to the base member and upper frame member, one of said pairs extending along and outside of the said closed chamber and the other of said pairs extending along and outside of the said chamber having the open upper end, said rods securing together the base member, the upper member and the columns.

4. A press frame structure comprising a hollow transverse base member, two laterally spaced hollow vertical columns mounted upon said base member, each column being formed with an inner vertical face and a housing portion extending outwardly from said inner face, one of said columns being formed with a vertical closed chamber within the housing and the other of said columns being formed within the housing with a chamber open at its upper end and closed at its lower end, a transverse upper hollow frame member com-

prising a central vertical tubular portion open at its lower end, a bottom flange portion resting on the columns and formed with an opening registering with the open upper end of the chamber in one column and with abutments extending outwardly from said tubular member and integral with said bottom flange, and a horizontal upper flange above said abutments and extending outwardly over the columns and forming a tank bottom, and a pair of strain rods extending vertically within each of the columns and into and terminating within the base member and through the said abutments into and terminating within the upper frame member below the tank bottom and anchored to the base member and to said abutments in the upper frame member, one of said pairs extending along and outside of the said closed chamber and the other of said pairs extending along and outside of the said chamber having the open upper end, said rods securing together the base member, the upper member and the columns.

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