July 16, 1957 C. A. VAN DUSEN ET AL 2,799,187

WIDE THROAT PRESS

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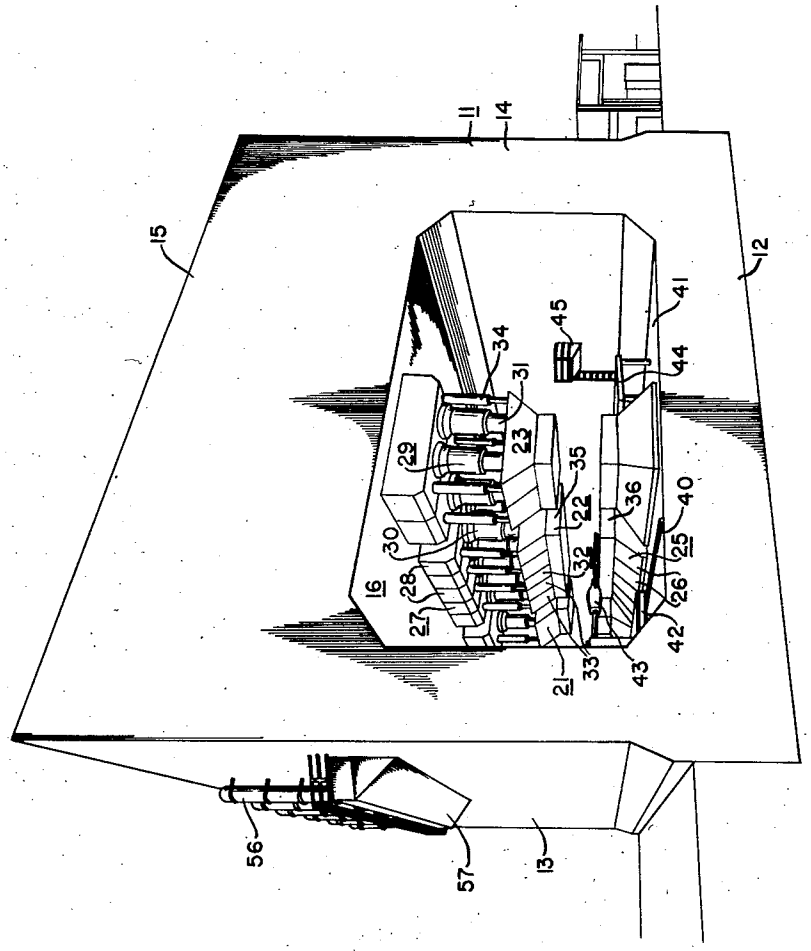

FIG. 1

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WIDE THROAT PRESS

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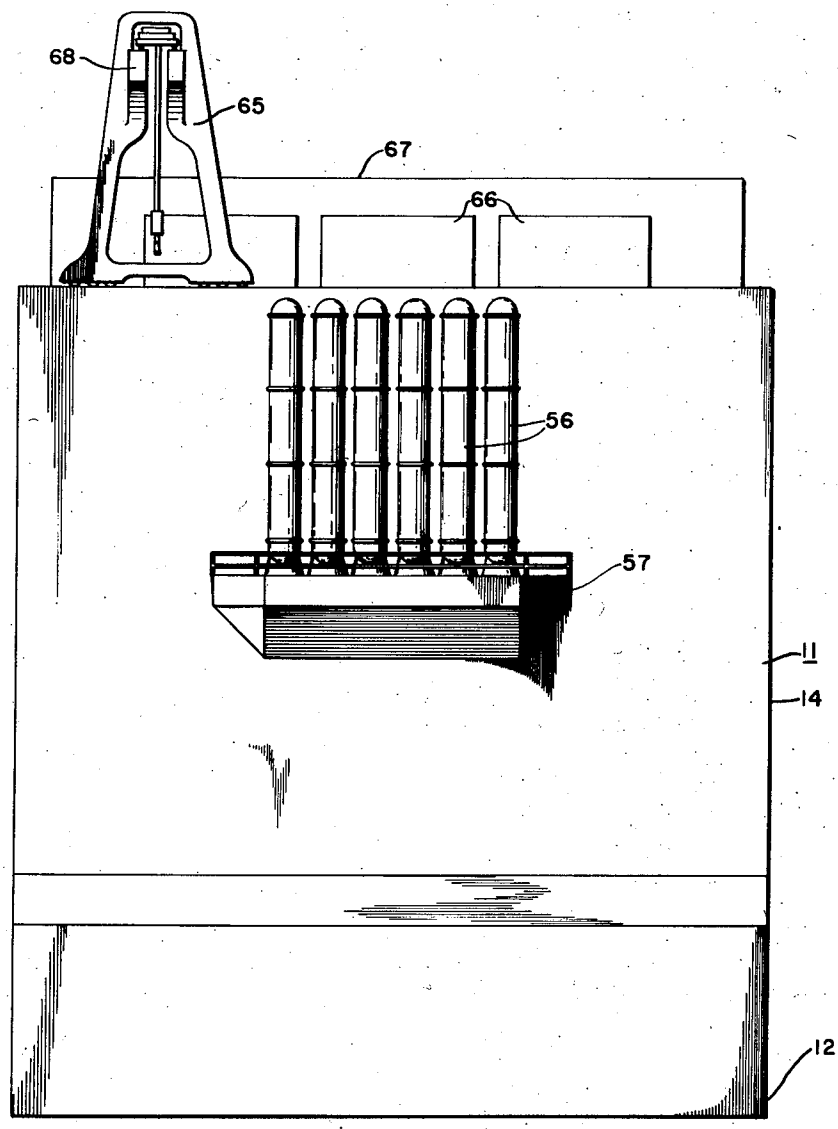

FIG.2

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WIDE THROAT PRESS

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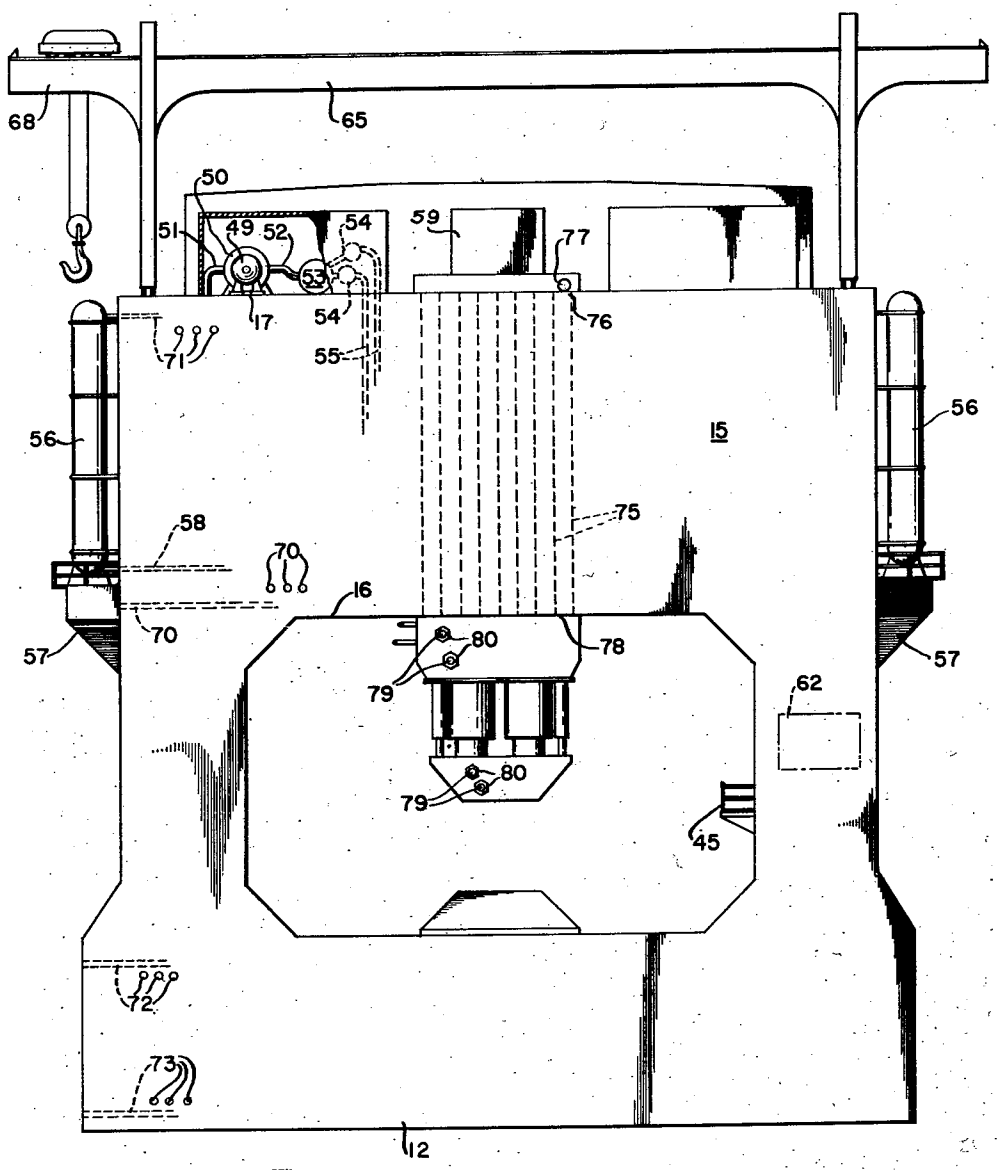

FIG. 3

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July 16, 1957 C. A. VAN DUSEN ET AL 2,799,187

WIDE THROAT PRESS

Filed Feb. 27, 1953 5 Sheets-Sheet 4

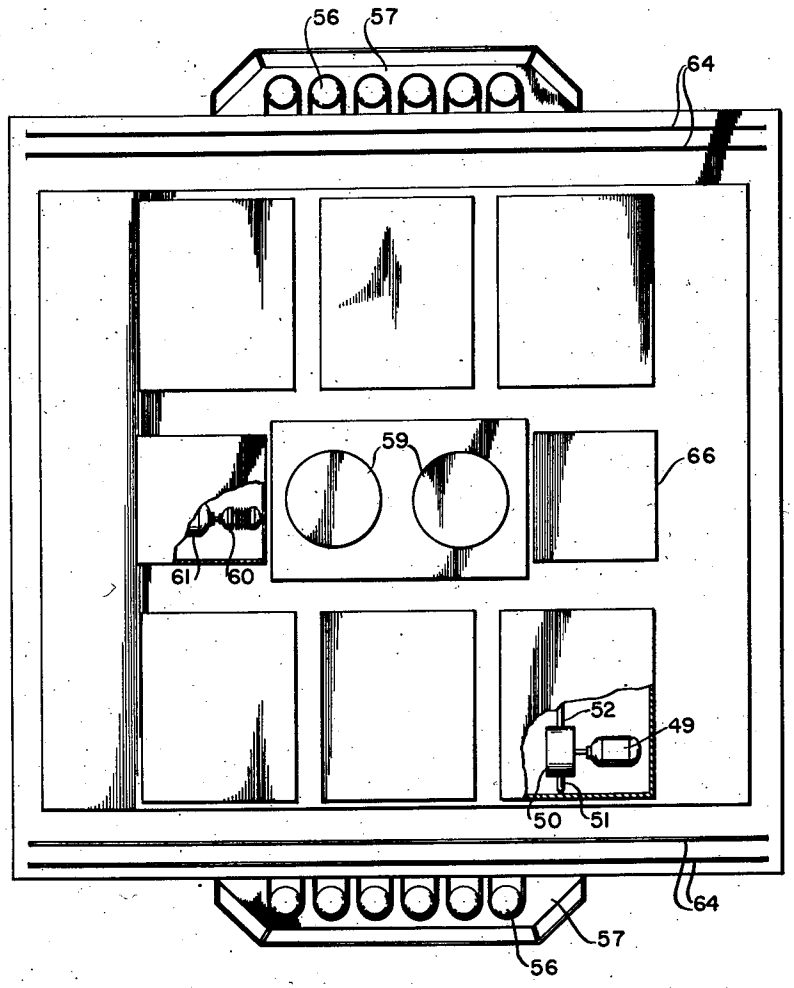

FIG. 4

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July 16, 1957 C. A. VAN DUSEN ET AL 2,799,187

WIDE THROAT PRESS

Filed Feb. 27, 1953 5 Sheets-Sheet 5

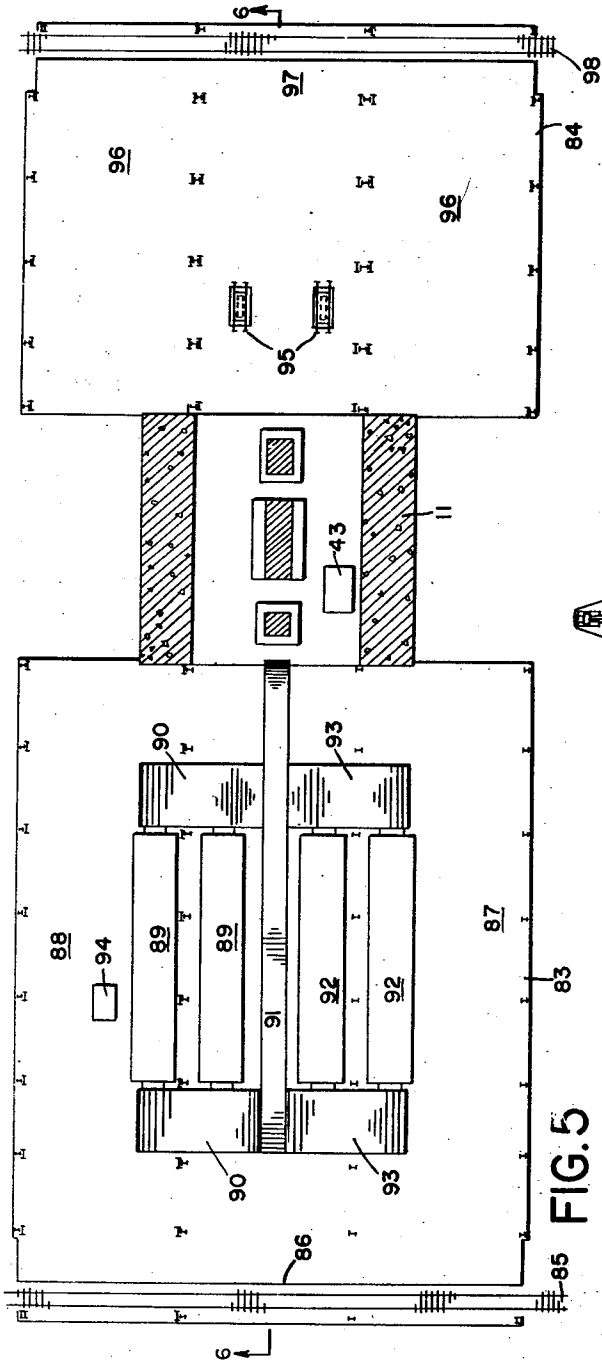

FIG. 5

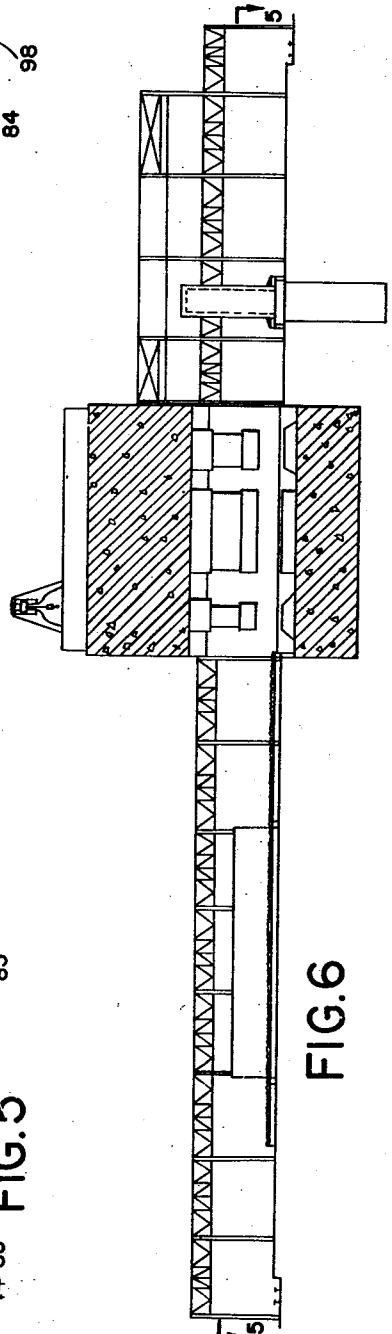

FIG. 6

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United States Patent Office 2,799,187 Patented July 16, 1957

2,799,187

WIDE THROAT PRESS

Charles A. Van Dusen, Escondido, Calif., and Richard F. Wittenmyer, Cleveland, and John A. Richter, Galion, Ohio, assignors to Throatless Press Company

Application February 27, 1953, Serial No. 339,324

3 Claims. (Cl. 78—42)

This invention relates in general to large capacity wide throat presses and more particularly to presses using a structural mass, such as reinforced concrete as a dead weight resisting the force of the press mechanism in a press construction which has the press components within a large area so that the press is essentially throatless.

Large capacity presses have been limited by the size of the component parts. Typical press construction utilizes strain rods or tie rods which must be of high strength steel to withstand the force of the press and to hold together the top and bottom of the press. These tie rods rapidly get up to 48 inches in diameter and 100 feet in length for even a 35,000 ton capacity press. Such large sized steel components take large sized foundry and machinery capacity just to make the parts of the press. Further, in order to withstand the force of the press, more than four tie rods are generally used, such as 6, 8, 10, 12, or more. Since the press platens are generally rectangular, this means that only the ends of the press are left open, and the part to be forged in the press must be inserted and manipulated through the ends of the press. In die forging and die quenching especially it is of the utmost importance that the forging be brought to a proper temperature in a heating oven and then quickly moved to the forging press before it cools beyond the point where the part can be press forged at the proper temperature. As presses grow larger, the heating and conveying facilities also grow larger, and this necessarily means an increase in time to get the large and cumbersome part from the oven to the forging press. In conventional forging press construction the fact that the tie rods obstruct at least the corners of the press platen seriously interferes with the ease of manipulation and handling the part to be forged. In order to build 50,000 or 75,000 tons capacity forging presses, the problems inherent in making a forging press along conventional lines become almost insurmountable.

The tie rods also present space limitations in forming presses wherein rubber pads or a liquid backed diaphragm is used as the female die. In such case the rubber pad must be encased in a steel housing in order to retain it. If this casing is made rectangular rather than circular, the side walls of the casing must be strong enough to resist a bending force rather than merely a tension force. A rectangular casing must be used in conventional presses in order to efficiently use the area inside the rectangularly spaced tie rods.

An object of the invention is to provide a wide throat press.

Another object of the invention is to provide a press having a 360 degree access in the horizontal plane to the dies and platens of a press in order to have a maximum of freedom in utilization of the press.

Another object of the invention is to provide a press of very large tonnage capacity.

Another object of the invention is to provide a press wherein the force of the press is resisted by the weight of a mass rather than resisted by tie rods.

Another object of the invention is to provide a press wherein the force of the press is resisted by a large and thick structural mass such as reinforced concrete which has sufficient bulk to be rigid, utilizing the inherent strength of the total weight of the mass to obtain maximum span or wide throat of the press frame consistent with allowable deflection in consideration of the work to be performed by such presses.

Another object of the invention is to provide a large capacity press contained inside a monolithic concrete frame wherein the weight of the upper portion of the frame plus the weight of the upper components of the press proper, its pumps and other auxiliaries, is more than sufficient to resist the force exerted by the press.

Another object of the invention is to provide a press frame construction which is earthquake and bomb resistant.

Another object of the invention is to provide a press with the pumps and motors, reservoirs and other necessary auxiliaries for operating the press located on the top of the press to achieve short lengths of fluid piping and to add to the weight available to resist the force of the press.

Another object of the invention is to provide a hydraulic press wherein accumulator bottles are mounted on the side of the press to achieve short lengths of piping to the working parts of the press.

Another object of the invention is to provide a structural mass having sufficient weight to resist the force of a plurality of presses located underneath the mass and which entire press may have the capacity thereof increased by adding to the weight of the mass by increasing any of the three dimensions of the mass.

Another object of the invention is to provide a multiple press construction wherein two or more presses are mounted inside a frame for simultaneous or inarticulated operation.

Another object of the invention is to provide a multiple press construction wherein two or more presses are mounted inside a frame together with control means interlocking the presses to prevent simultaneous closing of any two of these presses.

Another object of the invention is to provide a press construction wherein the crown hydraulic cylinders and upper platen of the press as a unit are dependently carried by a structural mass and with this structural mass having a thickness sufficient to be rigid to adequately resist all forces placed thereon by nonsymmetrical loads in the press.

Another object of the invention is to provide a structural member or members of large area supporting the upper and lower portions of a press, the platens of which are of relatively small area, so that large eccentricities in loading on the platens create only small eccentricities of loading on the large structural member or members.

Another object of the invention is to provide a forging press of wide throat design so that there is complete freedom of access to the dies carried by the press platens; and hence, billets may be heated in a furnace and quickly conveyed and manipulated into the dies before the billet or part has cooled below forging range of temperature.

Another object of the invention is to provide a wide throat press which may be used with rubber pads, fluid backed diaphragms or bag-type diaphragms as the female die so that the container housing the rubber pad or media may be circular or other section of symmetry in cross-section so that the walls thereof will need to resist forces essentially in tension, which container will thus not interfere with any tie rods.

Another object of the invention is to provide a method for assembling a large press wherein the crown and platen are made in sections and hydraulic cylinder motors

are provided for each section and wherein cables or rods may be used to raise individual sections and then the cables fastened in place to maintain the sections on the underside of the upper structural member of the press.

Another object of the invention is to provide a method for disassembling and servicing a large press wherein the crown and platen are made in sections and hydraulic cylinder motors are provided for each section and wherein the cables or rods may be used to lower individual sections for major services to a section or sections reinstalling the section by raising the individual sections as outlined immediately above.

Another object of this invention is to provide a press construction wherein the hydraulic cylinders and bed components may be arranged in any of various patterns to accomplish operations such as braking, coining or any other particular method or methods.

Another object of the invention is to provide for uniform distribution of load from the press cylinders to the frame avoiding the high concentration of stress encountered in conventional presses at points of attachment of the various components to the strain rods.

Other objects and a fuller understanding of this invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of the press constructed according to this invention;

Figure 2 is a front elevational view of the press;

Figure 3 is an end elevational view of the press;

Figure 4 is a top plan view of the press with the gantry crane and roof removed;

Figure 5 is a horizontal sectional view on the line 5—5 of Figure 6, showing the press and associated buildings; and

Figure 6 is an elevational sectional view on the line 6—6 of Figure 5.

Figures 1, 2, 3, and 4 show the construction of the press; and this press has a frame **11** which generally comprises a bottom slab **12**, side walls **13** and **14**, and a top slab **15**. In this embodiment the entire frame **11** is made from concrete. The base **12** would have dimensions and thickness sufficient to stand the bearing load for the soil or rock on which it rested. The top slab **15** has a horizontal lower surface **16** and a horizontal upper surface **17**. The press frame **11** houses first, second, and third presses **21**, **22**, and **23**. The second press is the largest and is used as a forging press, whereas the first press **21** is used as a cogging or blocking press, and the third press **23** is used as a trimming press. The second press **22** has a lower platen **25** made up by a plurality of sections **26**. This second press **22** has a head member or crown **27** also made up of a plurality of sections **28**. Hydraulic cylinder motors **29** are dependently carried by the crown **27**. Two cylinder motors are carried by each crown section **28**. Each cylinder motor **29** has a cylinder **30** and a piston **31**. The hydraulic cylinder motors **29** are those which urge downwardly an upper platen **32**. This upper platen **32** is composed of a plurality of sections **33**. Pull-back or push-back cylinder motors **34** are used to raise the upper platen **32**. The upper platen **32** carries an upper die **35**, and the lower platen **25** carries a lower die **36**.

The first press **21** which is used as a cogging press is considerably smaller and is otherwise constructed in a manner similar to the second press **22**. The third press **23**, used as a trimming press, may be somewhat larger than the cogging press but also is constructed in a manner similar to the second press **22**.

Rails **40** are provided in the floor **41** which is the upper surface of the base **12**. A rail car **42** is movable on the rails **40**, and this rail car carries a powered forging manipulator **43** to transport and manipulate the billets and forgings. A platform **44** is provided near the surface of the lower die **36** for convenience of workmen, and a control station **45** is provided for the press operator.

The horizontal upper surface **17** of the top slab **15** provides a floor and supporting surface for many of the working components of the press. Electric motors **49** are used to drive hydraulic pumps **50** to pump liquid such as water, oil, or other fluid from an intake line **51** to a pump outlet line **52**. The outlets of the pumps would go to a manifold **53**, and selector valves **54** would control the flow of fluid to the hydraulic cylinder motors in each of the presses **21**, **22**, and **23**. Interior or other arrangement of piping **55** connects the valves **54** with presses **21**, **22**, and **23**. A plurality of accumulator bottles **56** are mounted on shelves **57** on the outside walls of the press frame **11**. Interior or other arrangement of piping **58** innerconnects the accumulators **56** and the presses **21**, **22**, and **23**. Tanks **59** mounted on the top slab are used as storage for refilling the accumulators **56**. Compressors **60** driven by electric motors **61** are used to compress the air or other gaseous fluid in the top of the accumulators **56**.

Control means **62**, diagrammatically shown in Figure 3, are available at the control station **45** to control the presses **21**, **22**, and **23** to prevent simultaneous closing of the second press **22** and either or both of the presses **21** or **23**. This control means would permit simultaneous operation of all presses, but when the second press **22** is operating at maximum force, neither press **21** nor **23** may operate to exceed the total capacities of the system and the frame. This assures that the force exerted by the presses will not exceed the allowable safe limit set by the total maximum weight of the top slab **15** together with units mounted thereon.

Rails **64** are mounted in the upper surface **17** and a gantry crane **65** rides on these rails. Buildings **66** are used to house the motors, pumps, and compressors; and these buildings **66** have roofs **67** which may be lifted off by the gantry crane so that component parts may be lifted into and out of the buildings **66** by this gantry crane. Further, the gantry crane has a cantilever extension **68** on each end so that the gantry crane may service the accumulators **56**. Thus, the gantry crane **68** may be used in the erection as well as the maintenance of the entire press.

The top slab has reinforcing steel **70** which extends through the bottom of the slab near the lower surface thereof. This reinforcing steel **70** extends in two directions and is placed under tension and locked into the concrete so that the lower portion of the top slab is prestressed in compression in two generally perpendicular directions in the horizontal plane.

The top slab is thus prestressed in compression at least at a central area of this top slab so that the concrete slab will be able to take the various loads from the crown **27**. Reinforcing steel **71** also extends through the top slab **15** near the upper surface thereof and is placed in tension force to thus prestress this upper portion of the top slab in compression in two generally perpendicular directions in the horizontal plane. This prestressing in compression of the concrete in the top slab enables the concrete to withstand a greater force from the presses **21**, **22**, and **23**; and it will thus be able to withstand forces, in directions transverse to the slab, greater than those normally causing failure. The bottom slab **12** is similarly prestressed in compression near the top and bottom thereof by reinforcing steel **72** and **73**.

The top slab may be approximately 50 feet thick, or even 80 feet thick, 120 feet wide, and 120 feet long. The side walls may be 20 feet thick, 50 feet high, and 120 feet long. The bottom slab may be 30 feet thick, 120 feet long, and 135 feet wide. The top slab with all accessory eqipment including pumps, compressors, electric motors, crowns, hydraulic cylinder motors, and upper platens would thus weigh about 100,000 tons for a maximum force of 75,000 tons of the second press **22**. The maximum force of the press **22** is thus about 75 percent of the total weight of the top slab and units thereon. The first

press 21 may have a capacity of only 5,000 tons and the third press 23, 30,000 tons as an example.

The presses 21, 22, and 23 may be assembled in a novel manner. The crown 27 has been shown as being in five sections 28. Ten hydraulic cylinder motors 29 have been shown with two cylinder motors per section. The upper platen 32 has also been shown as being composed of five sections 33. A crown section 28, two cylinder motors 29, and an upper platen section 33 may be assembled together as a unit on the floor 41. Similarly, four additional units may be assembled. These units when in place are supported by rods or cables 75. The cables run vertically through apertures in the top slab 15 and are fastened by suitable fastening means 76 near the upper surface 17. The apertures may be formed in any suitable manner, such as by casting pipes into the top slab as it is formed. Winches 77 carrying additional lengths of cable may be placed in position on the upper surface 17. The cables on the winches may be payed out and run down through apertures in the top slab 15. The cables on the winches may then be fastened to the cables 75 which are attached to the first unit. The winches may then reel in the cables until the first unit is in position with the upper surface 78 of the crown section 28 against the lower surface 16 of the top slab 15. Cement grout, lead or other suitable material may be used to obtain an even distribution of load between the crown 27 and the top slab 15. The cables 75 may be fastened by the fastening means 76 to the top slab 15, and then the winches moved laterally to repeat a similar function in raising the additional assembled units. Tie rods 79 may then be run through the crown units and the platen units, and nuts 80 threaded thereon to fasten together the crown sections and platen sections as a composite unit.

The Figures 5 and 6 show the complete facilities used with the forging press wherein the frame 11 is positioned between a building 83 and a building 84. The building 83 has a railroad car siding 85, a receiving dock 86, a stock storage area 87, and a die storage area 88. Reheat furnaces 89 have rolls 90 at the ends thereof for conveying billets into and out of these furnaces. Live rolls 91 are aligned with the three presses 21, 22, and 23 and are used to convey the billets to a position near the cogging press 21. Preheat furnaces 92 are also provided in the building 83, and rolls 93 connect the ends of these furnaces to the live rolls 91. A die carriage 94 operates from the die storage area 88 to a position alongside the presses 21, 22, and 23 in order to move the upper and lower dies into and out of position in the presses.

The building 84 contains furnace and quench pits 95, a machining area 96, and a shipping dock 97 adjacent a railroad siding 98.

Operation

The floor area of the press frame 11 is 80 feet by 120 feet. The area of the platen of the second press 22 may be 12 by 40 feet. This is long enough to forge wing spars or long sections of wings of aircraft, or other large forged parts. In conventional press constructions the tie rods become larger and more bothersome as the size of the press increases. A capacity of 18,000 tons is the largest conventional forging press in operation in this country. The Germans also produced one press of 33,000 ton capacity built along conventional lines. The tie rods which are very closely adjacent the platens in conventional presses are approximately 50 inches in diameter and 74 feet long on a proposed conventional structure press of 35,000 ton capacity. Eight of these tie rod forgings are required, and each forging weighs 74 tons. The foundry and machining capacity necessary to make the individual components of the press of the instant invention is available in this country since each of the press units is relatively small. No heavy tie rods and upper and lower cross members are needed since these are all provided by the concrete frame 11. In the press of the instant invention there are no tie rods in the way and thus billets and forgings may be quickly moved from the furnaces 89 and 92 to the presses 21, 22, and 23. As presses become larger, the conveyor rolls 90 and 91 become larger, also the furnaces 89 and 92 become larger. This means that the distance from furnace to press not only becomes greater, but since the billet or forging is bigger and heavier, it is more difficult to move it between the furnace and press at the same rate of speed. This all adds up to considerably increased time in moving the billet or forging between the furnace and press. Powered forging manipulators have been used before; but they have always had to maneuver the forging into the end of the press or into the side of the press. With a proposed 35,000 ton press of conventional construction, since eight tie rods are being used, both sides of the press are closed and hence nonaccessible. This means that all work must be done from the two relatively small open ends of the press. This increases the difficulty of maneuvering forgings and very materially increases the likelihood that the forging will cool down to a point where it can no longer be worked satisfactorily.

With the area of the platen of the second press 22 being 12 by 40 feet and with the first and third presses being smaller than this, this assures that there will be a clear space around each of the presses at least equal to the width of the platen 25 of the second press 22. The absence of tie rods is also of prime consideration in the use of the presses in die quenching wherein the part being formed is squeezed in the dies until the part is quenched or cooled sufficiently to retain a permanent set and shape. Here the temperature must be controlled very closely; and hence, the reduced time from furnace to press achieved by elimination of tie rods is a very important consideration.

Where the presses used in the frame 11 are used for sheet or plate forming or drawing, a rubber pad, fluid-backed diaphragm, or bag-type diaphragm may be used as the female die in this forming or drawing process. In such case the rubber pad or diaphragm must be encased in a container to resist the outward force of the fluid or rubber. There have been explosions of such containers since such containers are generally rectangular in order to utilize to the greatest practical extent the rectangular area between the tie rods on conventionally constructed presses. In the present invention the rubber pads, fluid-backed diaphragms, or bag-type diaphragms may be encased in a container of circular cross-section so that the walls of the container need only resist tension force rather than bending force as well. This increases the safety of the press, increases its usefulness, and decreases the weight carried by the upper platen for faster operation of the press.

The weight of the top slab may be increased in order to increase the capacity of the press. For instance, large capacity presses may be installed inside the frame 11, and thus the total weight of the top slab may be increased simply by increasing any of the three dimensions of this top slab 15. This is impossible with presses built along conventional lines.

The top slab is quite thick relative to the vertical dimension of the crown 27, cylinder motors 29, and upper platen 32. This top slab 15 is a structural mass since it is reinforced concrete, and being thick, it is very rigid. This rigidity successfully resists eccentric or nonsymmetrical loads. The platen being 12 by 40 feet may have the center of the applied load two or four feet off the geometric center of these platens, yet this two or four foot eccentricity will mean very little in the total dimension of the upper slab which is 120 feet square. This is another advantage of having the top slab 15 of large area as opposed to presses of conventional construction wherein eccentric loads are very serious and impose severe stresses on the tie rods. The concrete frame 11 is not only the frame of the presses, but it is also the

building which houses the presses since it makes a weatherproof structure for these presses. The thick concrete top slab **15** provides a bomb resistant shelter for the presses. Further, the mass of the entire concrete frame is earthquake resistant, and thus several additional advantages are gained by the use of the monolithic concrete structure for these presses.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A wide-throat press comprising a frame having a base, laterally spaced supports and a top slab, said top slab being a substantially monolithic structural means supported by and extending between said spaced supports and spaced above said base, said frame defining an opening, a downwardly facing lower surface on said top slab within said opening, a lower platen on said base, a crown structure supported by said slab and abutting said lower surface of said top slab, an upper platen carried by said crown structure, mechanism for relatively riciprocating said platens into and out of engagement, the lateral dimensions of said platens being substantially less than the lateral spacing between said supports to thus establish a wide-throat press with a large, clear working area for workmen and equipment between said platens and said supports and within said opening, the weight of said top slab, crown structure and upper platen exceeding the total force-exerting capabilities of said mechanism to maintain said laterally spaced supports in compression when maximum force of said mechanism is attained, said top slab having sufficient contained structural strength to act also as a rigid beam to carry the weight thereof between said supports.

2. A press according to claim 1, including reinforcing members extending horizontally in said top slab in tension for prestressing said top slab in compression.

3. A press according to claim 1, having a plurality of crown structures and upper and lower platens a trackway in said opening extending between said press units and said supports and adjacent said plurality of said press units whereby a work manipulator may be moved therealong to move work successively from one press unit to an adjacent press unit without interference from said supports.

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